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# The potential long-term influence of fly ash and lime-stabilized sewage sludge on mine spoil reclamation : simulated weathering

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To the Graduate Council:

I am submitting herewith a thesis written by Darlene E. Allred entitled "The potential long-term influence of fly ash and lime-stabilized sewage sludge on mine spoil reclamation : simulated weathering." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Plant, Soil and Environmental Sciences.

M.E. Essington, Major Professor

We have read this thesis and recommend its acceptance:

J.T. Ammons, J.E. Foss, M. Mullen

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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Accepted for the council:

CW Minkel
Associate Vice Chancellor and
Dean of the Graduate School

# The Potential Long-Term Influence of Fly Ash and Lime-Stabilized Sewage Sludge on Mine Spoil Reclamation: Simulated Weathering

A Thesis
Presented for
The Master of Science
Degree
The University of Tennessee, Knoxville

Darlene E. Allred
May 1998

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# Dedication

This thesis is lovingly dedicated to my grandparents, Mr. and Mrs. Van and Ruby Garvin, Mrs. Lillian Allred, and the late Mr. Thomas Leon Allred, whose love and understanding will always be cherished.

# Abstract

Surface mining allows pyrite to be brought to the surface, where it is readily oxidized, producing acid mine drainage. A feasible alternative for the reclamation of mine spoil is the utilization of lime-stabilized sewage sludge (LSS) and fly ash (FA). Lime-stabilized sewage sludge provides essential nutrients to assist in revegetation efforts in an otherwise deficient environment, provides organic matter to improve spoil physical characteristics, and provides a mechanism for disposal. Using a neutral FA in co-application with LSS can enhance mine spoil nutrient levels and physical characteristics. The University of Tennessee, Tennessee Valley Authority, and Electric Power Research Institute initiated a field study in 1994 to address the feasibility of LSS and FA co-utilization for mine spoil reclamation. To complement the field study, simulated laboratory weathering of unamended and amended mine spoil was initiated to assess the potential long-term influence of LSS and FA on mine spoil systems.

The total elemental content of the FA, LSS, and mine spoil was determined by employing both $HNO_3$ extraction and total digestion (aqua regia/HF). The percent recovery of elements by $HNO_3$ digestion was determined by dividing the $HNO_3$-extractable concentrations by the total elemental content determined using the aqua regia/HF method.

Variations in $HNO_3$-extractability of metals in the mine spoil, LSS, and FA was a function of element speciation in the mineral phase. In general, $HNO_3$ digestion was more efficient at extracting Al, Ca, Mg, Cr, Cu, Pb, and Zn from LSS; K and Na from the FA; and Fe, Mg, P, Co, and Mn from mine spoil. Further, $HNO_3$-extractability was not a function of total concentrations and the $HNO_3$ digestion method did not yield a constant percent extractability that could be uniformly applied, irrespective of material.

The chemical analyses of amended mine spoil leachates showed a neutralization of acidity generated by pyrite oxidation. Slight pH and nitrate fluctuations were observed during the later weathering cycles, which may have been due to increased microbial activity. Also, the initially high electrical conductivity (EC) of the mine spoil leachates was increased further upon LSS application and did not vary with FA rate. The EC of all mine spoil leachates decreased with weathering and mirrored the behavior of Ca and $SO_4$. The dissolution and mobilization of Al, Fe, K, Cu, Mn, Ni, and Zn decreased upon LSS application, irrespective of FA rate.

A sequential-selective dissolution (SSD) procedure partitioned elements (Ba, Co, Cr, Cu, Mn, Ni, Pb, Sr, and Zn) into the following operationally-defined pools: (1) soluble-exchangeable, (2) adsorbed, (3) organic, (4) carbonate, (5) sulfide, and (6)residual. The speciation of Ba increased in the soluble-exchangeable and carbonate fractions with increasing FA rate. Strontium increased in the soluble-exchangeable and sulfide fractions with increasing FA rate. Weathering tended to shift Ba to the carbonate fraction and Sr showed no significant shifts to any other phase. Chromium found in the residual fraction significantly increased upon LSS application. Weathering of the LSS-amended mine spoil increased Cr found in the adsorbed fraction, yet maintained predominance in the residual fraction. Chromium solid-phase speciation was not impacted by FA application or weathering. Although primarily found in the residual fraction, Co showed a significant decrease in the soluble-exchangeable form upon LSS and FA application in the weathered material. In general, FA did not impact Co solid-phase speciation. However, LSS application decreased Co found in the soluble-exchangeable fraction. Copper speciation decreased in the soluble-exchangeable and residual fractions upon LSS application with an increase in the carbonate fraction. Primarily, weathering shifted Cu into the residual forms. Fly ash rate had no influence on Cu speciation for the weathered or unweathered mine spoil. In general, increasing FA rate increased Ni found in the residual fraction. Weathering shifted Ni into the carbonate and sulfide forms which decreased with FA application rate. However, Mn was primarily found in the soluble-exchangeable and residual fractions, irrespective of amendment. Weathering shifted Mn into the carbonate form in the amended mine spoil upon LSS application and into the residual form for the unamended mine spoil. Upon LSS application, Pb decreased in the soluble-exchangeable fraction. However, when weathered, amendment did not influence Pb solid-phase speciation. In general, FA rate increased the carbonate form of Zn in the unweathered material. However, weathering shifted Zn from the soluble-exchangeable and sulfide forms into the carbonate fraction, which was influenced by the LSS. In general, the impact of FA co-application with LSS was element specific with respect to the solid-phase speciation of elements.

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# Chapter I

# Introduction

Surface mining for Eastern U.S. coal allows pyrite to be brought to the surface, where it is readily oxidized, producing acidic conditions. The reduced pH results in the release of aluminum and iron which hydrolyze, further reducing solution pH and resulting in the solubilization and mobilization of metal cations. High acidity also inhibits the establishment of vegetation, thereby increasing runoff and erosion. Reclamation of these mining areas is one method of controlling the production of acidity through pyrite oxidation.

Many studies have shown that the application of lime-stabilized sewage sludge (LSS) increases the pH of spoil material, favoring revegetation and drastically reducing erosion. Lime stabilized sewage sludge is a reservoir of nutrients, organic matter, and beneficial microorganisms which are typically needed in mine spoil systems. Further, potential acidity of the mine spoil is neutralized by the alkalinity of the LSS. Increasing the pH also minimizes the activity of *Thiobacillus* (sp.) bacteria, resulting in reduced pyrite oxidation and acid production. Moreover, increasing the pH of the mine spoil material reduces the solubilization and subsequent hydrolysis of aluminum and other metals. For these reasons, LSS is an effective and viable option for reclaiming surface mining areas.

Many coal-fired power generation plants use coal obtained from surface mining operations. Fly ash (FA) is a by-product of coal combustion. There are approximately 1.8 million tons of FA available in Tennessee. Fly ash is mainly disposed of in slurry ponds or in specified landfills. Fly ash is also utilized for construction purposes (e.g., filler in concrete). The utilization of FA in mine spoil reclamation has been shown to enhance plant micronutrient availability and to enhance the physical characteristics of the spoil. While many studies have addressed the chemical effects and attributes of utilizing alkaline FA, very few have identified the impact of neutral and acidic FA. Further, studies that examine the co-utilization of neutral FA with LSS are basically nonexistent.

The application of large quantities of FA during the reclamation of mine spoil material may be a mechanism for FA disposal. The University of Tennessee, the Tennessee Valley Authority (TVA), and the Electric Power Research Institute initiated a field study in Caryville, TN to evaluate co-utilization of FA and LSS for mine spoil reclamation. This field study, initiated in 1994, will take many years to evaluate the potential long-term chemical impact of FA on the mine spoil environment. Yet, the potential long-term impact of co-utilization of FA and LSS can be evaluated by accelerating the weathering process through the use of simulated laboratory weathering techniques. Alternating wetting-drying cycles in the laboratory environment hastens weathering, allowing for an evaluation of potential long-term impact of LSS and FA applications to mine spoil. The objectives of this study are to (1) to examine the $HNO_3$-extractable elemental content of LSS, FA, and mine spoil for comparison to total elemental content, (2) to evaluate the leachate chemistry of LSS and FA amended mine spoil during simulated laboratory weathering, and (3) to examine the solid-phase speciation of elements in LSS and FA amended, weathered and unweathered mine spoil.

# Chapter II

## Literature Review

The neutralization of acidity produced by the oxidation of sulfides is key in reclaiming mine spoil areas. Typically, acid mine spoil leachates result from the oxidation of pyrite, which may be characterized by the following reactions (Stumm and Morgan, 1981):

$2\ FeS_2 + 7\ O_2 + 2\ H_2O = 2\ Fe^{2+} + 4\ SO_4^{2-} + 4\ H^+$ [1]

$4\ Fe^{2+} + O_2 + 4\ H^+ = 4\ Fe^{3+} + 2\ H_2O$ [2]

$Fe^{3+} + 3\ H_2O = Fe(OH)_3\ (s) + 3\ H^+$ [3]

$FeS_2 + 14\ Fe^{3+} + 8\ H_2O = 15\ Fe^{2+} + 2\ SO_4^{2-} + 16\ H^+$ [4]

The microbially mediated (*T.* thiooxidans) oxidation of sulfide in pyrite by dissolved oxygen to form sulfate [Reaction 1] releases ferrous iron and acidity. The ferrous iron can then undergo microbially mediated (*T.* ferrooxidans) oxidation by consuming dissolved oxygen and protons to produce ferric iron [Reaction 2], which may hydrolyze to form ferric hydroxide and acidity [Reaction 3]. Overall, the oxidation of pyrite to form ferric hydroxide releases four moles of proton for every one mole of pyrite oxidized. Ferric iron may also oxidize the sulfide in pyrite [Reaction 4] releasing ferrous iron which may reenter the cycle through reaction 2.

Sullivan et al. (1988) suggested that secondary mineral formation may also control acid generation and iron/aluminum solubility. Sullivan et al. (1988) determined that as leaching time increased, pH decreased, and metal solubility increased. They proposed that if secondary minerals control aluminum and iron activity, thermodynamic constants can be used to predict long-term water quality. If the oxidation of $FeS_2$ occurs and secondary minerals form, iron and aluminum activity can be predicted by the following:

1. If $pH > 6.0$ and $pe+pH < 11.0$ (moderately reducing to reducing environment), sulfate activity is not predicted to influence aluminum and iron activity. Aluminum is controlled by $Al(OH)_3$ (s) and iron is controlled by $Fe(OH)_3$.
2. If $pH < 6.0$ but $pH > 3.0$ and $pe+pH < 11.0$, then aluminum and iron activities are controlled by sulfate secondary mineral formation (e.g., $AlOHSO_4$, $FeOHSO_4$).
3. If $pH < 3.0$ and $pe+pH > 11.0$ (oxidizing environment), then iron will be controlled by ferrous sulfate mineral formation.

For all three conditions, equilibrium pH is determined by iron and aluminum hydrolysis and secondary mineral formation. These results reflect a reaction time of one week by the humidity cell technique before leachate analysis (Sullivan et al., 1988).

Overburden in mining areas of the U.S. generally consists of shales or sandstones which have low base content and are acidic upon weathering. There are two distinct groups, according to geographical location: (1) western U.S. coal fields, and (2) eastern U.S. coal fields. Western U.S. coal fields generally generate low sulfur coal. Eastern U.S. coal fields produce high sulfur coal containing extensive pyritic deposits (Evangelou, 1995). During the regrading process of mining, these overburden and coal refuse materials are typically deposited at the surface. When this material is weathered and the pyritic materials are oxidized, acidity can be generated before vegetation is restored (Swaine and Goodarzi, 1995).

The acidity generated through pyrite oxidation allows for the mobilization and solubilization of metals such as aluminum, iron, and manganese. Solubilization of these metals contributes to active acidity via hydrolysis reactions and can generate phytotoxic concentrations that minimize revegetation efforts (Swaine and Goodarzi, 1995). However, overburden that contains pyrite has a greater residual or potential acidity relative to active acidity (Doolittle et al., 1993). Pyrite oxidation may continue to produce sulfuric acid for many years after mining operations have ceased (Dent, 1992). This potential acidity, the acidity that is continually generated, must be neutralized for successful reclamation (Evangelou, 1995; McIntosh and Kriesel, 1992).

In most instances, acidity and infertility result in poor revegetation (Olyer, 1988). The pH of pyritic spoil material normally ranges between 2.5 and 4.0. However, acidity alone does not inhibit plant growth (Sopper and Kerr, 1979; Dent, 1992). Phytotoxic concentrations of soluble aluminum, iron, and manganese in spoil materials may also contribute to poor revegetation (Sopper and Kerr 1979; Olyer, 1988; Dent, 1992). Also, phosphorus and nitrogen are nutrients that are typically limiting in spoil materials further restricting revegetation efforts (Walker, et al., 1996; Evangelou, 1995; Smith, 1996).

## Reclamation Alternatives

Several mechanisms for the reclamation of mine spoils have been proposed and utilized. These include the use of liming agents (such as alkaline earth carbonates) to neutralize potential acidity, bactericides to minimize microbially mediated iron and sulfide oxidation, wetlands to treat acid mine drainage, and organic waste to provide neutralizing capacity, plant nutrients, and physical conditioning (Evangelou, 1995).

The three forms of acidity present in pyritic systems are pore solution acidity, surface acidity, and potential acidity. Pore solution acidity refers to the acidity present in percolating water. Surface acidity refers to the exchangeable acidity on mineral surfaces. Combined, pore solution acidity and surface acidity are defined as active acidity. Potential acidity is the acidity that can be generated by the spoil material through the oxidation of pyritic materials (Evangelou, 1995).

Neutralization of active and potential acidity can be achieved by using carbonate sources (e.g., calcite, dolomite). Acid-producing potential is defined as the difference between the potential acidity and the neutralizing potential of a material. If the acid-producing potential is negative, acidity will be generated. Conversely, if the acid-producing potential is positive, acidity will not be generated. In mine spoils, potential acidity can be extremely high; thus, neutralization potential of the liming source must equal the acid-producing potential to attain neutralization. Acid neutralization is achieved according to the following reactions:

[5] $H_2SO_4(aq) + CaCO_3(s) = CaSO_4(aq) + H_2O(l) + CO_2(g)$

[6] $2H_2SO_4(aq) + CaMg(CO_3)_2(s) = CaSO_4(aq) + MgSO_4(aq) + 2H_2O(l) + 2CO_2(g)$

Calcite and dolomite also have the ability to neutralize the acidity generated by iron and aluminum hydrolysis, resulting in the precipitation of hydroxides (e.g., gibbsite, geothite, ferrihydrate) and basic sulfates (e.g., jurbanite, jarosite). However, the neutralization capacity of the liming materials is short-lived due to the continual amount and rate of acid production from the potential acidity fraction and the relatively high mobility of the alkalinity

(Evangelou, 1995).

Rock phosphate or refined apatite rock [$Ca_5(PO_4)_3(F,Cl,OH)$] has also been used to neutralize the acidity generated by pyrite oxidation (Stiller et al., 1985). Rock phosphate may control pyrite oxidation by acting as a weak base in solution and enhancing precipitation of iron phosphate minerals (e.g., strengite, vivanite) (Huang and Evangelou, 1992 and 1994). Yet, the beneficial aspects of applying rock phosphate are short-lived due to the accumulation of iron oxide coatings on the rock phosphate, preventing the further release of phosphate (Stiller et al. 1986; Loomis and Hood, 1984; Evangelou et al., 1992).

Bactericides have been used in recent years to mitigate acid mine drainage. Detergents, organic acids, and food preservatives have been shown to imped bacterial growth. (Erickson and Ladwig, 1985; Dugan, 1987). These surfactants have been shown to reduce acid mine drainage by 60 to 90 percent (Evangelou, 1995). The two main limitations with using these amendments are (1) the surfactants must be applied repeatedly to prevent microbial repopulation due to high mobility, and (2) adsorption of the surfactant to mineral phases present might limit surfactant availability to the bacteria (Erickson and Ladwig, 1985; Evangelou, 1995).

The creation of wetlands to control acid mine drainage is also an alternative for acid mine reclamation. The potential removal of metals from the aqueous phase in wetland systems is accomplished by the formation of sparingly-soluble metal sulfides, iron oxyhydroxides, plant uptake, and organic complexation. Because plant uptake and organic complexation is relatively finite, the precipitation of metals as oxides or sulfides is the most effective means of long-term metal removal. Staub and Cohen (1992) and Hammack and Edenborn (1991) studied the removal of Co, Cu, Cd, Ni, Pb, and Zn by sulfide precipitation meditated by sulfate-reducing bacteria. Because this process requires an anaerobic environment, this alternative has been scrutinized due to the uncertainty in maintaining saturation thus limiting the process (Wildeman, 1991).

The application of organic wastes is a beneficial treatment alternative for the reclamation of acidic mine spoils. The growth of beneficial microorganisms may limit *Thiobacillus* (sp.) activity by competing for oxygen. Complexation of Fe(III) and pyritic iron(II) by humates may also limit oxidation of pyritic material by limiting *Thiobacillus* (sp.) catalyzation. Luther et al. (1992) identified that organic wastes might actually contribute to pyritic oxidation by Fe(II) complexation by oxygen containing ligands, thereby acting as the litigating atom. Solubilization of $Fe(OH)_3$ may promote pyrite oxidation by forming Fe(III)-carboxylate complexes (e.g., Fe(III)-

catechol and Fe(III)[$C_6H_4O_2$]$^+$). These complexes may adsorb onto pyritic surfaces acting as electron acceptors (Luther et al., 1992). This can be remediated by utilizing well-decomposed organic wastes, composted or treated wastes (Loomis and Hood, 1984). However, a limitation of use is that Fe(III)-organic complexes tend to decompose over time by electron transfer from the organic fraction yielding soluble Fe(II) and $CO_2$. Thus, soluble Fe(II) is able to reenter the oxidation process resulting in acid production. To remediate this problem, additional application of waste material might be needed (Evangelou, 1995).

## Lime-Stabilized Sewage Sludge

Amendments have been used to neutralize acidity generated through pyrite oxidation and to impart fertility for successful revegetation. Liming agents, such as dolomite and calcite alone, lack organic matter and other nutrients that promote revegetation of mine spoils. Lime-stabilized sewage sludge (LSS) is a source of organic matter, essential nutrients, microorganisms, and alkalinity (Sloan and Basta, 1995). For these reasons, LSS has been used as an aid in successful revegetation efforts in mine spoil reclamation (Walker, 1993; Mathias et al. 1979, Griebel, et al., 1979).

Lime-stabilized sewage sludge can contain up to 25% organic carbon to aid in increased infiltration, increased water-holding capacity, and complexation of toxic metals

(Sloan and Basta, 1995). Organic matter in mine spoils is necessary to establish vegetation because most mining areas lack soil properties necessary to maintain vegetation (Dent, 1992). Also, organic matter enhances soil physical structure by enhancing aggregation of fragmented conglomerants by glues produced by microbial activity (Metting, 1993; McIntosh and Kriesel, 1992; Smith, 1991).

Neutralization of the potential acidity in spoil material by the application of alkaline amendments is commonly employed in mine spoil revegetation efforts (Sullivan et al., 1986; Mays and Bengtson, 1978). The high $CaCO_3$ equivalent of LSS can neutralize acidity in mine spoil solutions generated by the oxidation of pyrite. Alkaline sewage sludge may also increase solution pH which, in turn, can facilitate the precipitation of iron and aluminum (Sloan and Basta, 1995; Cavallaro et al., 1993; Kardos et al., 1979). Further, aluminum toxicity can be minimized by application of LSS by means of precipitation as well as organic complexation in mine spoil systems (Cavallaro et al., 1993). Regulations existing before 1993 prevented direct land application on acid soils because of pH requirements prior to application. New EPA regulations are not contingent on pH maintenance and allow for the possibility of LSS to be a potential liming material (Sloan and Basta, 1995).

By increasing the pH of the mine spoil system using a liming agent, microbial catalyzation of pyrite oxidation can be dramatically reduced, subsequently decreasing the amount of acidity generated (Doolittle et al., 1993). Reduction in microbial catalyzation of pyritic oxidation significantly reduces acidity produced by maintaining a pH above 4.0 such that Thiobacillus (sp.) activity diminishes (Burt and Caruccio, 1986).

Sopper and Seaker (1983) noted that improvements in water-holding capacity and percent water-stable aggregates were attributed to increased loading rates of LSS amendments on the mine spoil studied. An increased availability of N and P as well as decreased acidity in acid-producing mine spoil materials with the utilization of LSS has also been observed (Walker, 1993).

Studies have also shown many beneficial effects of LSS application for reclamation including enhancement of beneficial microorganisms (Fresquez and Linderman, 1982) and increased vegetation and nutrient supply (Mathias et al., 1979; Berg, 1983).

### Fly Ash

Fly ash has been studied as a possible amendment to aid in the reclamation of mine spoils (Stehouwer et al., 1995; Haering and Daniels, 1991; Singh et al., 1982; Capp, 1978). Fly ash production in Tennessee was 2.3 million tons in 1991, with 1.8 million tons available for disposal or utilization (McIntosh and Kriesel, 1992). Disposal alternatives for FA include ponding, placement in landfills, utilization in construction, and possibly utilization in acid mine spoil reclamation. Fly ash typically consists of small glass-like spheres ranging from 0.01 μm to 100 μm in diameter. Because FA is composed of small particles, it generally has a large surface area to mass ratio which can enhance infiltration, nutrient retention, and water holding capacity of the mine spoil (McIntosh and Kriesel, 1992).

Fly ash particles may also be coated with metal oxides from the combustion process (Mattigod et al., 1990). These coatings could alter aquatic environments by releasing metals in low pH systems (Theis and Wirth, 1977). However, when FA is used in co-application with LSS, mobilization of metals may be reduced due to the neutral to alkaline pH and high sorption capacity of organic matter present in the LSS (McIntosh and Kriesel, 1992). Keefer et al. (1979) studied the effects of applied organics and fly ash to mine spoil. Legume growth increased on the co-amended mine spoil relative to either material alone.

Leaching of arsenic and boron from FA has been of particular concern. Boron can be up to 90% extractable in water alone depending on the FA:water ratio (Pagenkoph and Connolly, 1982). Experiments with acidic FA show that As solubility in water ranges from 2% to 18% of the total As present (Breslin and Duedall, 1983). In addition, As and B tend to be more soluble in high pH systems, whereas metals such as Pb and Cu are less soluble in high pH systems (McIntosh and Kriesel, 1992). In amended mine spoil systems, the solubilization of both As and B are expected to be less than the water-extractable concentrations due to high affinity for sorption to both organics and minerals present (Phung et al., 1979; McIntosh and Kriesel, 1992).

A bulk of the studies that examine FA utilization focus on alkaline fly ash. However, neutral to acidic fly ash material may also be beneficial in reclamation efforts providing essential macro- and micronutrients. The pH of the spoil system is of importance as stated earlier due to solubilities in low pH systems. When a neutral fly ash is used in coapplication with a liming agent, the pH of the system is favorable for decreased mobility of metals in the system (Capp, 1978).

### Coapplication: LSS and FA

Co-mixtures of LSS and FA may enhance mine spoil physical characteristics and nutrient availability and retention. Neutral FA may improve micronutrient availability, promote soil aggregation, and enhance soil physical characteristics (Capp, 1978). For these reasons, amendment co-application can be a beneficial method of FA disposal.

Beaver (1995) examined the addition of coal ash to a composting mix. In this study, dairy manure/compost was amended with coal ash at rates of 0, 54, 87, 188, and 318 kg $MT^{-1}$ and the mixtures were monitored for six weeks to determine the impact of coal ash on microbial activity. Microbial activity was not impacted by the coal ash additions. The pH, C:N ratio, and electrical conductivity (EC) of each treatment were determined weekly. The pH and C:N ratios of the plots were relatively constant with values of 8.5 and 27.5, respectively. The EC of the treatments increased with coal ash amendment rate, ranging from 1.25 to 1.95 dS $m^{-1}$. In growth trials, the biomass of tomato plants grown on dairy manure/coal ash amended soil was greater than soil amended with compost alone. In another growth trial, grain yields increased with increasing coal ash amendments. It was postulated that this yield increase was due to micronutrients (e.g., potassium and magnesium) supplied by the coal ash (Keefer et al., 1979).

Adriano et al. (1982) examined the feasibility of applying a mixture of alkaline fly ash and anaerobically digested sewage sludge in sudan grass production. The rationale for this study was that N and P, which fly ash lacked, was supplied by the sewage sludge fraction of the amendment. The fly ash used was alkaline and predicted to reduce the solubility of metals in the sludge, thereby decreasing metal phytotoxicity. The results of the study show that Cd uptake by sudan grass was reduced with increasing alkaline fly ash amendments on two California soils with sludge additions containing 30 mg $kg^{-1}$ Cd. Crop yields increased with sludge rate but decreased with increasing fly ash rates. This was postulated to be due to the unweathered nature of the fly ash. Unweathered fly ash contributes to toxic metal concentrations due to the ready available metals on the surface of the fly ash particles. Upon weathering of the fly ash, these metals are removed thereby reducing toxic elemental concentrations in leachates. The study was conducted with a weathered fly ash which was found to have no effect on crop yields.

## Laboratory Weathering

One method of evaluating the potential long-term effects of amendment applications in a timely manner is by laboratory weathering. The two general types of laboratory weathering are equilibrium and non-equilibrium weathering. Equilibrium weathering is a steady-state evaluation and study of leachate chemistry (Essington, 1991). Non-equilibrium laboratory weathering involves alternating wetting-drying cycles to simulate natural environmental conditions. Two methods that have been employed for non-equilibrium laboratory weathering methods are the soxhlet and the humidity cell techniques (Essington, 1991; Sullivan et al., 1986).

In the soxhlet method, the solids are added to a porous thimble and placed in the mixing/extraction chamber. Leaching is achieved through the condensation of a heated solvent ($H_2O$) moving through the sample. In the original soxhlet design, the mixing/extraction chamber was located directly above the boiling solvent, and the temperature of the extracted leachates exceeded normal environmental conditions, limiting microbial activity (Sobek et al., 1982). Since pyritic oxidation is catalyzed by microbial activity, it is important to promote during simulated weathering (Backes et al., 1993).

A modification to the soxhlet design by Sobek et al. (1982) decreased the fluctuation in temperature of the leachate during simulated weathering. This was done by moving the mixing/extraction chamber away from high temperature refluxing solution (Sobek et al., 1982). This modification allows for the introduction and sustained activity of microbes during weathering. However, the rapid leaching environment that the soxhlet provides may not allow for the adequate initiation of microbial activity for pyrite oxidation (Sullivan and Sobek, 1982).

The humidity cell technique involves alternating wetting-drying cycles to simulate natural seasonal fluctuations in soil water content. The humidity cell technique has been used to assess the generation of acidity in both high and low leaching environments (Sullivan et al., 1988). One benefit of using this technique is that weathering is conducted at ambient temperatures in the laboratory which favors microbial activity (Sullivan and Sobek, 1982). Another benefit of using the humidity cell technique is that the aerobic unsaturated environment allows oxidation to occur in a moist environment for leachate equilibration (Sullivan et al., 1988). One noted pitfall associated with this technique is that it is not as timely as the soxhlet method, yet it is a relatively reliable method of leachate characterization (Sullivan et al., 1988). In addition, the results from the humidity cell technique need validation with field experiments as well as differences in leaching/equilibration time. This technique provides reproducible results, is relatively short-term and cost-effective, and does not require specialized equipment (Essington, 1991).

## Element Solid-Phase Speciation

Due to the concern associated with elevated metal concentrations in sewage sludge amended soils, techniques have been developed to closely monitor the mobility of such metals (Lake et al., 1984). Guidelines that limit land application of sewage sludge were generally developed based on phytotoxic effects founded on plant uptake studies (Lake et al., 1984). Metal distribution in sewage sludge amended soils have been investigated by sequential-selective dissolution (SSD) techniques. Such extraction procedures can represent only an arbitrary comparison of metal forms and distributions, as the chemical reagents employed lack selectivity (Sterritt and Lester, 1980). The role of reagent use in SSD methods is to discretely remove metals by fractions in order of chemical resistance. Success is not easily achieved because of the lack of validation (Nirel and Morel, 1990; Ma and Uren, 1995). Differences among SSD techniques include reaction time, reagent, reagent sequence, and reagent strength. Although no standard SSD method has been identified, SSD techniques are considered to be more useful than single extractants to determine trace metal distribution in sludge amended soils (Stover et al. 1976).

Sequential-selective dissolution can provide an estimation of the distribution of trace metals in chemical pools (Essington, 1989). The procedure used in this study was developed by Stover et al. (1976) and revised by Lund et al. (1980) for the indirect characterization of trace element solid-phase speciation in sewage sludge and sewage sludge-amended soil. This method partitions trace elements into the following operationally-defined pools: exchangeable, adsorbed, organic, carbonate, and sulfide forms. In addition, trace elements residing in the residual (non-extractable) fraction were computed by the difference between the total metal content and the sum of the extractable metals. The trace element pools in the solid phase were extracted by use of the following reagents: (1)

exchangeable: 0.5 M $KNO_3$ for 16 hours (2) adsorbed: deionized water for 2 hours repeated 3 times, (3) organic: 0.5 M NaOH for 16 hours, (4) carbonate: 0.05 disodium EDTA for 6 hours, and (5) sulfide: 4 M $HNO_3$ for 16 hours.

Sequential selective dissolution of trace elements into defined pools can provide information on the distribution of heavy metals in mine spoil systems amended with sewage sludge (Cao et al. 1984). Many trace elements are essential for microbial and plant growth in small amounts, but above optimum concentrations, can become harmful to both plants and animals (Angel and Feagley, 1987). Thus, monitoring trace metals is crucial when introducing potential metal loadings by utilizing amendments. Although many SSD procedures have been scrutinized, SSD is a viable method to monitor the speciation of metals. The majority of heavy metals added by sludge application are acid-extractable (Neuhauser and Hartenstein, 1980) and the results are comparable to stronger acid digestible methods such as nitric acid digestion, perchloric digestion, and hydrofluoric decomposition (Burkitt, et al. 1972; Harrison and Laxen, 1977; Cao et al., 1984). Yet, nitric acid digestion yield results consistently underestimated heavy-metal content in a study conducted by Chang et al. (1983) on sludge-treated soils.

## Implemented Field Study

The utilization of sewage sludge has been shown to aid in revegetation efforts for reclamation of mined lands (Sloan and Basta, 1995; Cavallaro et al., 1993; Little et al, 1991). Fly ash has also been studied as a possible amendment for reclamation of mine spoils (Stehouwer et al., 1995; Haering and Daniels, 1991; Singh et al., 1982; Capp, 1978). Keefer et al. (1979) studied the effects of applied organics and fly ash to mine spoil hypothesizing that the materials might complement one another. Co-mixtures of LSS and FA may enhance spoil characteristics and nutrient availability (Taylor and Schuman, 1988). Neutral FA may improve micronutrient availability, hastening of soil aggregation, and enhancement of particle size distribution which may provide a favorable environment for revegetation (Capp, 1978). For these reasons, amendment co-application can be a beneficial method of FA disposal.

To analyze the feasibility of LSS and FA co-application for mine spoil reclamation, The University of Tennessee, the Tennessee Valley Authority (TVA), and the Electric Power Research Institute initiated a field study in Caryville, TN. This field study, initiated in 1994, will take many years to evaluate the long-term chemical impact of FA for reclamation of the mine spoil. Yet, the potential long-term impact of co-utilization of FA and LSS can be evaluated by accelerating the weathering process through the use of simulated laboratory weathering techniques. Alternating wetting-drying cycles in the laboratory environment hastens weathering, allowing for an evaluation of potential long-term impact of LSS and FA applications to mine spoil.

## Objectives

The objectives of this study are as follows:

(1) to examine the $HNO_3$-extractable elemental content of LSS, FA, and mine spoil and for comparison to total elemental content.

(2) to evaluate the leachate chemistry of LSS and FA amended mine spoil during simulated laboratory weathering.

(3) to examine the solid-phase speciation of trace elements in LSS and FA amended, weathered and unweathered mine spoil.

# Chapter III

# Materials and Methods

## Materials

The mine spoil material was collected from an abandoned coal mine located in the Western Appalachian Plateau/Cumberland Mountains physiological region of East Tennessee (Campbell County). The exact location of the site is 36° 17' 51'' N and 84° 15' 48'' W with an elevation of 930 m. The disturbed site resulted from the surface mining of the Cold Gap Coal Bed of the Cross Mountain Formation in the Middle Pennsylvanian. In 1994, the mine spoil site was subjected to reclamation with LSS and FA amendments as part of a demonstration project for Tennessee Valley Authority. Prior to amendment, surface 30 cm samples of the mine spoil were collected at randomly selected locations at the mine site and composited. The mine spoil samples were transported to Knoxville, TN, allowed to air-dry, thoroughly mixed, and stored in a sealed containers at ambient temperature (22°C to 25°C) until needed. The LSS was obtained from the Knoxville Utility Board's Kuwahee Waste Water Treatment Plant located in Knoxville, TN. This sewage sludge is classified as a Class A, low metal sewage sludge as per the US EPA Part 503 sludge management regulations (Chapter 40 Code of Federal Regulations, Part 503). The LSS was stored in a tightly sealed container at 4°C until needed. The FA was collected from the Kingston Fossil Plant, operated by TVA and located in Kingston, TN. The FA was dry when delivered and was stored in a sealed container at ambient temperature until needed.

## Characterizations

Acid-base accounting yields the net acid or neutralization potential of a material by taking the difference between the neutralization potential and the maximum acid producing potential (Miller and Murray, 1988). Neutralization potential was determined in triplicate by reacting standardized 0.1 M HCl with a known mass of mine spoil, LSS, or FA and boiling the solution for approximately one minute. The mixture was cooled and back titrated with standardized 0.1 M NaOH to determine the amount of HCl consumed. Acid-producing potential was determined by total sulfur analysis with the LECO CR-12 furnace after sulfate removal (Grube et al., 1993; Miller and Murry, 1988). Sulfate removal was accomplished by filtering approximately 50 mL of a 2:3 HCl solution through the material followed by thorough rinsing with distilled, deionized water (US EPA, 1974). The acid-base account is expressed as tons $CaCO_3$ eq/1000 tons material by using a 31.25 correction factor(assuming that all S is from pyrite or marcasite). Averaged among triplicates, the results of the acid base accounting of the mine spoil and LSS were -12.5 and 151 t

$CaCO_3$ equivalent per 1000 t dry material, respectively. Thus, the LSS amendment rate, computed on a dry-weight basis, was 88 tons LSS/1000 tons mine spoil (197 Mg $ha^{-1}$). Also, the FA had an acid-base account of 16.94 tons $CaCO_3$ eq/1000 tons of material when averaged among triplicates. The moisture content of the LSS was determined to be 12.5% by standard gravimetric evaluation by oven-drying (Gardner, 1986).

The total elemental content of the mine spoil, LSS, FA, and the weathered material was facilitated in triplicate using the microwave-induced fluoroboric acid dissolution technique by Nadkarni (1984) with modification by Ammons et al. (1995). A 200 mg sample (<60 mesh) was pre-treated with 2 mL HF in polyallomer centrifuge tubes, mixed by vortexing, and allowed to react for 16 hours. After pretreatment, 5 mL of *aqua regia* (3:1:1 - $HCl:HNO_3:H_2O$) was added to each sample and mixed by vortexing. Samples were then heated in a microwave for a 3 minute reaction time at 80% power to hasten the dissolution reaction. After cooling, 1 gram of boric acid was added to each sample to neutralize excess HF present. Samples were mixed by vortexing and heated in the microwave for an additional 10 minutes at 20% power to dissolve the boric acid. While still warm, the samples were mixed by vortexing to facilitate boric acid dissolution. The cooled samples were filtered through Whatman #42 filter paper into 100 mL volumetrics and brought to volume with deionized water. The chemical analysis was performed by a Thermo Jerrell Ash Model 61 inductively-coupled argon plasma optical emission spectrophotometer (ICP-OES) to determine the concentrations of Al, As, Ba, Ca, Cd, Co, Cr, Cu, Fe, K, Mn, Ni, P, Pb, Se, Sr, and Zn.

The $HNO_3$-extractable metal content of the mine spoil, LSS, and FA was facilitated by 4 M $HNO_3$ digestion (Cao et al., 1984). The triplicate digestion tubes contained 3.5 g of sample and 21 mL of 4 M $HNO_3$ and were placed in a digestion block calibrated to 80°C. The samples were refluxed for 16 hours. After the samples were cooled and brought to 35 mL total volume, the solution was filtered and subjected to ICP-OES analysis to determine Al, As, Ca, Cd, Cr, Cu, Fe, K, P, Pb, Mg, Mn, Ni, Se, and Zn content.

Sequential-selective dissolution analysis was performed on samples from the 2 and 18 week weathering cycles for comparison of metal pool distribution. The procedure used in this study was developed by Stover et al. (1976) and revised by Lund et al. (1980) for the indirect characterization of trace element solid-phase speciation in sewage sludge and sewage sludge-amended soil. This method partitions trace elements into the following operationally-defined chemical pools: exchangeable, adsorbed, organic, carbonate, and sulfide forms. In addition, trace elements residing in the residual (non-extractable) fraction were computed by the difference between the total metal content and the sum of the extractable metals. Extractions were performed in 50 mL polypropylene centrifuge tubes using triplicate 2 g samples with 25 g the of appropriate reagent. The metal pools of the solid phase were extracted by use of the following reagents: (1) exchangeable: 0.5 M $KNO_3$ for 16 hours (2) adsorbed: deionized water for 2 hours repeated 3 times, (3) organic: 0.5 M NaOH for 16 hours, (4) carbonate: 0.05 M EDTA for 6 hours, and (5) sulfide: 4 M $HNO_3$ for 16 hours. The samples were centrifuged between steps for approximately 10 minutes to separate the solid from the extractant. The extracts were analyzed by ICP-OES for As, Ba, Co, Cr, Cu, Mn, Ni, Pb, Se, Sr, and Zn. The mass of a given element extracted by a given reagent was calculated as follows: $\mu g$ extracted = (A * 25g) - (B * C) where A is the concentration in $\mu g/g$ (liquid) extracted, B is the concentration in $\mu g/g$ (liquid) extracted from the previous step, and C is the mass in grams of extracting solution left over from proceeding extraction step to the current step (Sposito et al., 1982).

The bulk mineralogy of the mine spoil and the FA was determined by powder x-ray diffraction (powder mount) and the clay mineralogy of the mine spoil was determined by x-ray diffraction of Mg-saturated, Mg-glycol, and K-saturated samples. Prior to x-ray diffraction analysis soluble salts and carbonates, Mn oxides and organic matter, and Fe oxides were removed using standard techniques (Kunze and Dixon, 1986).

A humidity cell technique was used for non-equilibrium laboratory weathering in this study (Essington, 1989). Fifteen 64 X 38 cm polypropylene containers were obtained and weighed. A 500 g sample of mine spoil was placed in each container. The LSS and FA amendment rates, as determined by acid-base accounting were: 0:0, 197:0, 197:197, 197:295, 197:394 Mg $ha^{-1}$ on a dry-weight basis. Since the objective was to utilize large quantities of FA, FA amendments were 1 X, 1.5 X, and 2 X the calculated amendment rate for the LSS, ignoring the neutralization potential of the FA.

The LSS and FA rates were added to the 500 g spoil sample and thoroughly mixed. A 500 mL volume of deionized water was then added and the amended spoil was allowed to equilibrate for 2 hours. The spoil solution was extracted from the solids by vacuum filtration through Whatman #2 filter paper into a polypropylene Erlenmeyer flask. The leachate was collected in acid-washed polypropylene bottles. The leachates were not allowed to contact glass to maintain the integrity of the leachates for boron analysis. Both the pH and the electrical conductivity (EC) of the leachate were determined immediately after filtration. The remainder of the leachate was capped and stored at 4°C for chemical analysis.

The solid cake collected on the filter paper was returned to the corresponding plastic container and distributed evenly to facilitate drying. The solids were allowed to air-dry for one week, after which time the material was extracted again with a mass of water equal to the mass of the amended spoil material. This weathering technique continued for 18 cycles. Nitrate, sulfate, fluoride, and chloride concentrations in collected leachates were determined by ion chromatography (IC) using Dionex DX-100 ion chromatograph. Leachate Al, B, Ca, Cd, Cu, Fe, K, P, Pb, Mg, Mn, Ni, and Zn concentrations were determined by ICP-OES.

Statistical analyses to compute standard errors the mine spoil, LSS, and FA were performed using MS Excel data analyses VBA tool pack (Microsoft Corporation, 1994). Also, statistical analyses to determine the impact of treatment and weathering cycle on element solid-phase speciation was performed by SAS using the General Linear Model and Student-Newman-Keuls test for determining differences (SAS Institute Inc., 1985).

# Chapter IV

## Results and Discussion

### Clay and Bulk Mineralogy

The clay mineralogy of the mine spoil was determined by x-ray diffraction using standard saturation and treatment methods as detailed in EPA-600/2-78-054 (U.S. EPA, 1978) (Figures 1 and 2). The clay mineralogy of the mine spoil was identified as vermiculite, kaolinite, and mica. The presence of a 1.44 nm peak before and after glycolation indicated the occurrence of vermiculite. Kaolinite was identified from the 0.72 nm and the 0.36 nm peaks that disappeared upon heat treatment at 550 C. Mica was identified by the presence of the 1.0 nm and 0.5 nm peaks in the $Mg^{2+}$-saturated samples.

The bulk mineralogy of the mine spoil was determined to be primarily composed of quartz. The FA mineralogy was dominated by quartz and mullite ($Al_6Si_2O_{13}$). Mullite was not clearly identified in the LSS/FA-amended mine spoil due to dilution of the FA. The mineralogy of the weathered mine spoil, as determined by x-ray diffraction, was not different from the unweathered mine spoil.

### Amendment Characteristics

The total elemental content of the FA, LSS, and mine spoil was determined by employing both $HNO_3$ extraction and

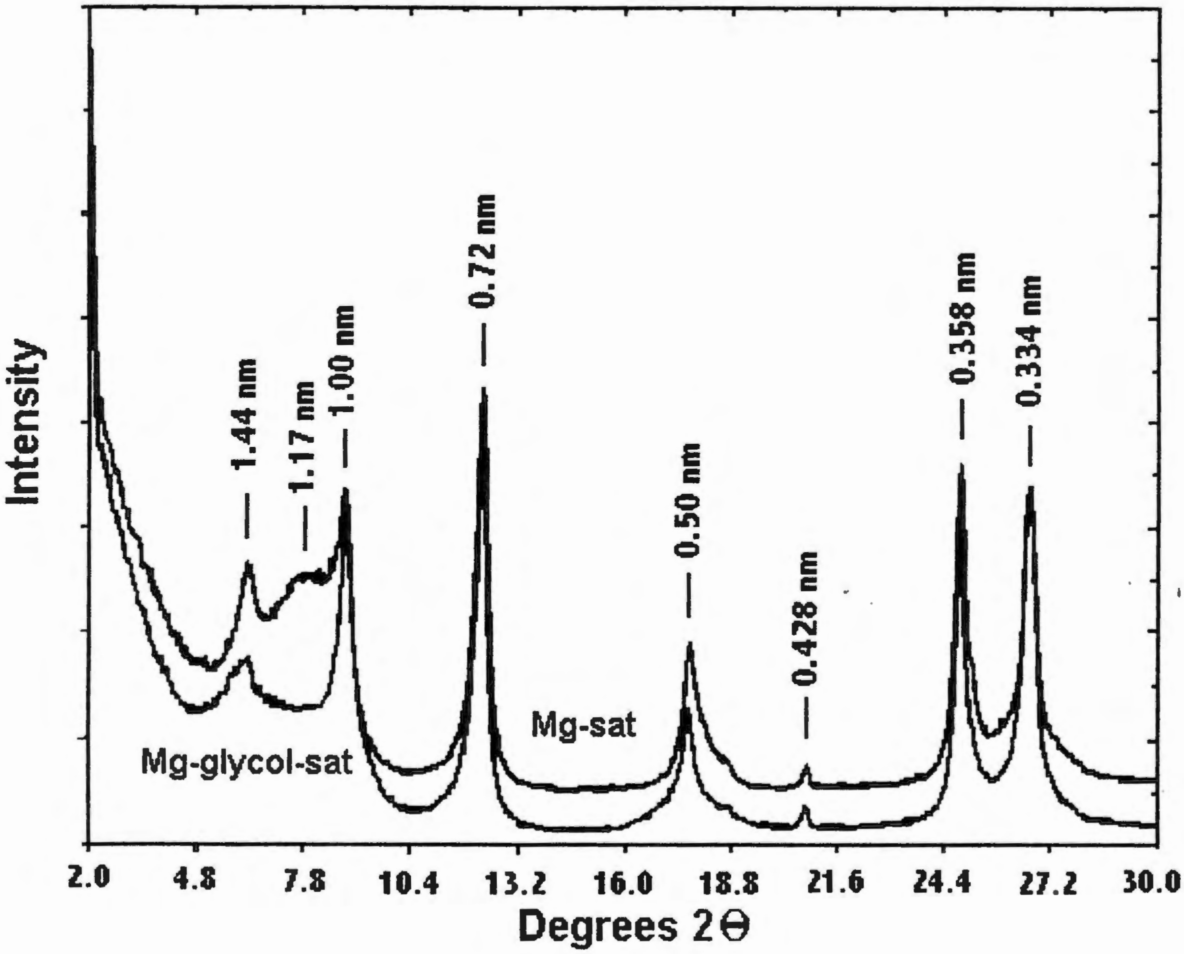

Figure 1. X-ray diffraction patterns of the <2 $\mu$m size fraction (Mg-saturated and Mg-glycol saturated) of the Caryville mine spoil.

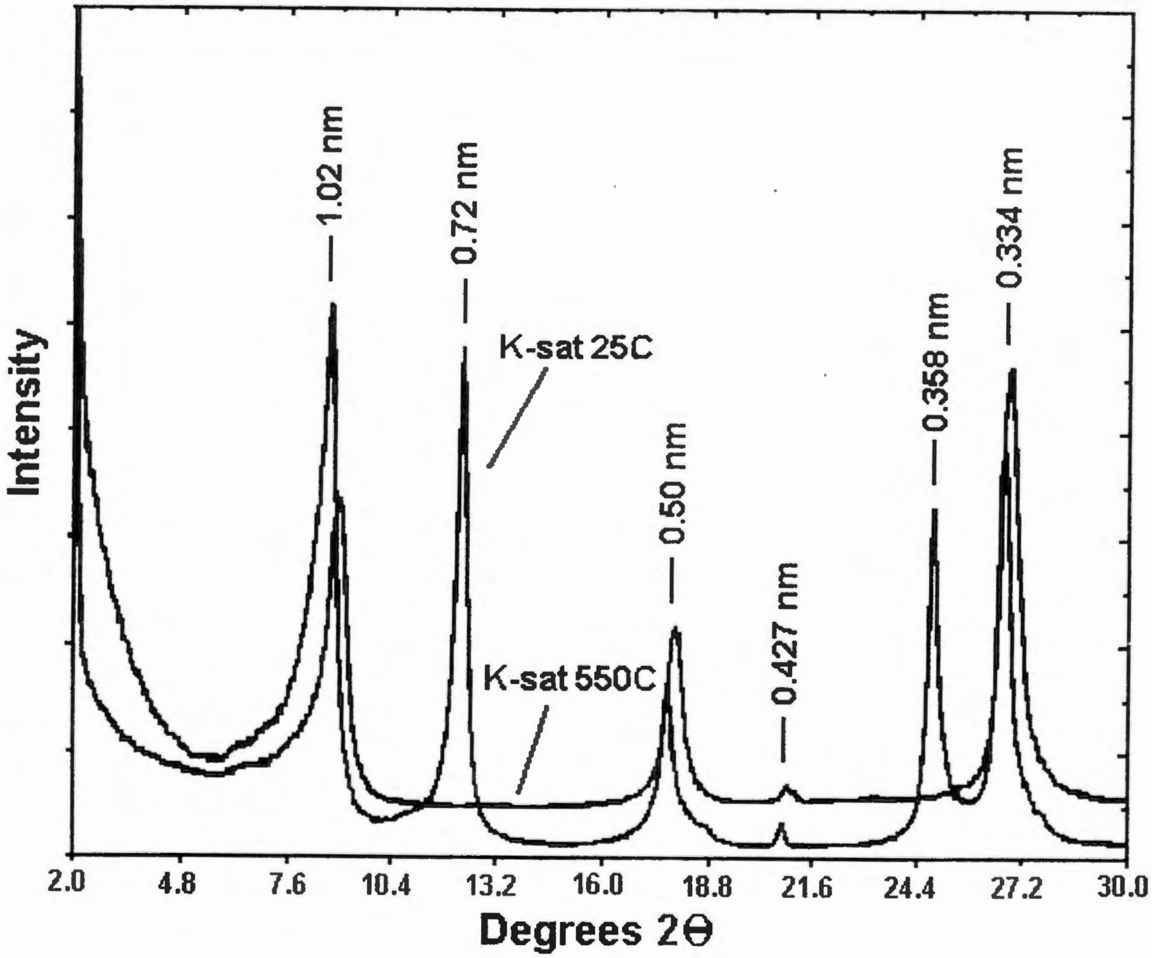

Figure 2. X-ray diffraction patterns of the <2 μm size fraction (K-saturated and K-saturated heat treated at 550°C) of the Caryville mine spoil.

total digestion (aqua regia/HF)(Table 1). The percent recovery of elements by $HNO_3$ digestion was determined by dividing the $HNO_3$-extractable concentrations by the total elemental content determined using the aqua regia/HF method.

Although Al content was highest in the FA (106 g $kg^{-1}$) and lowest in the LSS (13.4 g $kg^{-1}$), the $HNO_3$-extractability was greatest for the LSS (37.4%). However, total Fe content and $HNO_3$-extractability were highest for the mine spoil (49.9 g $kg^{-1}$ and 100%, respectively) which was expected due to the presence of pyrite. Consequently, Fe content was lowest for the LSS (9.06 g $kg^{-1}$), yet the $HNO_3$-extractability was determined to be 82.8%. The $HNO_3$-extractability of Fe in the FA was determined to be the lowest at 31.8%.

Total Ca content and $HNO_3$-extractability were greatest for the LSS (58.2 g $kg^{-1}$ and 91.7%, respectively) and lowest for the mine spoil material (1.86 g $kg^{-1}$ and 12.7%, respectively). Total K and Mg concentrations were highest in the mine spoil material (9.80 g $kg^{-1}$ and 11.3 g $kg^{-1}$, respectively) and lowest for the LSS (3.91 g $kg^{-1}$ and 7.25 g $kg^{-1}$, respectively). However, the FA was found to have the greatest K and Mg $HNO_3$-extractability (73.5% and 21.7%, respectively).

Although total Na content was highest for the mine spoil material (40.3 g $kg^{-1}$) and lowest for the LSS (27.3 g $kg^{-1}$), FA had the greatest $HNO_3$-extractability (2%). Indisputably, Na was in a mineral phase that was resistant

Table 1. Elemental composition of the Kingston fly ash, Knoxville lime-stabilized sewage sludge, and the Caryville mine spoil determined after the $HNO_3$ extraction and aqua regia/HF dissolution.

| | Fly ash | | | | | | Lime-Stabilized Sewage | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Element | $HNO_3$ | SE[††] | (% T)[φ] | Total | SE | Range[†] | $HNO_3$ | SE | (% T) | Total | SE | Range[‡] |
| | g $kg^{-1}$ | | | | | | | | | | | |
| Al | 27.9 | 2.3 | (26.3) | 106 | 1.91 | 1.0 - 209 | 5.00 | 0.07 | (37.3) | 13.4 | 1.30 | 1.0 - 135 |
| Ca | 7.40 | 0.63 | (85.0) | 8.7 | 0.10 | 1.1 - 223 | 58.2 | 0.04 | (91.7) | 63.5 | 5.45 | 1.8 - 200 |
| Fe | 10.4 | 1.4 | (31.8) | 32.7 | 0.56 | 10 - 276 | 9.06 | 0.04 | (83.1) | 10.9 | 0.64 | 1.0 - 154 |
| K | 5.90 | 0.13 | (73.6) | 8.02 | 2.39 | 1.7 - 67 | 0.34 | 0.01 | (8.7) | 3.91 | 1.03 | 0.2 - 39 |
| Mg | 2.36 | 0.11 | (21.7) | 10.9 | 5.59 | 0.4 - 77 | 1.40 | 0.03 | (19.3) | 7.25 | 2.79 | 0.3 - 19 |
| Na | 0.60 | 0.03 | (6.7) | 8.9 | 3.59 | 0.1 - 71 | 0.22 | 0.002 | (0.5) | 39.2 | 1.98 | 0.1 - 22 |
| P | 1.50 | 0.18 | (61.0) | 2.46 | 0.53 | ---- | 4.55 | 0.03 | (97.6) | 4.66 | 0.27 | 5 - 143 |
| | mg $kg^{-1}$ | | | | | | | | | | | |
| Cd | 1.36 | 0.28 | (17.7) | 7.69 | 4.29 | 0.1 - 130 | <0.4 | NA | (NA) | <0.4 | NA | 0.6 - 3400 |
| Co | 23.8 | 1.22 | (40.7) | 58.5 | 3.91 | ---- | 1.61 | 0.12 | (26.7) | 6.03 | 0.90 | 2 - 2490 |
| Cr | 18.2 | 3.27 | (19.6) | 92.8 | 1.17 | 4 - 900 | 21.6 | 0.35 | (94.3) | 22.9 | 1.40 | tr - 99000 |
| Cu | 103 | 1.08 | (53.1) | 194 | 9.32 | 33 - 2200 | 63.7 | 1.4 | (84.7) | 75.2 | 7.66 | 45 - 17000 |
| Mn | 82.0 | 6.06 | (35.0) | 234 | 90.9 | 25 - 3000 | 247 | 0.67 | (59.5) | 415 | 78.1 | 32 - 14035 |
| Ni | 43.4 | 6.13 | (53.1) | 81.8 | 2.11 | 2 - 4300 | 12.5 | 0.21 | (NA) | <10.0 | NA | 2 - 8000 |
| Pb | 60.6 | 5.32 | (26.8) | 226 | 7.00 | 3 - 2100 | 19.5 | 0.62 | (35.6) | 54.7 | 13.8 | 13 - 26000 |
| Zn | 106 | 6.13 | (59.9) | 177 | 8.60 | 14 - 3500 | 178 | 0.75 | (98.9) | 180 | 7.34 | 50 - 49000 |

[††] Standard error.

[φ] ($HNO_3$-extractable/Total)* 100

[†] Ranges given for coal fly ash (Mattigod et al., 1990; Eary et al., 1990).

[‡] Ranges given for anaerobically digested sewage sludge (Essington and Mattigod, 1990).

* Mean shale (Bowen, 1979).

Table 1. (continued)

| | Mine spoil | | | | | |
|---|---|---|---|---|---|---|
| Element | $HNO_3$ | SE | (% T) | Total | SE | Mean* |
| | | | $g\ kg^{-1}$ | | | |
| Al | 9.00 | 3.06 | (12.4) | 72.7 | 2.68 | 88 |
| Ca | 1.86 | 0.39 | (49.6) | 3.75 | 0.15 | 16 |
| Fe | 49.9 | 0.93 | (100) | 44.8 | 0.77 | 48 |
| K | 1.72 | 0.81 | (17.5) | 9.80 | 1.73 | 25 |
| Mg | 2.22 | 0.17 | (45.5) | 4.88 | 0.10 | 16 |
| Na | 0.08 | 0.01 | (0.4) | 17.9 | 2.13 | 5.9 |
| P | 1.36 | 0.002 | (100) | 0.99 | 0.02 | 0.7 |
| | | | $mg\ kg^{-1}$ | | | |
| Cd | <0.4 | NA | (NA) | <0.4 | NA | 0.22 |
| Co | 11.3 | 2.69 | (65.3) | 17.3 | 2.80 | 19 |
| Cr | 16.4 | 0.93 | (24.9) | 65.9 | 1.19 | 90 |
| Cu | 16.6 | 1.15 | (73.5) | 22.6 | 2.72 | 39 |
| Mn | 278 | 21.6 | (83.7) | 332 | 138.8 | 850 |
| Ni | 26.3 | 0.30 | (NA) | <10.0 | NA | 68 |
| Pb | 27.9 | 7.57 | (20.1) | 139 | 10.43 | 23 |
| Zn | 93.0 | 9.30 | (84.5) | 110 | 27.2 | 120 |

[††] Standard error.

[φ] ($HNO_3$-extractable/Total)* 100

[†] Ranges given for coal fly ash (Mattigod et al., 1990; Eary at al., 1990).

[‡] Ranges given for anaerobically digested sewage sludge (Essington and Mattigod, 1990).

* Mean shale (Bowen, 1979).

to nitric acid extraction. Conversely, P maintained high $HNO_3$-extractability in the mine spoil (100%), LSS (97.6%), and FA (61%).

Although Cd was below the ICP-OES detection limit for both the LSS and the mine spoil, the Cd content in FA was determined to be 7.69 mg $kg^{-1}$ with 17.7% being $HNO_3$-extractable. Similarly, Ni concentrations in the LSS and mine spoil were below detectable levels, but was detected to be 81.8 mg $kg^{-1}$ in the FA with an $HNO_3$-extractability of 53%.

Copper content was highest in the FA (193.8 mg $kg^{-1}$) and lowest in the mine spoil material (22.59 mg $kg^{-1}$). However, the greatest determined $HNO_3$-extractability was for the LSS (84.7%) when compared to the mine spoil (73.6%) and FA (53.1%). Although, the Mn content was highest in LSS (415.0 mg $kg^{-1}$) and lowest in the FA (234.0 mg $kg^{-1}$) the $HNO_3$-extractability was highest for the mine spoil (80%). Further, Zn content was highest in the LSS (180.0 mg $kg^{-1}$) and lowest in the mine spoil (109.8 mg $kg^{-1}$) with Zn $HNO_3$-extractability being highest for the LSS (98.7%).

The highest Pb concentration was observed in the FA (226.0 mg $kg^{-1}$) and lowest in the LSS (19.5 mg $kg^{-1}$). However, the greatest $HNO_3$-extractability for Pb was observed for the LSS (35.6%). Also, Co content was highest for the FA(58.5 g $kg^{-1}$) and lowest for the LSS(6.03 mg $kg^{-1}$), but the greatest $HNO_3$-extractability was observed for the mine spoil (65.3%). Comparatively, Cr content was greatest for the FA (92.8 mg $kg^{-1}$), but only 19.6% was $HNO_3$-extractable. Chromium concentrations were determined to be the lowest for the LSS (22.9 mg $kg^{-1}$), yet maintained the highest $HNO_3$-extractability (94.3%).

Variations in $HNO_3$-extractability of metals in the mine spoil, LSS, and FA was a function of element speciation in the mineral phase. In general, $HNO_3$ digestion was more efficient at extracting Al, Ca, Mg, Cr, Cu, Pb, and Zn from LSS; K and Na from the FA; and Fe, Mg, P, Co, and Mn from mine spoil. Further, $HNO_3$-extractability was not a function of total concentrations and the $HNO_3$ digestion method did not yield a constant percent extractability that could be uniformly applied, irrespective of material.

### Laboratory Weathering

Simulated laboratory weathering was conducted over a period of 18 cycles. A weathering cycle consisted of the following steps: (1) saturation of mine spoil and amended mine spoil with water and equilibration for one hour, (2) separation of leachate from solids by vacuum filtration, (3) analysis of collected leachate, and (4) drying of the solids for one week. Each leaching cycle was designed to simulate water table fluctuation or a rainfall event, to imitate the variation in water saturation, and to accelerate weathering. Leachate pH and EC were determined immediately upon collection. The remaining chemical analyses were completed within one week of collection by IC and ICP-OES.

The leachate pH increased and maintained pH values near neutral with LSS amendment throughout simulated weathering, except for fluctuations around cycle 15 (Figure 3). Further, leachate pH was not influenced by FA amendment. During cycle 14, leachate pH was lowest for the 0 and 197 Mg $ha^{-1}$ FA rates. In cycle 15, leachate pH was lowest for the 295 and 394 Mg $ha^{-1}$ FA rates. The pH of the unamended mine spoil leachate was also slightly depressed during cycles 14 and 15. By cycle 16, the leachate pH of all treatments reverted to pH values observed prior to cycle 14. This fluctuation in leachate pH may have resulted from increased mineralization/nitrification by microorganisms because the leachate pH reduction coincided with increased nitrate levels in the leachates (to be discussed).

The EC in all amended spoil material was higher for cycles 2 through 14 due to the application of the LSS (Figure 4). Fly ash rates did not influence leachate EC. The decrease in leachate EC was due to the removal of soluble salts. The EC during weathering of the unamended mine spoil leachates decreased more rapidly than that of the amended mine spoil material, indicating that the LSS/FA amendments were a source of soluble salts.

Calcium in the amended mine spoil leachates mirrored

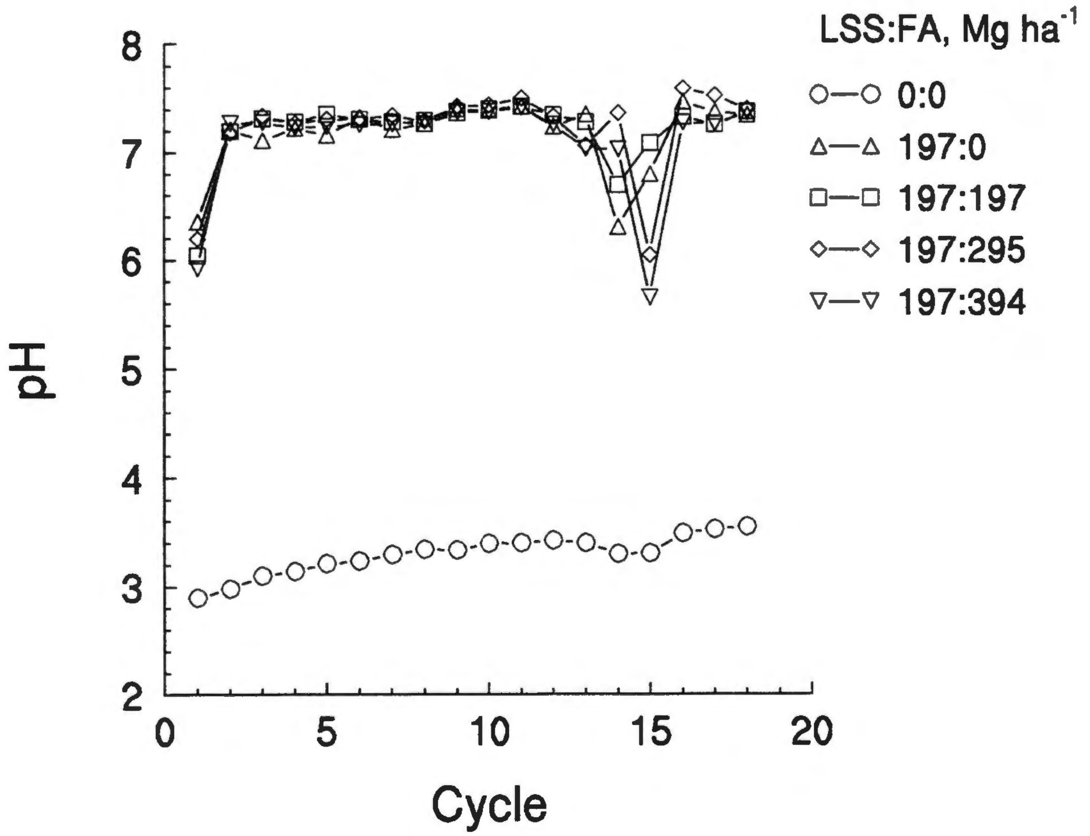

Figure 3. The pH of humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

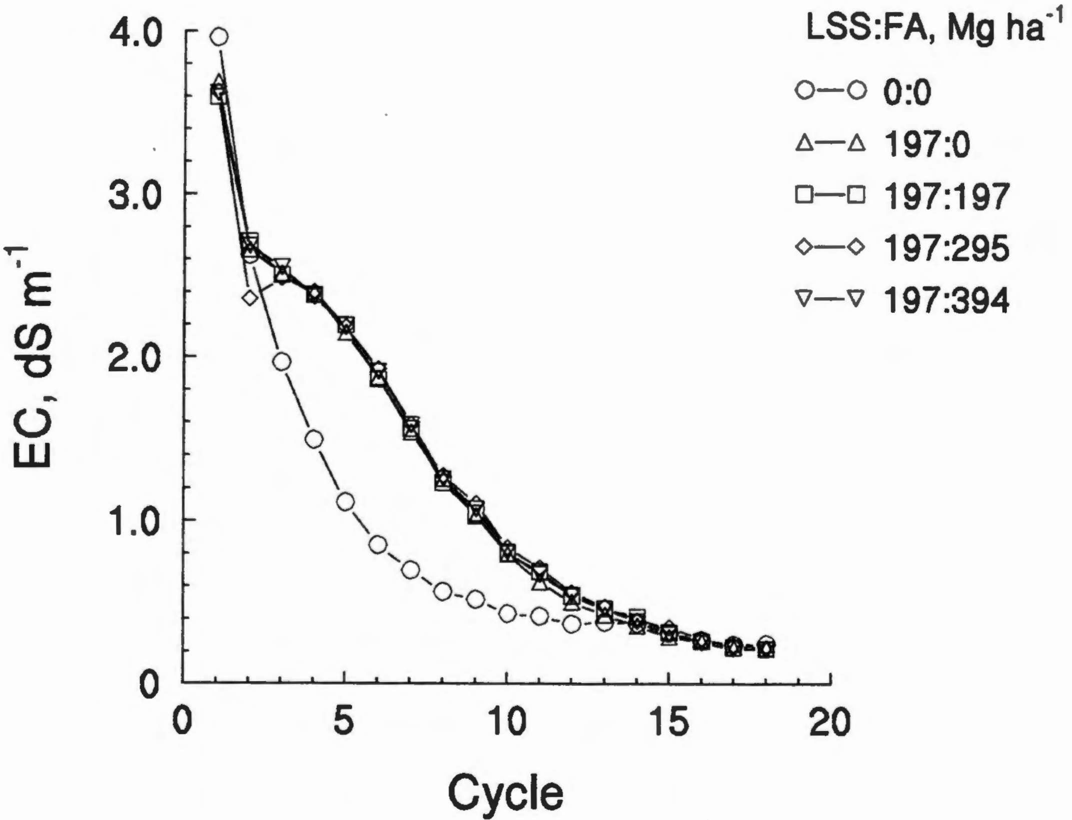

Figure 4. The EC of humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

leachate EC and ranged from a high of 900 mg $L^{-1}$ during the first weathering cycle to 50 mg $L^{-1}$ by cycle 18 (Figure 5). Soluble Ca was not influenced by FA amendment rates. The differences in leachate Ca concentration between the unamended mine spoil and amended mine spoil was attributed to LSS application, which supplied the system with additional soluble Ca (Table 1). The Ca concentration in leachate from the unamended mine spoil decreased with weathering. The initial leachate concentration of 450 mg $L^{-1}$ decreased to 12 mg $L^{-1}$ by the end of the study. The leaching behavior of Mg was similar to that of Ca shown by the decrease in leachate Mg with weathering (Figure 6). However, while there was a noticeable difference in Mg concentration between the unamended and amended mine spoil leachates, this difference was small in comparison to that observed for Ca.

Leachate sulfate concentrations decreased with weathering for all amended and unamended spoil material (Figure 7). While sulfate concentrations in the unamended and amended mine spoil leachates behaved similarly to that observed for Ca, sulfate concentrations in the unamended spoil leachates were initially greater than in the amended spoil leachates. Further, by the end of the weathering study, all leachates had similar sulfate levels unlike Ca.

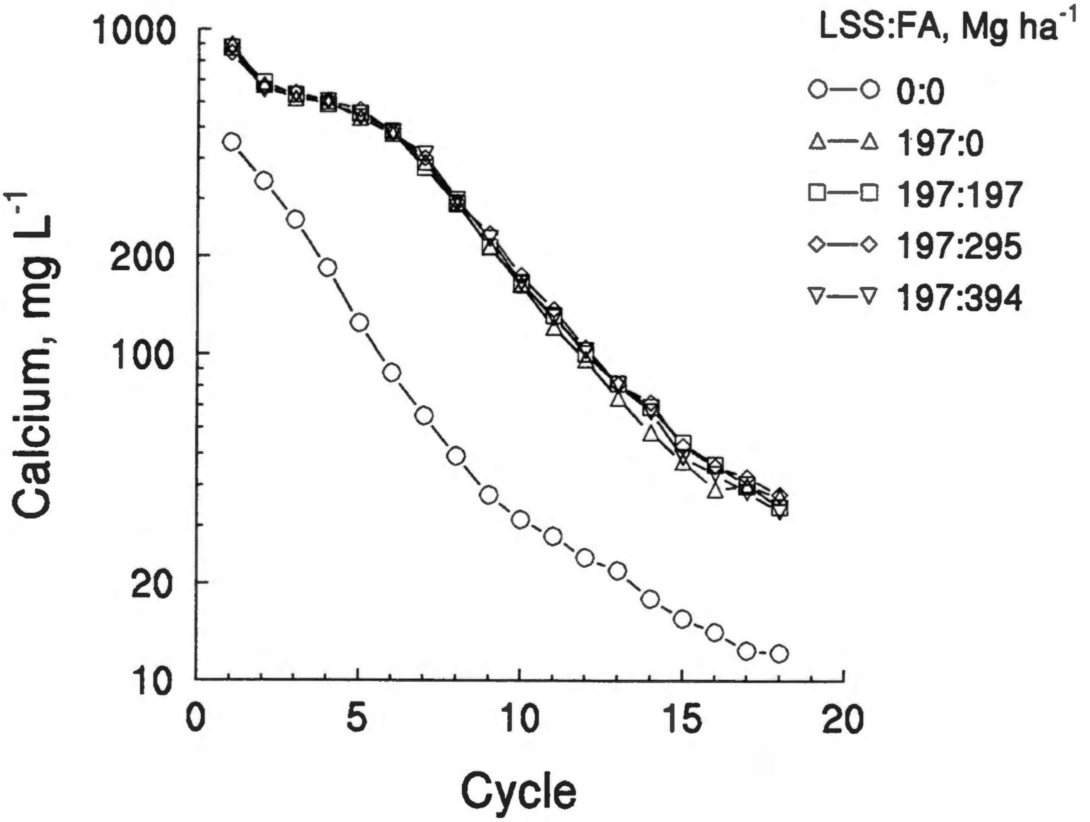

Figure 5. The concentration of calcium in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

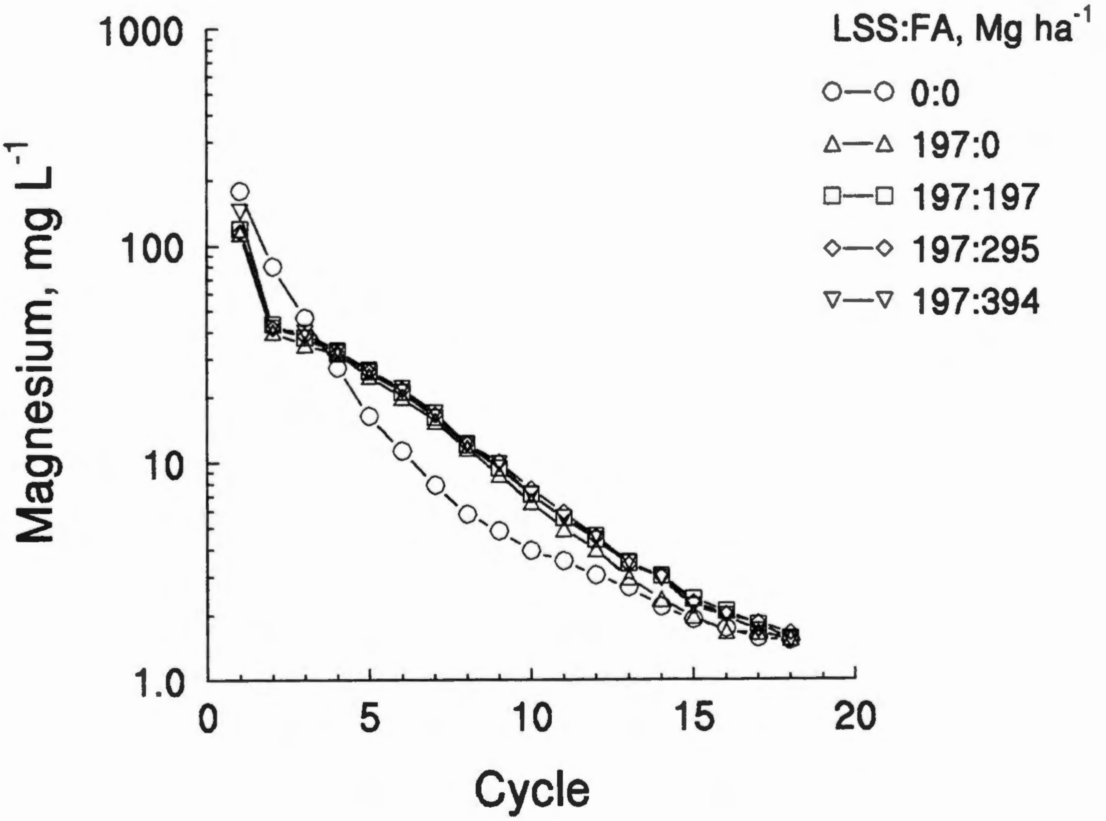

Figure 6. The concentration of magnesium in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

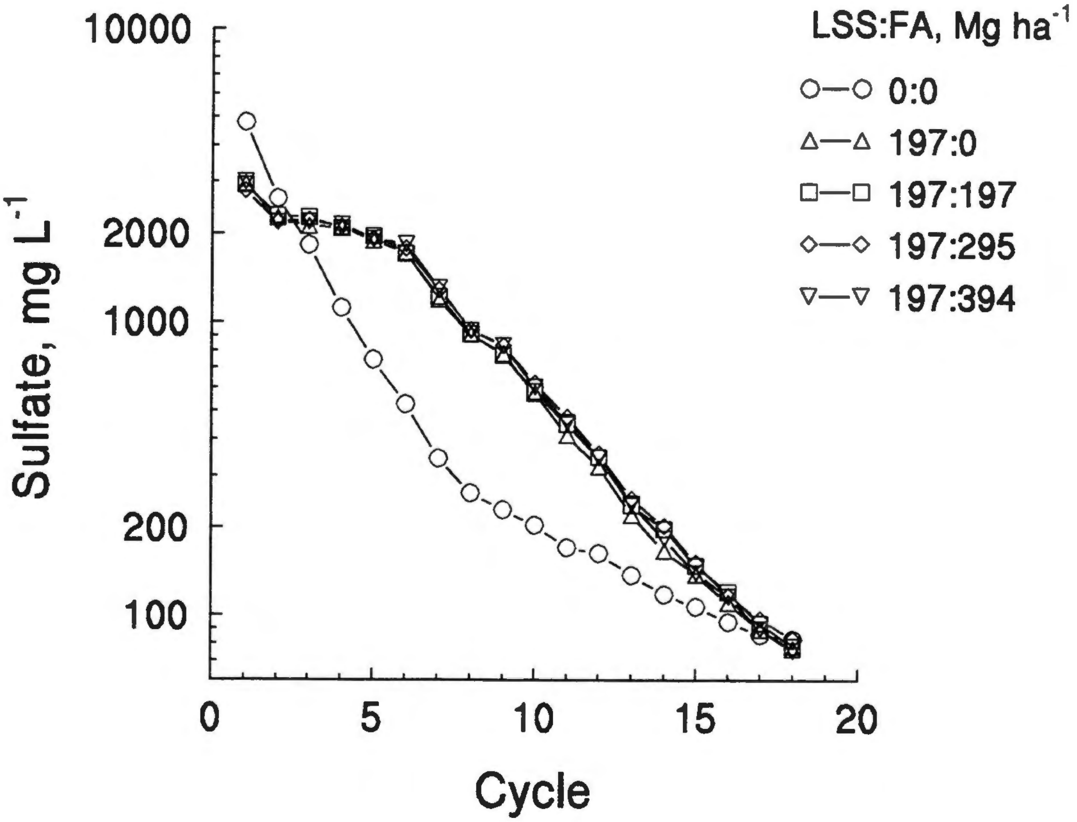

Figure 7. The concentration of sulfate in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

This was probably due to the microbial catalyzed oxidation of pyrite, which would continue to generate sulfate and acidity. It was evident that pyrite oxidation continued throughout the weathering study as leachate pH remained between 2 and 3 for the unamended mine spoil. The rate of FA application did not influence sulfate concentrations.

Chloride concentrations in amended mine spoil leachate reached 250 mg $L^{-1}$ during the first weathering cycle. Leaching reduced chloride concentrations to approximately 1 mg $L^{-1}$ by the tenth weathering cycle (Figure 8). Clearly, LSS had a pronounced impact on leachate chloride, while FA rates did not influence leachate chloride. Chloride in the unamended mine spoil leachate peaked during the second weathering cycle and was reduced to approximately 0.7 mg $L^{-1}$ by cycle 8.

Fluoride behavior was similar to that of magnesium (Figure 9). Fluoride concentrations peaked at approximately 12 mg $kg^{-1}$ during the first weathering cycle and decreased steadily until cycle 10 when the amended spoil leachate fluoride concentrations were approximately 0.3 mg $L^{-1}$. The decrease in leachate fluoride concentrations was more rapid in the unamended spoil. The LSS was a source of fluoride and FA rates had no impact on leachate concentrations.

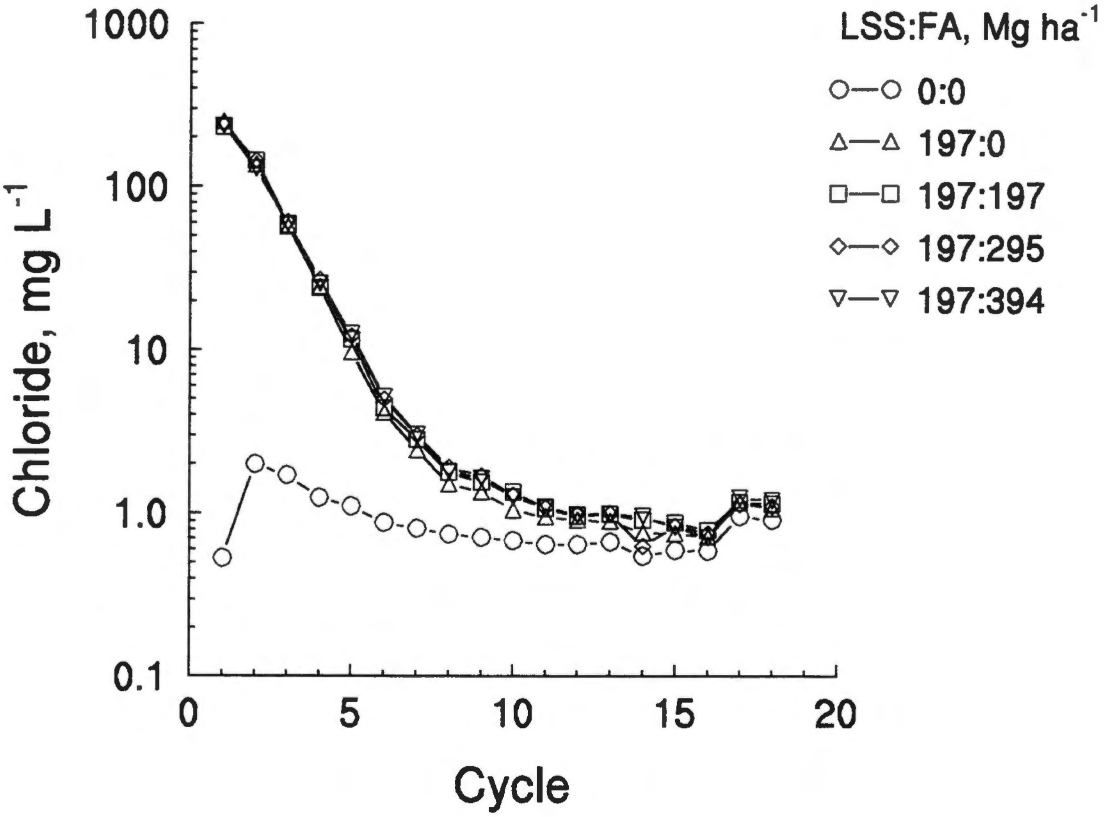

Figure 8. The concentration of chloride in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

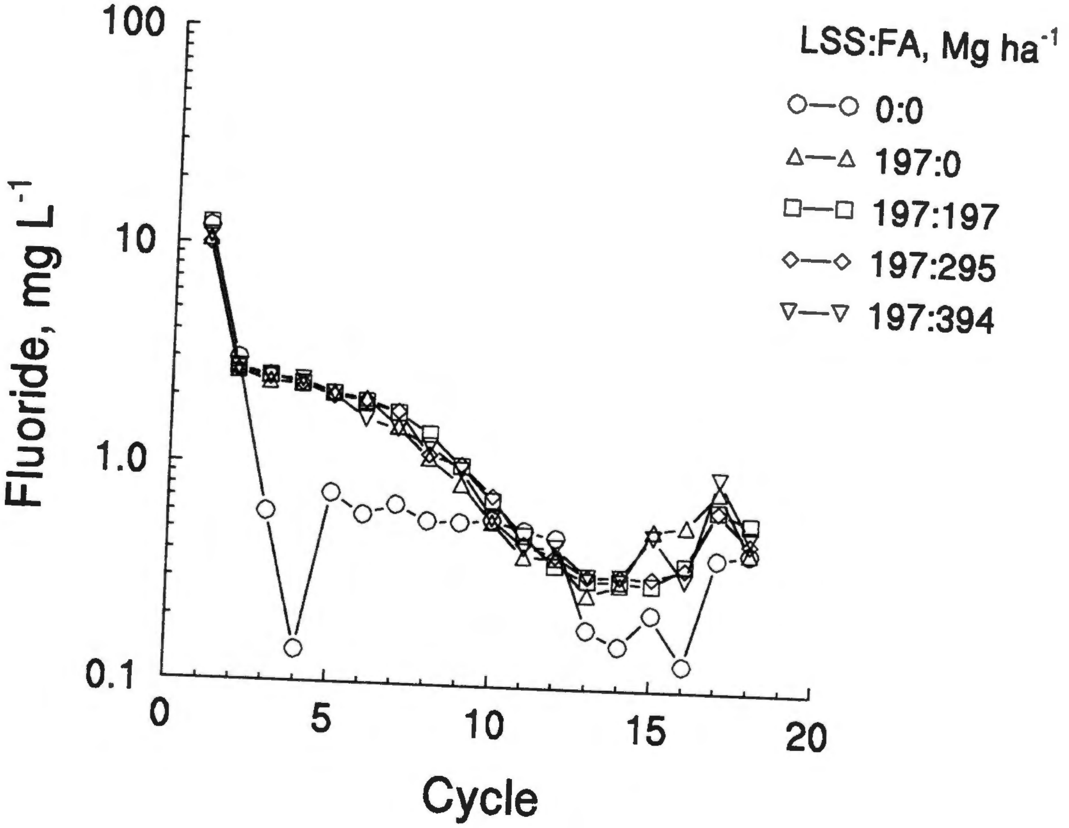

Figure 9. The concentration of fluoride in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

Phosphorus concentrations in the mine spoil leachate increased with LSS amendment (Figure 10). There also appeared to be a slight trend towards increasing leachate P with FA rate. Concentrations of P in the unamended mine spoil leachates were generally below 0.05 mg $L^{-1}$ throughout the study. However, fluctuations in P correspond to the fluctuations in pH and $NO_3$ indicating that P mobility was depressed as pH lowered.

Nitrate leachate concentrations were not influenced by the LSS or FA amendments through the first 12 weathering cycles (Figure 11). Nitrate concentrations smoothly decreased to range between 1 and 2 mg $L^{-1}$. However, after cycle 11, nitrate concentrations increased to approximately 20 mg $L^{-1}$. Nitrate leachate concentrations were highest for the 0 and 197 Mg $ha^{-1}$ FA rates (with LSS) during cycle 14. During cycle 15, the unamended mine spoil and the 295 and 394 Mg $ha^{-1}$ FA amended spoil material had the highest leachate concentrations of nitrate. The flush of leachate nitrate that began during cycle 12 coincides with reduced leachate pH levels. Further, the flush of nitrate was not unique to LSS amended mine spoil, as elevated nitrate levels were observed in the unamended mine spoil leachates. Although the reason for this fluctuation was not clear, microbes were likely in sufficient number to oxidize organic-N to nitrate resulting in higher leachate nitrate and acid production.

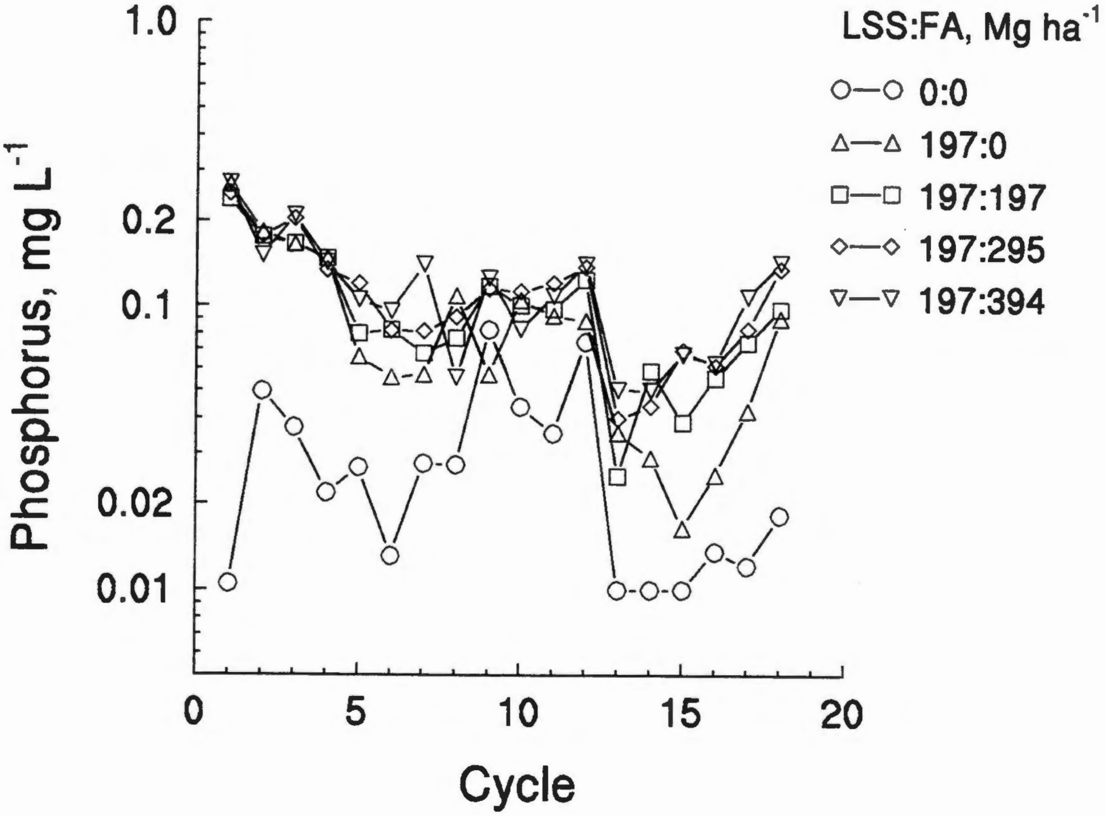

Figure 10. The concentration of phosphorus in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

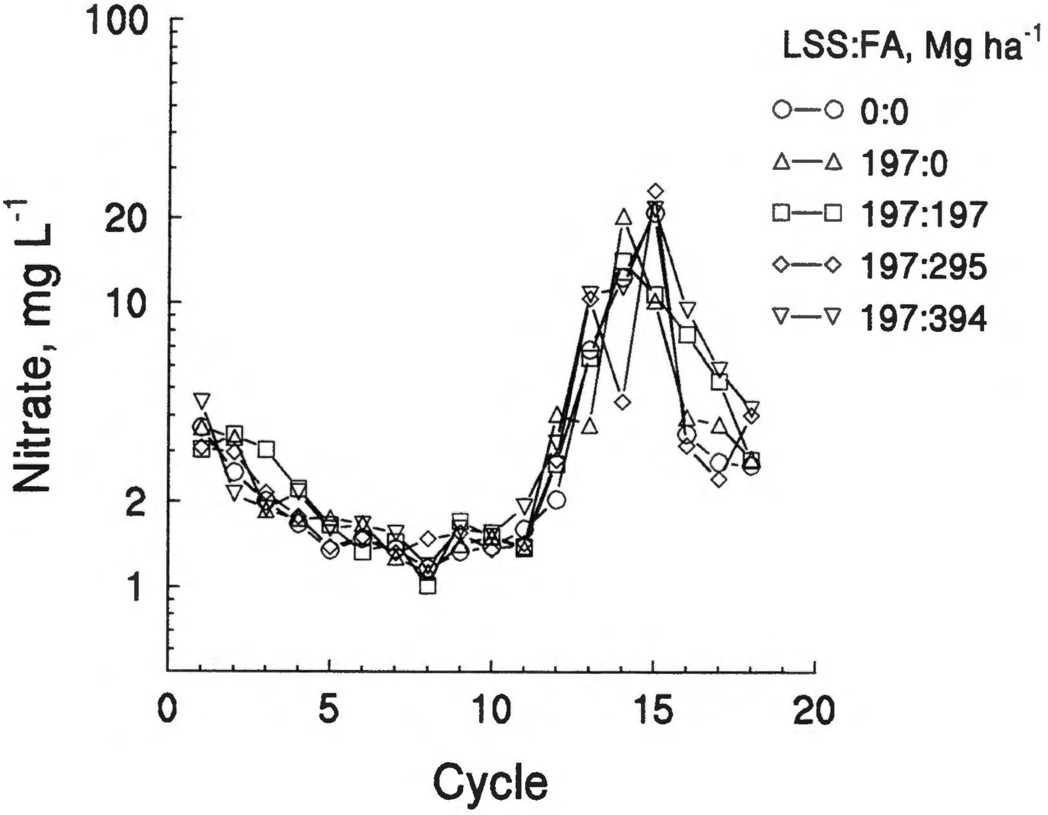

Figure 11. The concentration of nitrate in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

Potassium concentrations in the unamended mine spoil leachate increased with weathering from an initial concentration of 0.3 mg $L^{-1}$ to approximately 6 mg $L^{-1}$ (Figure 12). Potassium concentrations in the amended spoil leachate initially dropped to approximately 1 mg $L^{-1}$ then oscillated around 2 mg $L^{-1}$. Acid generation in the unamended mine spoil provided acidic conditions that enhance K-bearing mineral solubilization (e.g. mica). This contributed to the increased K concentrations in the unamended spoil leachates. In general, leachate K concentrations were not influenced by FA rate.

Boron concentrations in the mine spoil leachates increased with increasing fly ash rate (Figure 13). Boron was expected to be found in amended mine spoil leachates because FA particles are generally described as spheroidal borosilicate glass structures. However, during weathering cycles 1 through 4, B concentrations in the LSS amended spoil was elevated relative to the unamended spoil due to the contribution of B from the LSS. The influence of LSS in leachate B concentrations was also observed for the LSS and FA amended mine spoil during the initial weathering cycles.

The difference between amended and unamended mine spoil leachate Al and Fe concentrations was attributed to the LSS applications that increased pH and reduced the solubility of Al- and Fe-bearing minerals. Clearly, Al and Fe

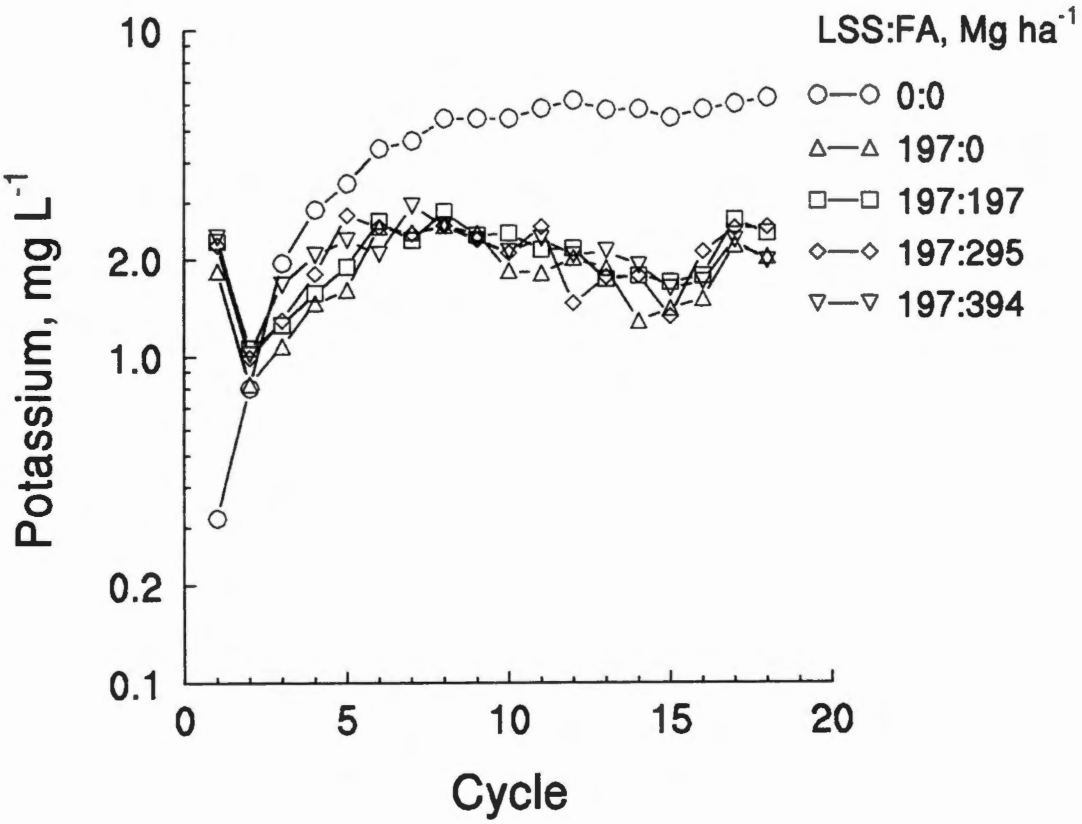

Figure 12. The concentration of potassium in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

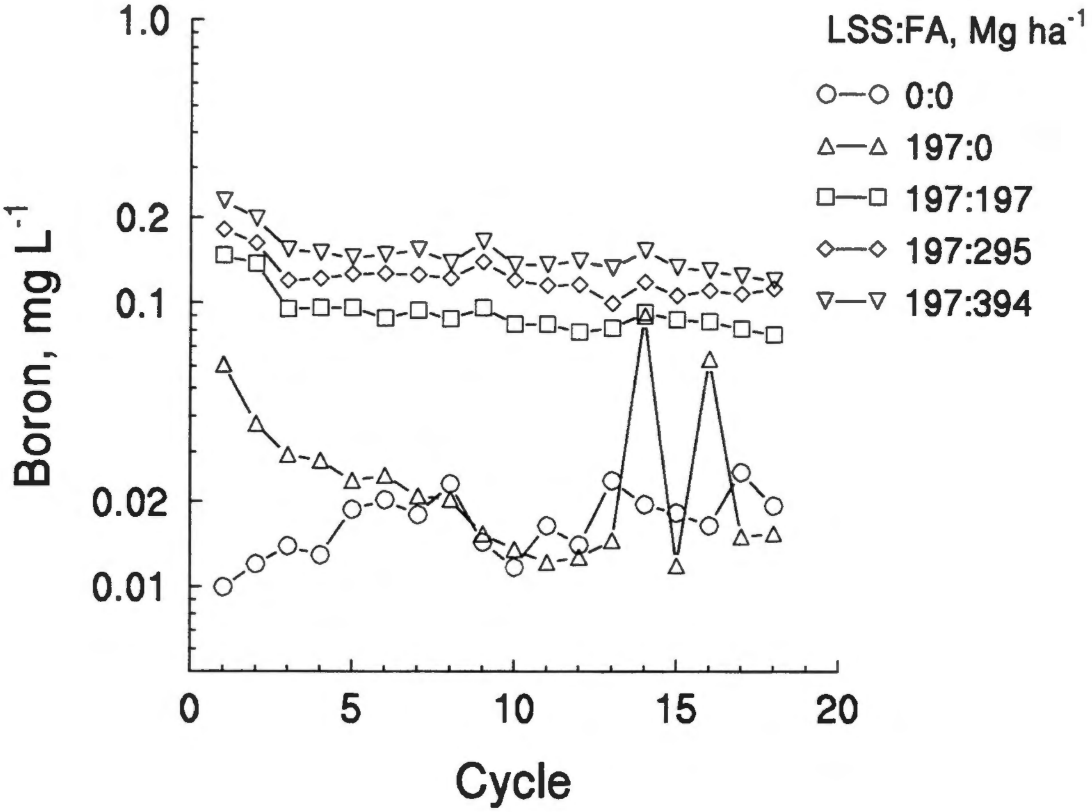

Figure 13. The concentration of boron in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

concentrations in amended spoil leachates were near the levels of detection after the initial weathering cycle. Aluminum concentrations in the unamended mine spoil leachate decreased from approximately 200 mg $L^{-1}$ during cycle 1 to approximately 1.0 mg $L^{-1}$ by cycle 18 (Figure 14). Similarly, Fe concentrations in the unamended mine spoil decreased from 40 mg $L^{-1}$ to approximately 0.6 mg $L^{-1}$ by the end of the weathering study (Figure 15). There was no influence of varying FA rate in leachate Al or Fe concentrations.

Like Al and Fe, Mn concentrations were highest in unamended mine spoil leachates. Leachate Mn values in the unamended mine spoil were 30 mg $L^{-1}$ upon initial weathering, decreasing to approximately 1.0 mg $L^{-1}$ by the end of the study (Figure 16). However, unlike Al and Fe, leachate Mn decreased gradually in the amended spoil from approximately 20 mg $L^{-1}$ to levels approaching the detection limit by the end of the weathering study.

The concentrations of Cu were highest in the unamended mine spoil (1.0 mg $L^{-1}$) during the first weathering cycle due to Cu mobility in low pH systems, but decreased with weathering (Figure 17). Copper concentrations in the amended mine spoil fluctuated about 0.01 mg $L^{-1}$ for all amended spoil with no apparent influence of FA rate. The difference between amended and unamended spoil Cu leachate

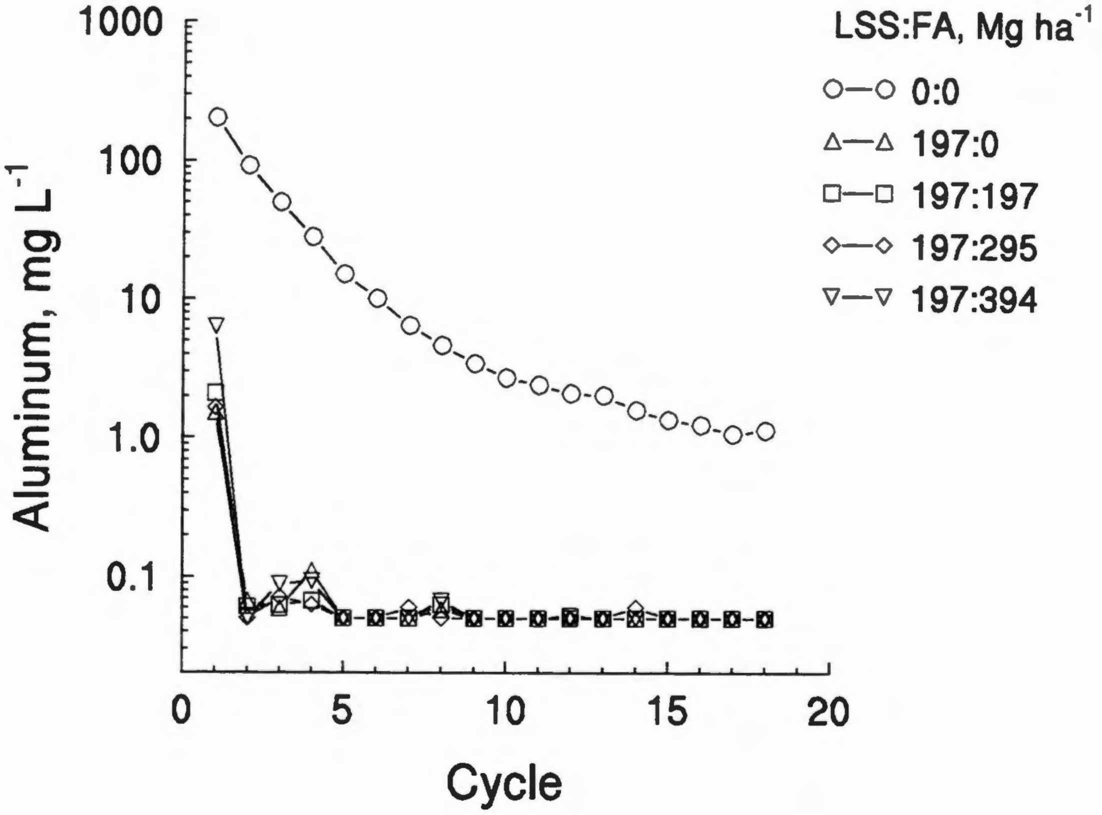

Figure 14. The concentration of aluminum in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

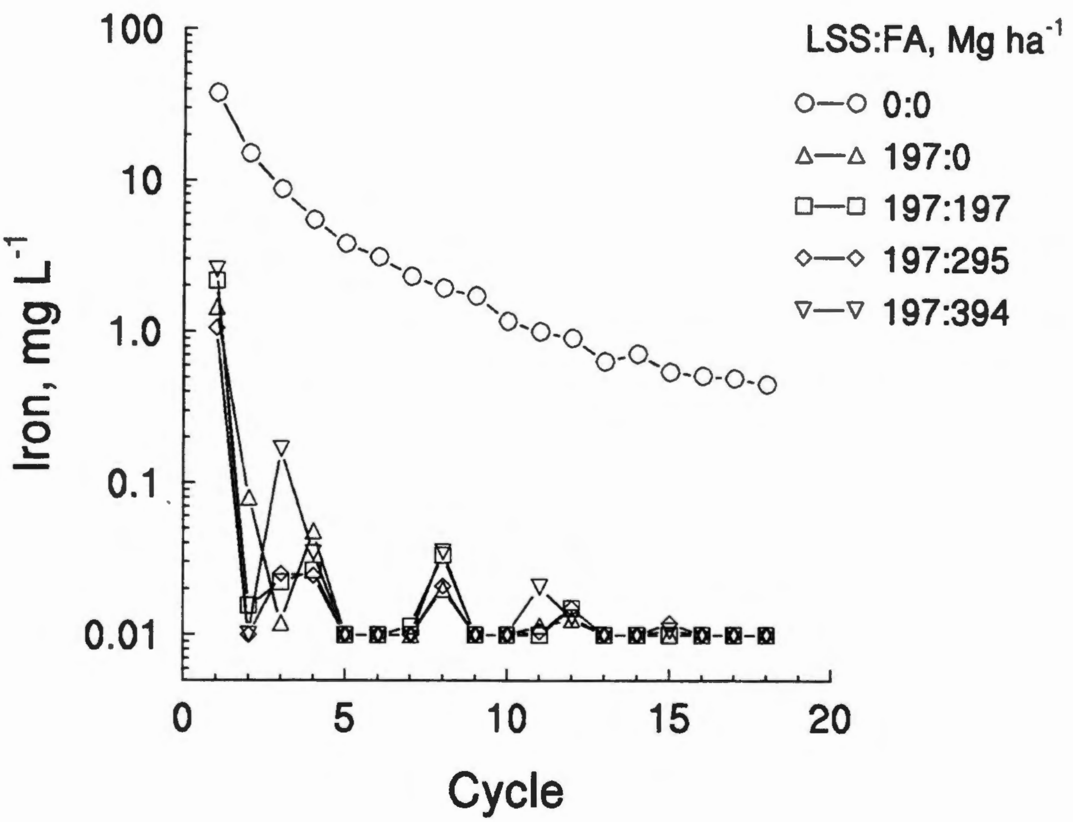

Figure 15. The concentration of iron in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

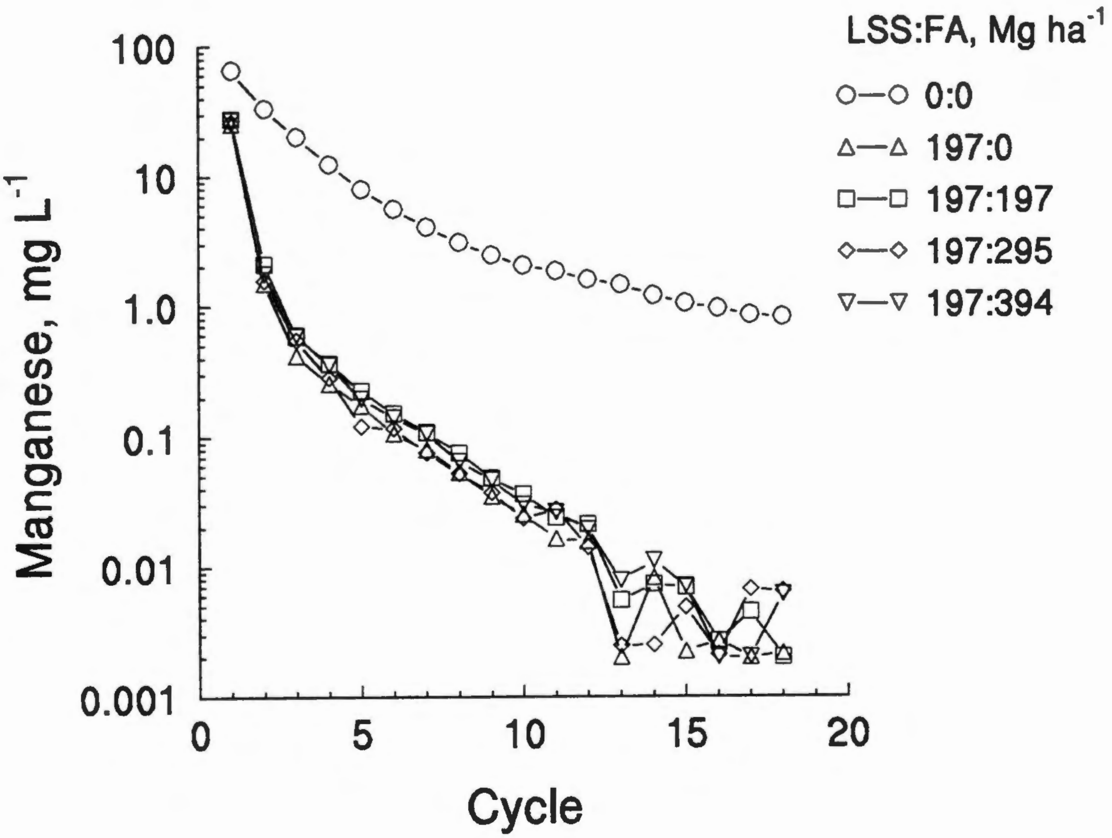

Figure 16. The concentration of manganese in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

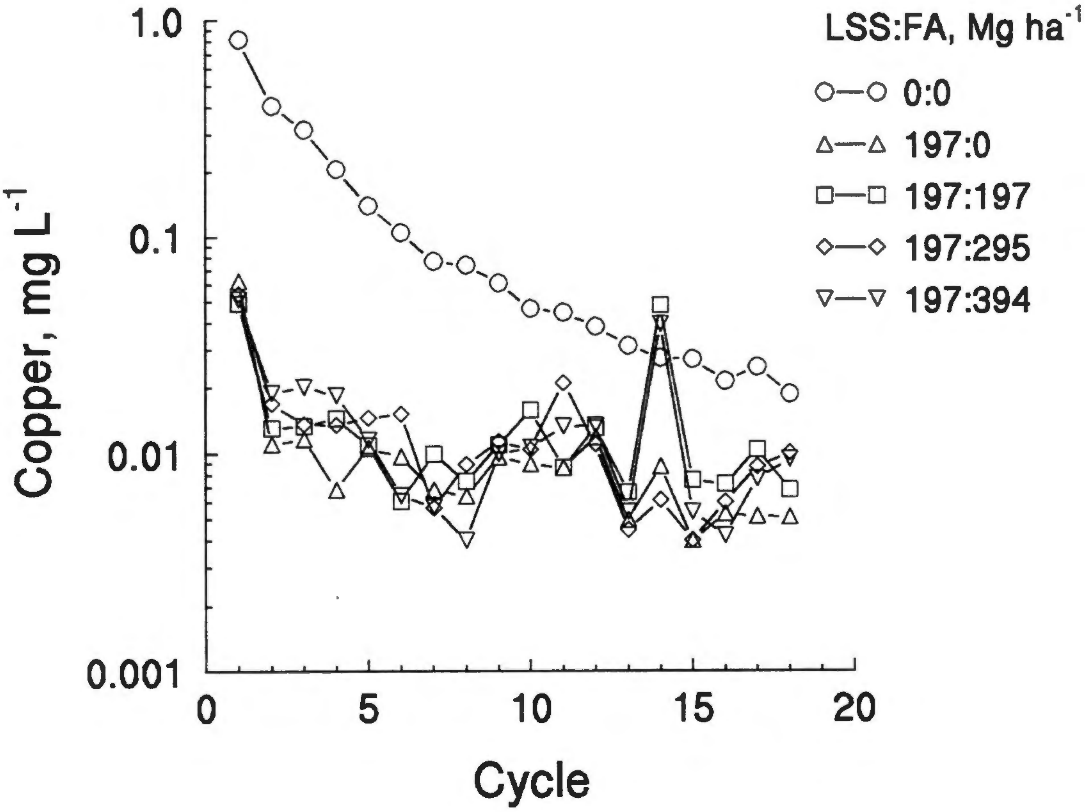

Figure 17. The concentration of copper in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

concentrations was attributed to the LSS application, increasing pH and the stability of Cu-bearing minerals. Nickel leachate concentrations for the unamended mine spoil were initially found at 3 mg $L^{-1}$, but decreased to the 0.03 mg $L^{-1}$ level of detection within 8 weathering cycles (Figure 18). The difference between amended and unamended spoil leachate Ni concentrations was attributed to the LSS application increasing pH and the stability of Ni-bearing minerals. Similar to Ni, Zn in amended spoil leachates were near detectable limits throughout the weathering study, irrespective of FA amendment rate (Figure 19). However, the unamended mine spoil leachate concentrations were initially high in Zn (9.0 mg $L^{-1}$) and gradually decreased to approximately 0.1 mg $L^{-1}$ with weathering, as was noted for Cu and Ni, the difference between amended and unamended spoil leachate Zn concentrations was attributed to the LSS application which increased solution pH and the stability of Zn- bearing minerals.

In summary, simulated laboratory weathering showed that the LSS amendment had a dominate impact on leachate chemical characteristics. Leachate pH was effectively neutralized for the duration of the weathering study through the addition of LSS. The decrease of pH observed during the later weathering cycles coincided with fluctuations in

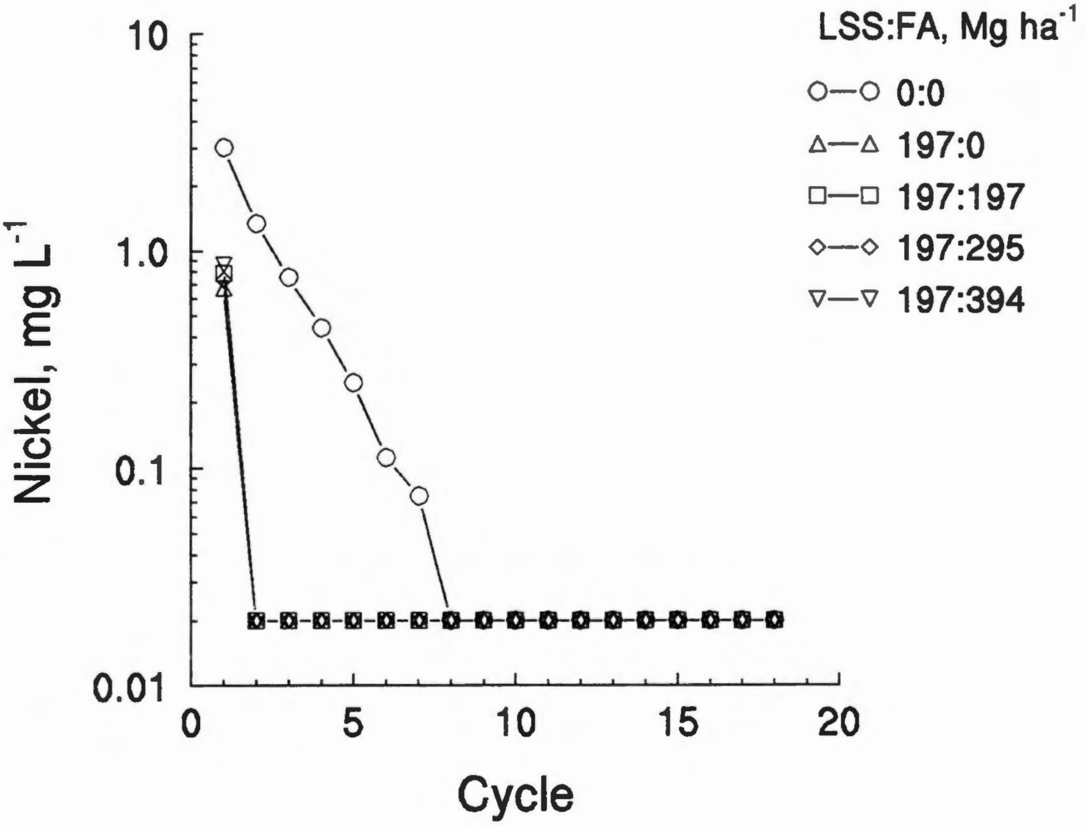

Figure 18. The concentration of nickel in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

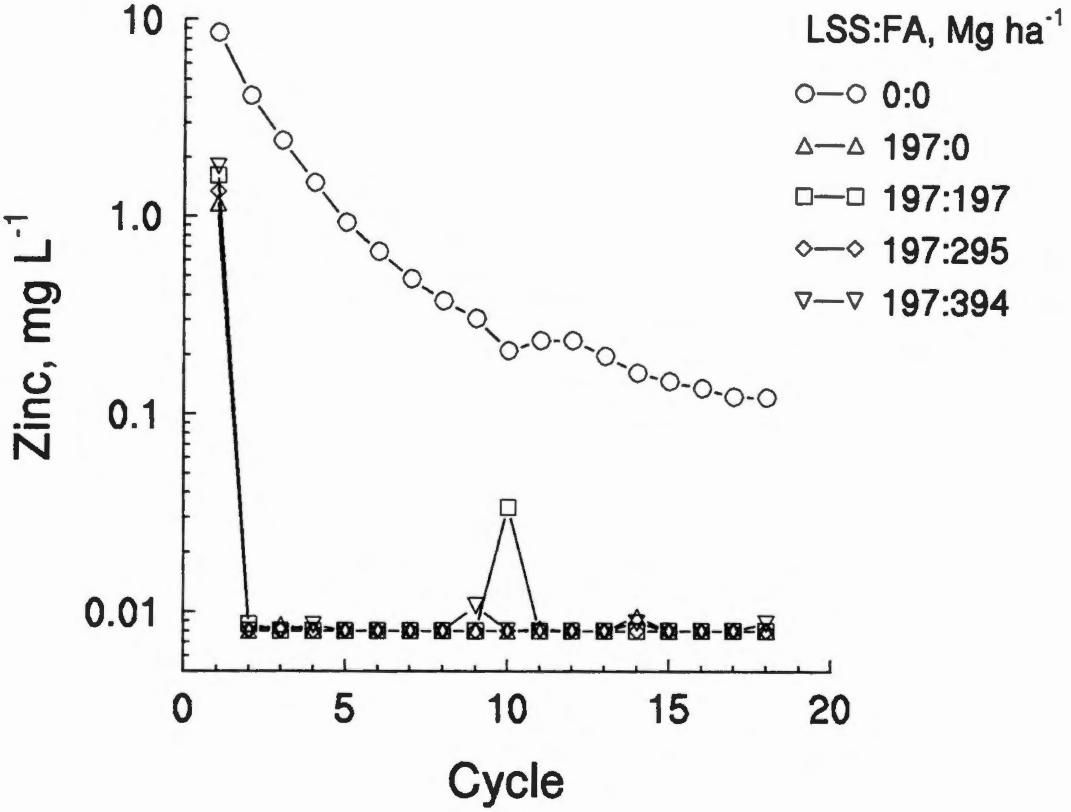

Figure 19. The concentration of zinc in humidity cell leachates from unamended and lime-stabilized sewage sludge (LSS) and fly ash (FA) amended mine spoil.

nitrate concentrations, suggesting increased microbial activity. Sewage sludge was the primary source for calcium, sulfate, chloride, fluoride, and phosphorus in the amended spoil leachates. In general, the leachate concentrations of these elements decreased with weathering. With the exception of phosphorus and boron, FA had no impact on leachate chemistry. Phosphorus and boron were found to increase in the amended mine spoil leachates with increasing FA rates. Conversely, leachate potassium concentrations were greatest in the unamended mine spoil due to dissolution of K-bearing minerals, irrespective of FA rate. Aluminum, iron, manganese, copper, nickel, and zinc concentrations in leachate were highest in the unamended mine spoil due to elevated metal mobility in low pH systems with no apparent influence of FA rates.

## Sequential-Selective Dissolution

The sequential selective dissolution (SSD) procedure employed in this study is reported to partition elements into the following operationally-defined chemical pools: soluble-exchangeable ($KNO_3$-extractable), adsorbed ($H_2O$-extractable), organic (NaOH-extractable), carbonate (EDTA-extractable), and sulfide forms ($HNO_3$-extractable). The fraction of the total elemental content that is not extracted by the SSD reagents is defined as the residual fraction. The elements subjected to SSD characterization were Ba, Co, Cr, Cu, Mn, Ni, Pb, Sr, and Zn in the mine spoil and in the LSS/FA-amended mine spoil collected after 2 cycles (unweathered) and after 18 cycles (weathered) of simulated weathering.

For the unweathered material, Ba was found to primarily reside in the residual fraction (Figure 20). Barium in the residual fraction slightly decreased with increasing FA rate with significant increases in the carbonate and soluble-exchangeable forms (Table 2). The sulfide fraction significantly increased upon FA application. The soluble-exchangeable and carbonate forms of Ba were the highest for the highest FA rate. Upon weathering, Ba in the soluble-exchangeable phase was reduced in the FA amended spoil and significantly increased in the carbonate fraction upon LSS application. In general, the residual fraction of Ba was not influenced by weathering. However, in the weathered material, FA rate significantly increased Ba found in the soluble-exchangeable and sulfide forms and decreased in the residual fraction. The application of LSS increased Ba in the adsorbed and carbonate fractions and decreased the organic and residual forms of Ba.

For the unweathered material, Co was primarily found in the residual form which significantly increased upon FA application, irrespective of FA rate (Figure 21). The soluble-exchangeable form of Co was highest in the unamended

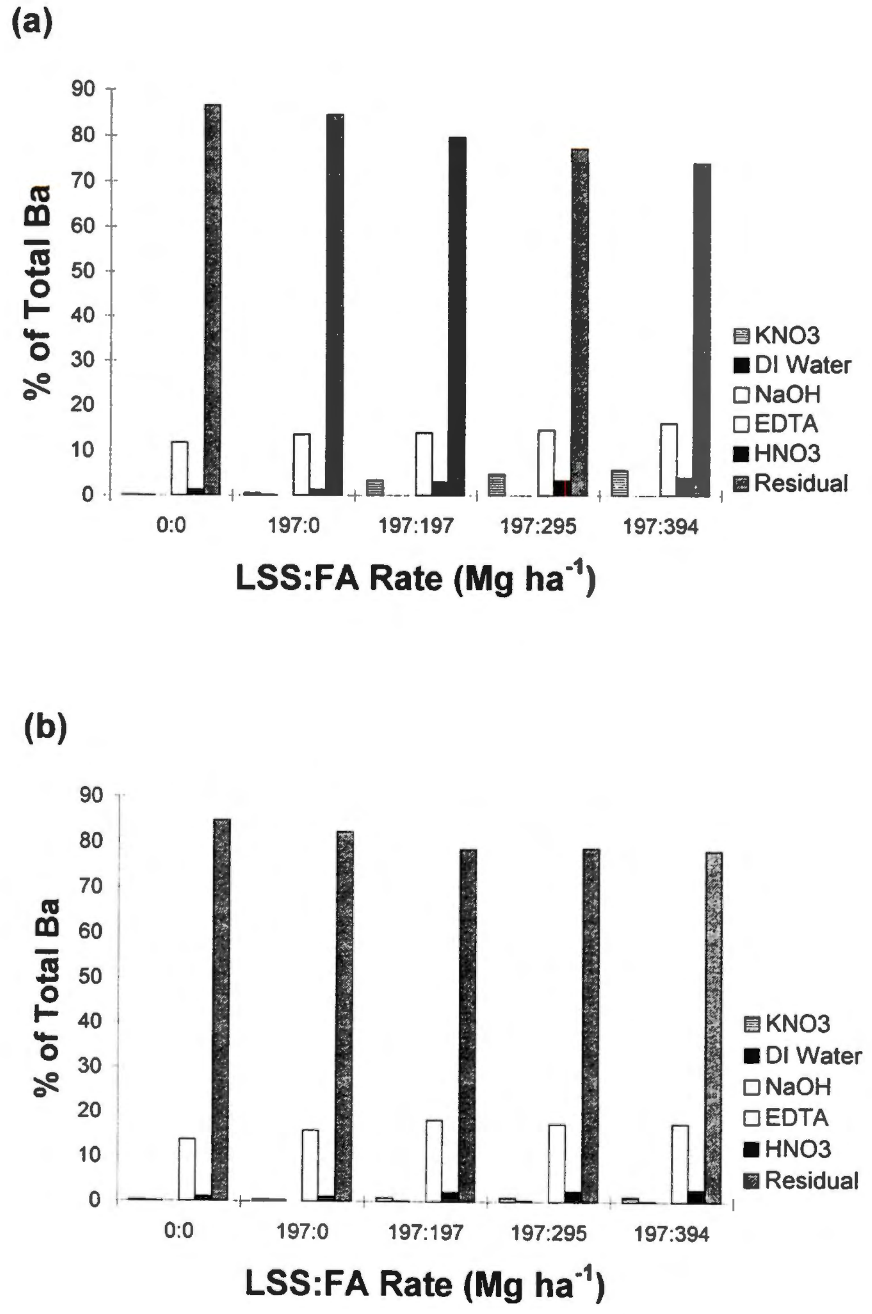

Figure 20. Influence of weathering and lime-stabilized sewage sludge (LSS) and fly ash (FA) amendments on the solid-phase speciation of barium in the mine spoil after (a) 2 cycles and (b) 18 cycles of weathering.

Table 2. Percentages of elements in the extractable fractions of amended mine spoil. Differences between treatments (Trt) and weathering cycles (Cycle) determined by SAS using the general liner model and Student-Newman-Keuls test (95% confidence interval).[†]

| Cycle | Trt[††] | $KNO_3$ | $KNO_3$ %T[ϕ] | DI Water | DI %T | NaOH | NaOH %T | EDTA | EDTA %T | $HNO_3$ | $HNO_3$ %T | Residual | Residual %T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Barium | | | | | | |
| 2 | 1 | Da | 0.20 | Ba | 0.05 | Aa | 0.01 | Ba | 11.82 | Ba | 1.29 | Aa | 86.63 |
| | 2 | Da | 0.49 | Aa | 0.06 | Aa | 0.01 | ABa | 13.56 | Ba | 1.31 | Aa | 84.57 |
| | 3 | Ca | 3.38 | Ba | 0.01 | Aa | 0.01 | ABa | 13.93 | Aa | 3.02 | Ba | 79.66 |
| | 4 | Ba | 4.73 | Ba | 0.00 | Ba | 0.00 | ABa | 14.58 | Aa | 3.44 | Ca | 77.24 |
| | 5 | Aa | 5.72 | Ba | 0.03 | Ba | 0.00 | Aa | 16.13 | Aa | 4.01 | Ca | 74.10 |
| 18 | 1 | Ea | 0.25 | Ba | 0.04 | Aa | 0.01 | Ba | 13.82 | Ca | 1.07 | Aa | 84.81 |
| | 2 | Da | 0.39 | Ab | 0.27 | Bb | 0.00 | Aa | 15.91 | Ca | 1.14 | Ba | 82.30 |
| | 3 | Cb | 0.83 | ABb | 0.17 | Ba | 0.00 | Ab | 18.30 | Bb | 2.16 | Ca | 78.54 |
| | 4 | Bb | 0.94 | Ab | 0.27 | Ba | 0.00 | Ab | 17.46 | ABb | 2.45 | Ca | 78.87 |
| | 5 | Ab | 1.14 | ABb | 0.18 | Ba | 0.00 | Aa | 17.55 | Aa | 2.80 | Ca | 78.33 |
| | | | | | | | Cobalt | | | | | | |
| 2 | 1 | Aa | 13.66 | Aa | 1.98 | Ba | 1.21 | Aa | 6.59 | Aa | 10.64 | Ba | 65.91 |
| | 2 | Aa | 11.64 | Aa | 1.19 | Ba | 1.25 | Aa | 7.56 | Aa | 9.31 | Ba | 69.05 |
| | 3 | Ba | 6.66 | Aa | 0.96 | ABa | 1.92 | Aa | 6.11 | Aa | 9.14 | Aa | 75.21 |
| | 4 | Ba | 5.64 | Aa | 0.96 | ABa | 1.79 | Aa | 6.80 | Aa | 9.67 | Aa | 75.14 |
| | 5 | Ba | 4.43 | Aa | 0.90 | Aa | 2.35 | Aa | 6.49 | Aa | 9.59 | Aa | 76.25 |
| 18 | 1 | Ab | 2.77 | Ba | 1.30 | Aa | 0.96 | Ca | 8.86 | BCa | 11.10 | Ab | 75.02 |
| | 2 | Bb | 1.12 | Aa | 1.61 | Aa | 1.75 | Ab | 17.40 | Ab | 14.32 | Ba | 63.79 |
| | 3 | Bb | 0.87 | Ba | 1.25 | Aa | 1.64 | Bb | 13.73 | ABb | 12.78 | Aa | 69.72 |
| | 4 | Bb | 0.77 | BCa | 1.11 | Aa | 1.40 | BCb | 12.04 | BCa | 11.27 | Aa | 73.42 |
| | 5 | Bb | 0.59 | Ca | 0.86 | Ab | 1.39 | BCb | 10.99 | Ca | 8.69 | Aa | 77.48 |

[†] For each element, capital letters indicate differences between treatments within the same extractant and the same weathering cycle while lower case letters indicate differences between weathering cycles within the same extractant and the same treatment.

[††] Treatments: 1, 0:0 Mg ha$^{-1}$ LSS:FA; 2, 197:0 Mg ha$^{-1}$ LSS:FA; 3, 197:197 Mg ha$^{-1}$ LSS:FA; 4, 197:295 Mg ha$^{-1}$ LSS:FA; 5, 197:394 Mg ha$^{-1}$ LSS:FA.

[ϕ] Extracted/Total*100 = %T

Table 2. (continued)

| Cycle | Trt | $KNO_3$ | $KNO_3$ %T | DI Water | DI %T | NaOH | NaOH %T | EDTA | EDTA %T | $HNO_3$ | $HNO_3$ %T | Residual | Residual %T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chromium | | | | | | | | | | | | | |
| 2 | 1 | Aa | 0.36 | Aa | 0.53 | Aa | 0.39 | Aa | 3.81 | Aa | 4.51 | Ba | 90.40 |
| | 2 | Aa | 0.38 | Aa | 0.55 | Aa | 0.39 | Ba | 1.18 | Aa | 4.81 | Aa | 92.69 |
| | 3 | Aa | 0.35 | Aa | 0.50 | Aa | 0.34 | Ba | 0.85 | Aa | 4.62 | Aa | 93.35 |
| | 4 | Aa | 0.34 | Aa | 0.50 | Aa | 0.33 | Ba | 1.16 | Aa | 4.91 | Aa | 92.77 |
| | 5 | Aa | 0.35 | Aa | 0.50 | Aa | 0.34 | Ba | 1.14 | Aa | 5.17 | Aa | 92.50 |
| 18 | 1 | Aa | 0.37 | Ba | 0.52 | Aa | 0.35 | Ab | 6.34 | Da | 5.17 | Cb | 87.25 |
| | 2 | Aa | 0.37 | Ab | 1.18 | Ba | 0.31 | Ba | 1.08 | ABb | 6.20 | ABb | 90.86 |
| | 3 | Aa | 0.37 | Ab | 1.11 | Ba | 0.31 | Ba | 1.41 | Ab | 6.47 | Bb | 90.34 |
| | 4 | Aa | 0.44 | Ab | 1.15 | BCa | 0.29 | Ba | 1.21 | BCa | 5.77 | ABb | 91.14 |
| | 5 | Aa | 0.32 | Ab | 0.96 | Ca | 0.27 | Ba | 1.14 | CDa | 5.33 | Ab | 91.98 |
| Copper | | | | | | | | | | | | | |
| 2 | 1 | Aa | 68.74 | Aa | 0.20 | Ca | 11.10 | Ca | 14.09 | Ba | 5.88 | Ba | 0.00 |
| | 2 | Ba | 18.43 | Aa | 0.14 | Aa | 36.56 | Aa | 37.29 | ABa | 7.58 | Ba | 0.00 |
| | 3 | Ca | 12.81 | Aa | 0.03 | Ba | 24.26 | Ba | 25.42 | ABa | 8.56 | Aa | 28.92 |
| | 4 | Ca | 7.69 | Aa | 0.01 | Ba | 22.41 | Ba | 24.95 | ABa | 9.13 | Aa | 35.80 |
| | 5 | Ca | 5.94 | Aa | 0.09 | Ba | 20.82 | Ba | 23.06 | Aa | 10.14 | Aa | 39.95 |
| 18 | 1 | Ab | 21.04 | Ba | 0.00 | Aa | 13.57 | Ab | 21.43 | Ab | 10.86 | Bb | 33.09 |
| | 2 | Bb | 0.23 | Ab | 0.44 | Ab | 13.04 | Ab | 25.54 | Ba | 5.55 | Ab | 55.19 |
| | 3 | Bb | 0.21 | Ab | 0.55 | Ab | 13.45 | Aa | 26.84 | Ba | 6.99 | Aa | 51.96 |
| | 4 | Bb | 0.20 | Ab | 0.51 | Ab | 12.60 | Aa | 24.83 | Ba | 7.15 | Ab | 54.71 |
| | 5 | Ba | 0.15 | Aa | 0.40 | Ab | 10.66 | Aa | 20.69 | Bb | 6.09 | Ab | 62.00 |

Table 2. (continued)

| Cycle | Trt | $KNO_3$ | $KNO_3$ %T | DI Water | DI %T | NaOH | NaOH %T | EDTA | EDTA %T | $HNO_3$ | $HNO_3$ %T | Residual | Residual %T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lead | | | | | | | | | | | | | |
| 2 | 1 | Aa | 2.66 | Aa | 1.40 | Ba | 0.88 | Aa | 20.08 | Ba | 2.72 | Aa | 72.25 |
| | 2 | Ba | 1.02 | Aa | 1.45 | Ba | 1.00 | Aa | 20.87 | Ba | 2.50 | Aa | 73.17 |
| | 3 | Ba | 0.95 | Aa | 1.35 | Aa | 1.44 | Aa | 18.91 | ABa | 3.56 | Aa | 73.79 |
| | 4 | Ba | 0.91 | Aa | 1.30 | Ba | 1.13 | Aa | 18.92 | Aa | 3.84 | Aa | 73.90 |
| | 5 | Ba | 0.86 | Aa | 1.22 | Aa | 1.62 | Aa | 19.80 | Aa | 4.25 | Aa | 72.25 |
| 18 | 1 | Ab | 2.03 | Ba | 1.08 | Aa | 0.78 | ABa | 19.10 | Aa | 3.08 | ABa | 73.93 |
| | 2 | Ba | 0.98 | Aa | 1.39 | Aa | 1.18 | Aa | 21.89 | Aa | 3.66 | Ba | 70.91 |
| | 3 | Ba | 0.83 | ABa | 1.19 | Aa | 1.14 | ABa | 18.64 | Aa | 3.73 | ABa | 74.47 |
| | 4 | Ba | 0.82 | ABa | 1.19 | Aa | 1.03 | ABa | 18.53 | Aa | 3.80 | ABa | 74.62 |
| | 5 | Ba | 0.70 | Ba | 1.00 | Ab | 1.03 | Ba | 16.34 | Aa | 3.22 | Aa | 77.71 |
| Manganese | | | | | | | | | | | | | |
| 2 | 1 | Aa | 49.93 | Aa | 0.00 | Aa | 0.09 | Aa | 6.70 | Aa | 9.24 | Aa | 34.05 |
| | 2 | ABa | 37.35 | Aa | 0.00 | Aa | 0.09 | Aa | 7.28 | Aa | 7.00 | Aa | 48.26 |
| | 3 | ABa | 47.52 | Aa | 0.00 | Aa | 0.15 | Aa | 9.41 | Aa | 9.96 | Aa | 32.95 |
| | 4 | ABa | 36.77 | Aa | 0.00 | Aa | 0.16 | Aa | 8.78 | Aa | 8.55 | Aa | 45.73 |
| | 5 | Ba | 27.92 | Aa | 0.00 | Aa | 0.09 | Aa | 7.92 | Aa | 7.43 | Aa | 56.65 |
| 18 | 1 | Ab | 4.73 | Ba | 0.00 | Aa | 0.04 | Ba | 6.35 | Aa | 4.19 | Ab | 84.69 |
| | 2 | Bb | 0.40 | Ab | 0.23 | Aa | 0.06 | Ab | 56.12 | Aa | 9.43 | Ba | 33.75 |
| | 3 | Bb | 0.58 | Ab | 0.30 | Aa | 0.06 | Ab | 69.37 | Aa | 11.80 | Ba | 17.90 |
| | 4 | Bb | 0.77 | Ab | 0.26 | Ab | 0.04 | Ab | 65.05 | Aa | 11.46 | Ba | 22.43 |
| | 5 | Bb | 0.46 | Ab | 0.19 | Aa | 0.07 | Ab | 50.37 | Aa | 8.69 | Ba | 40.22 |

Table 2. (continued)

| Cycle | Trt | $KNO_3$ | $KNO_3$ %T | DI Water | DI %T | NaOH | NaOH %T | EDTA | EDTA %T | $HNO_3$ | $HNO_3$ %T | Residual | Residual %T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nickel | | | | | | | | | | | | | |
| 2 | 1 | Aa | 21.82 | Aa | 3.53 | Aa | 3.16 | Aa | 17.94 | Aa | 20.42 | Ba | 33.13 |
| | 2 | Aa | 33.57 | Aa | 4.76 | Aa | 4.98 | Aa | 31.17 | Aa | 25.52 | Ba | 0.00 |
| | 3 | Ba | 11.60 | Ba | 2.48 | Aa | 3.71 | Ba | 17.21 | Ba | 14.85 | Aa | 50.15 |
| | 4 | CBa | 8.57 | Ba | 2.21 | Ba | 2.60 | Ba | 16.53 | Ba | 14.02 | Aa | 56.07 |
| | 5 | Ca | 7.32 | Ba | 2.16 | Ba | 3.25 | Ba | 16.90 | Ba | 14.67 | Aa | 55.70 |
| 18 | 1 | Ab | 6.55 | Ab | 6.27 | Ca | 4.32 | Da | 28.98 | Ab | 35.79 | Bb | 18.08 |
| | 2 | Bb | 3.50 | Ba | 5.02 | Ab | 7.90 | Ab | 53.79 | Ba | 29.79 | Ca | 0.00 |
| | 3 | Bb | 2.82 | Cb | 4.09 | Bb | 6.38 | Bb | 45.18 | Bb | 26.46 | Bb | 15.07 |
| | 4 | Bb | 2.17 | Da | 3.13 | Cb | 4.83 | Cb | 36.41 | Ca | 19.75 | Ab | 33.71 |
| | 5 | Bb | 1.70 | Ea | 2.46 | Ca | 3.90 | CDb | 30.65 | Ca | 16.10 | Ab | 45.20 |
| Strontium | | | | | | | | | | | | | |
| 2 | 1 | Da | 0.08 | Aa | 0.15 | Aa | 0.04 | Aa | 25.88 | Da | 0.37 | Aa | 73.49 |
| | 2 | Ca | 1.89 | Aa | 0.01 | Aa | 0.04 | Ba | 21.73 | Da | 0.26 | Aa | 76.07 |
| | 3 | Ba | 4.40 | Aa | 0.00 | Ba | 0.02 | Ba | 20.17 | Ca | 4.84 | Aa | 70.57 |
| | 4 | ABa | 4.82 | Aa | 0.00 | Ba | 0.02 | Ba | 19.06 | Ba | 5.42 | Aa | 70.67 |
| | 5 | Aa | 5.11 | Aa | 0.00 | Ba | 0.02 | Ba | 18.38 | Aa | 6.09 | Aa | 70.40 |
| 18 | 1 | Ca | 0.08 | Ab | 0.03 | ABb | 0.03 | Ab | 16.23 | Ba | 0.38 | Ab | 83.25 |
| | 2 | Bb | 0.95 | Ba | 0.00 | Aa | 0.03 | Aa | 17.01 | Ba | 0.50 | Aa | 81.50 |
| | 3 | Ab | 2.87 | Ba | 0.00 | BCa | 0.02 | Aa | 19.14 | Ab | 3.08 | Aa | 74.89 |
| | 4 | Ab | 3.12 | Ba | 0.00 | BCa | 0.03 | Aa | 16.58 | Ab | 3.64 | Aa | 76.64 |
| | 5 | Ab | 2.69 | Ba | 0.00 | Ca | 0.01 | Aa | 13.06 | Ab | 3.18 | Aa | 81.05 |

Table 2. (continued)

| Cycle | Trt | KNO$_3$ | KNO$_3$ %T | DI Water | DI %T | NaOH | NaOH %T | EDTA | EDTA %T | HNO$_3$ | HNO$_3$ %T | Residual | Residual %T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Zinc | | | | | | |
| 2 | 1 | Aa | 17.17 | Aa | 0.09 | Aa | 0.38 | Ca | 10.12 | Aa | 14.39 | Aa | 57.85 |
| | 2 | Ba | 16.78 | Aa | 0.00 | Aa | 0.41 | Ba | 12.04 | Aa | 14.19 | Aa | 56.58 |
| | 3 | ABa | 14.99 | Aa | 0.01 | Aa | 0.48 | Aa | 14.44 | Aa | 14.01 | Aa | 56.06 |
| | 4 | Ba | 12.73 | Aa | 0.00 | Aa | 0.48 | Aa | 15.25 | Aa | 12.92 | Aa | 58.62 |
| | 5 | Ba | 11.13 | Aa | 0.28 | Aa | 0.57 | Aa | 16.09 | Aa | 13.15 | Aa | 58.78 |
| 18 | 1 | Ab | 5.72 | Ca | 0.03 | Aa | 0.41 | Ba | 10.49 | Ab | 17.60 | Aa | 65.75 |
| | 2 | Bb | 0.19 | Ab | 0.69 | Aa | 0.36 | Ab | 28.51 | Ab | 17.82 | Ba | 52.43 |
| | 3 | Bb | 0.19 | Ab | 0.67 | Aa | 0.57 | Ab | 31.60 | Ab | 18.08 | Ba | 48.88 |
| | 4 | Bb | 0.27 | ABb | 0.59 | Aa | 0.65 | Ab | 27.82 | ABb | 14.89 | Ba | 55.77 |
| | 5 | Bb | 0.16 | Ba | 0.49 | Aa | 0.63 | Ab | 26.77 | Ba | 12.72 | Ba | 59.24 |

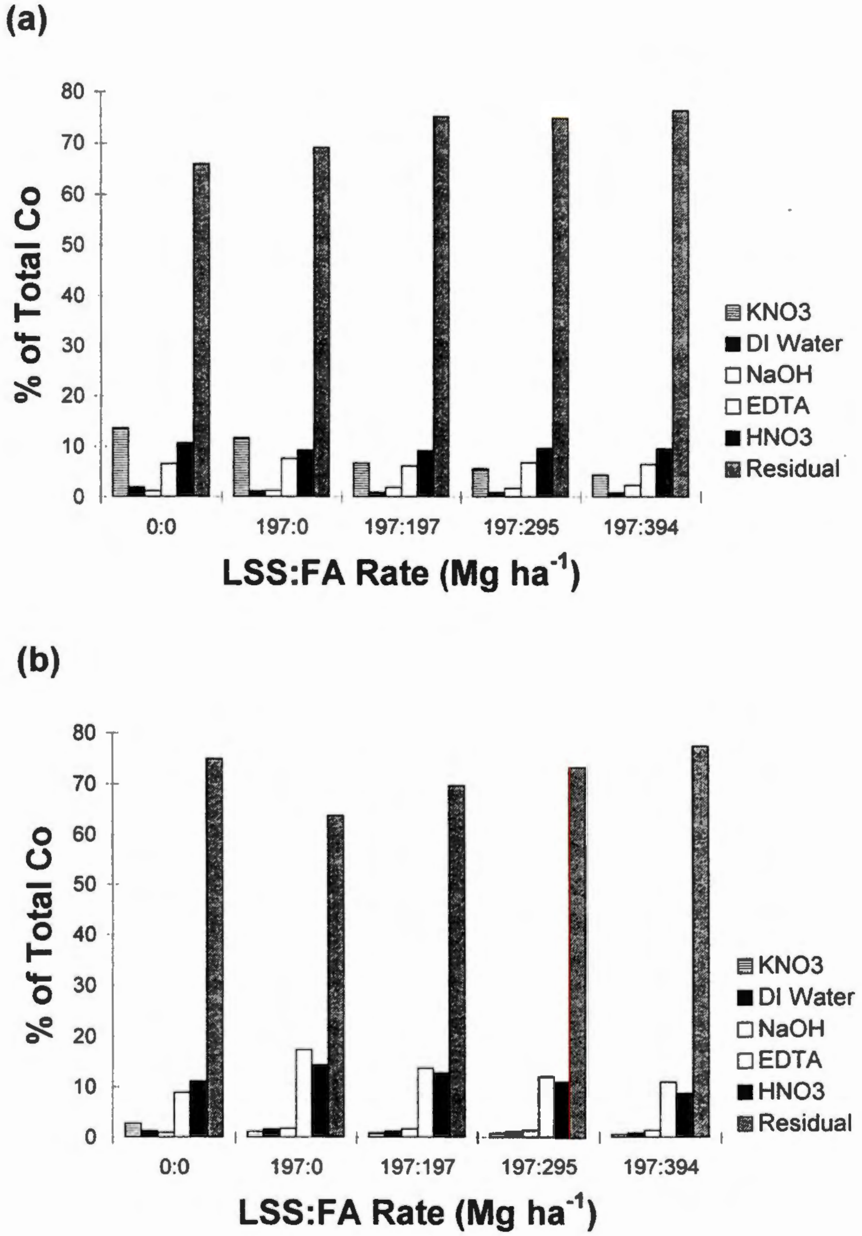

Figure 21. Influence of weathering and lime-stabilized sewage sludge (LSS) and fly ash (FA) amendments on the solid-phase speciation of cobalt in the mine spoil after (a) 2 cycles and (b) 18 cycles of weathering.

spoil (13.6%) and significantly decreased upon FA application (Table 2). Weathering significantly shifted Co speciation from the soluble-exchangeable form the to carbonate form. However, the soluble-exchangeable form of Co in the unamended mine spoil was significantly higher than that in the amended mine spoil, irrespective of weathering. In the weathered and amended mine spoil, the soluble-exchangeable form of Co significantly decreased upon LSS application, irrespective of FA rate.

For the unweathered material, Cr was primarily found in the residual phase (approximately 90%) and the sulfide form (between 5 and 11%) for unamended and amended mine spoil (Figure 22). The unamended mine spoil showed approximately equal proportions of Cr in the carbonate and sulfide fractions (5%). For the unweathered mine spoil, LSS application significantly decreased the carbonate form of Cr and significantly increased the residual forms (Table 2). In general, weathering significantly decreased the residual fraction and significantly increased in the adsorbed fraction of Cr. For the unweathered and weathered mine spoil, LSS application shifted Cr from the carbonate fraction to the sulfide and residual fractions.

For the unweathered and unamended mine spoil, Cu was primarily found in the soluble-exchangeable form at approximately 69% (Figure 23). A significant decrease in

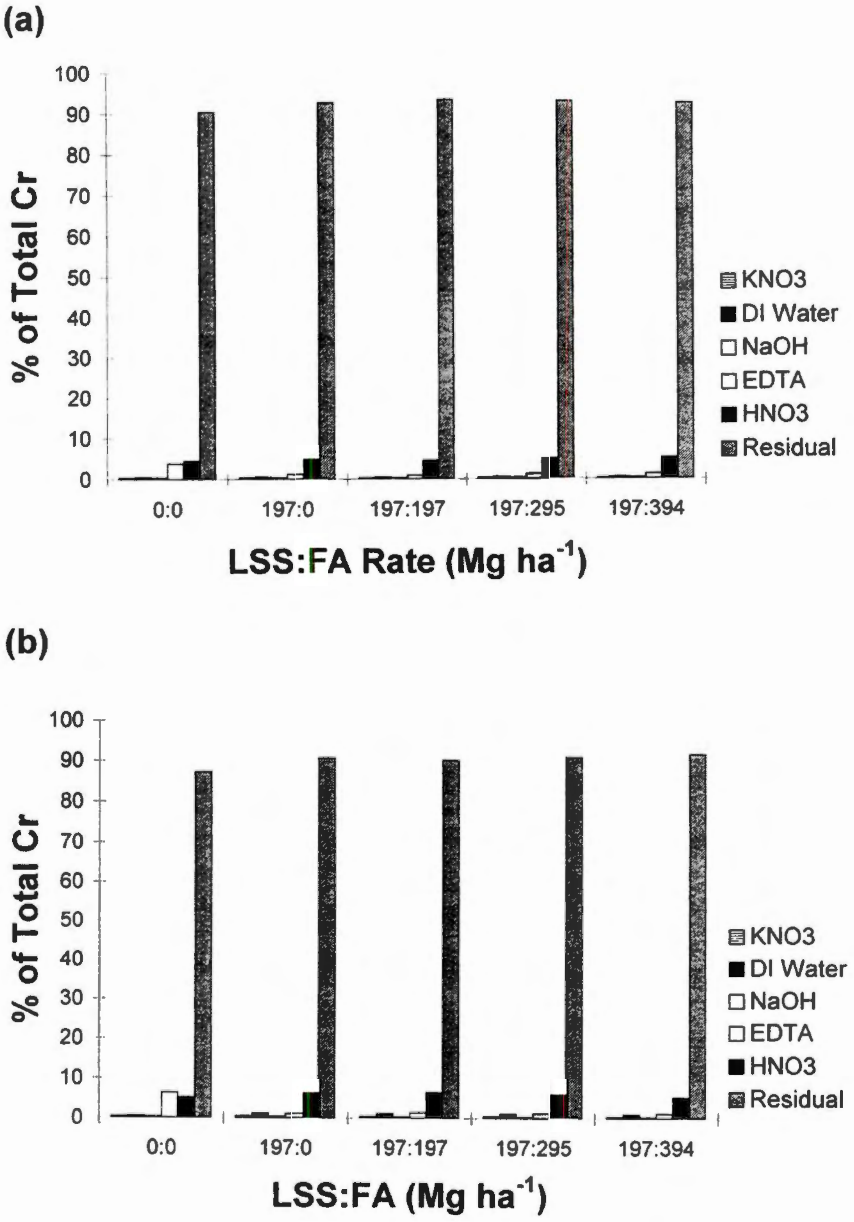

Figure 22. Influence of weathering and lime-stabilized sewage sludge (LSS) and fly ash (FA) amendments on the solid-phase speciation of chromium in the mine spoil after (a) 2 cycles and (b) 18 cycles of weathering.

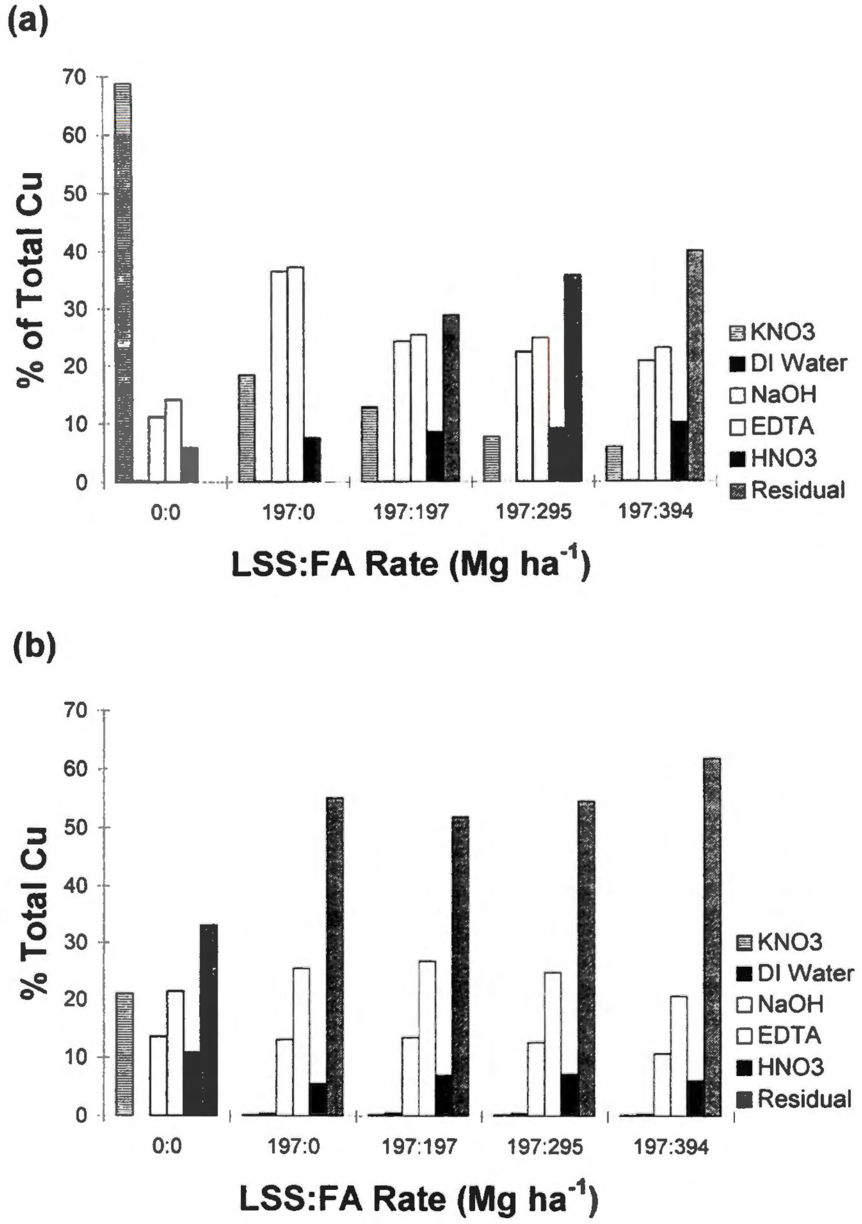

Figure 23. Influence of weathering and lime-stabilized sewage sludge (LSS) and fly ash (FA) amendments on the solid-phase speciation of copper in the mine spoil after (a) 2 cycles and (b) 18 cycles of weathering.

the soluble-exchangeable form was observed upon LSS application and FA rate (Table 2). The organic, carbonate, and sulfide forms of Cu were also present in the unamended spoil (11%, 14%, and 6%, respectively). The LSS amended mine spoil showed that Cu primarily resided in the organic (37 %) and carbonate forms (37%) with 18% of the extracted Cu residing in the soluble-exchangeable fraction. In general, increasing FA rates significantly decreased Cu in the soluble-exchangeable form and impacted the distribution of Cu in the organic, carbonate, and residual forms. In general, weathering allowed all Cu forms to shift to the residual forms. More specifically, weathering allowed the residual and adsorbed fractions of Cu to increase significantly upon LSS application, irrespective of FA rate. Further, LSS application significantly decreased the fraction of Cu found in the soluble-exchangeable and sulfide forms with weathering. Fly ash application rate did not influence the distribution of Cu in the weathered materials.

For the unweathered material, Mn was predominately found in the soluble-exchangeable and residual fractions, irrespective of amendment (Figure 24 and Table 2). Upon weathering, the unamended spoil decreased Mn found in the soluble-exchangeable and carbonate forms with a significant shift to the residual fraction. In all LSS-amended mine spoil, Mn shifted from the residual fraction to the carbonate form upon weathering, irrespective of FA rate.

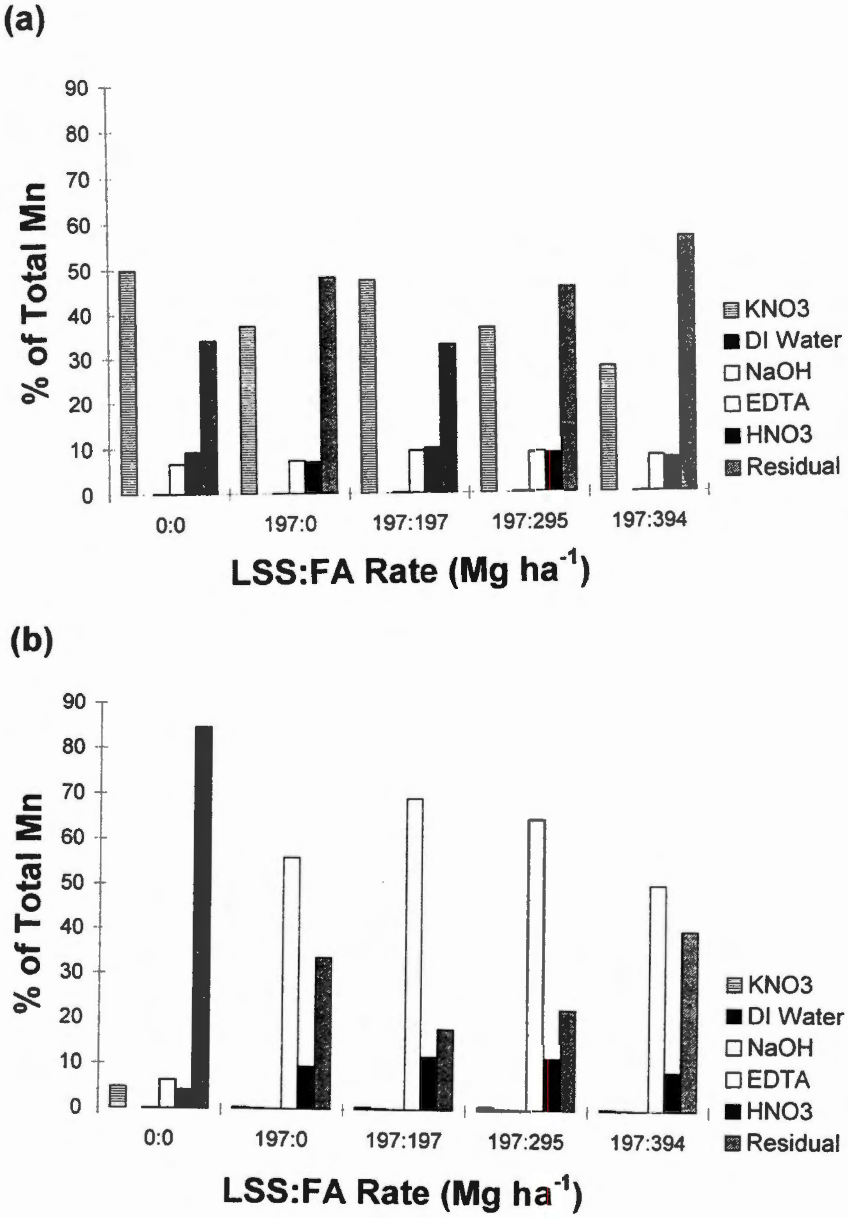

Figure 24. Influence of weathering and lime-stabilized sewage sludge (LSS) and fly ash (FA) amendments on the solid-phase speciation of manganese in the mine spoil after (a) 2 cycles and (b) 18 cycles of weathering.

For the unweathered and unamended spoil, Ni was highest in the residual fraction (33%), with approximately equal proportions in the adsorbed and organic fractions (approximately 3%) (Figure 25). Further, the soluble-extractable form of Ni was found to be 22%, with the carbonate and sulfide fractions containing 18% and 20%, respectively. For the unweathered and LSS-amended spoil, Ni was found in the soluble-exchangeable (34%), carbonate (31%), and sulfide forms (26%). Further, the adsorbed and organic forms of Ni were approximately in equal proportions (5%). In general, increasing FA rate increased Ni found in the residual form and decreased Ni found in the adsorbed, sulfide, and carbonate forms (Table 2). Upon weathering, Ni in the soluble-exchangeable and residual fractions decreased with subsequent increases in the carbonate and sulfide fractions. For the weathered and LSS-amended spoil, the soluble-exchangeable form of Ni decreased with subsequent increases in the carbonate and sulfide forms. In general, the residual forms of Ni decreased with weathering for the FA-amended mine spoil while increasing in the carbonate and sulfide fractions. In general, carbonate forms of Ni decreased with increasing FA rate. Further, sulfide forms of Ni increased upon weathering, yet decreased fairly linearly with FA rate.

Lead was primarily found in the residual fraction,

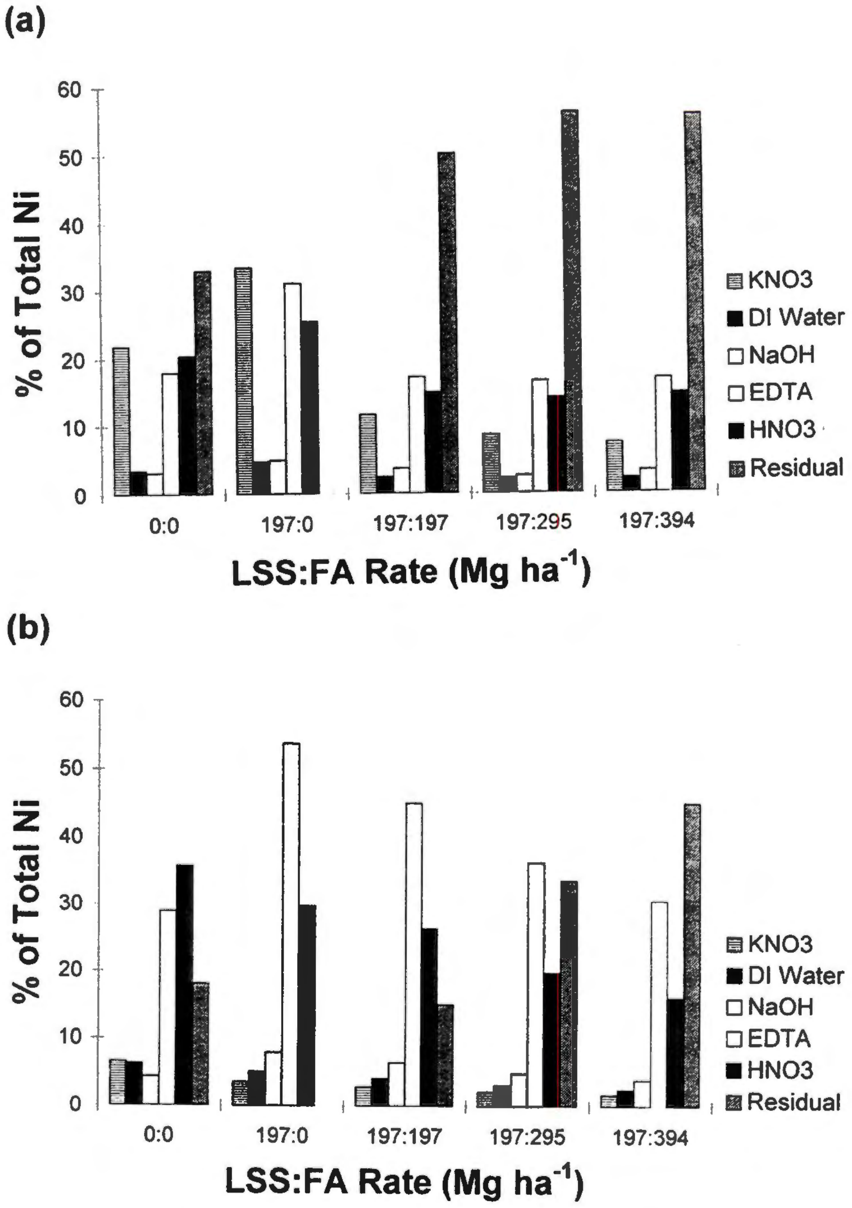

Figure 25. Influence of weathering and lime-stabilized sewage sludge (LSS) and fly ash (FA) amendments on the solid-phase speciation of nickel in the mine spoil after (a) 2 cycles and (b) 18 cycles of weathering.

irrespective of FA rate (Figure 26 and Table 2). The soluble-exchangeable form of Pb was found to decrease upon LSS application, irrespective of FA rate. Weathering did not impact Pb distribution in the amended mine spoil. However, the soluble-exchangeable forms of Pb were observed to decrease upon weathering and LSS amendment. In general, weathering had no influence on Pb distribution, irrespective of amendment.

Similar to Pb, Sr was primarily found in the residual fraction of the unweathered mine spoil, ranging from 70% to 76% (Figure 27). Strontium in the carbonate fraction ranged from 18% to 26%. In general, as FA rate increased, Sr was found to increase in the soluble-exchangeable and sulfide fractions (Table 2). Further, upon FA application, Sr was found to decrease in the organic form. However, LSS application significantly decreased the amount of Sr found in the carbonate fraction. Weathering resulted in significant decrease in the soluble-exchangeable form of Sr. Although the residual and the carbonate fractions of Sr predominated, FA application tended to increase Sr found in the soluble-exchangeable forms. In general, for FA amended mine spoil, the soluble-exchangeable forms of Sr shifted with weathering to the sulfide form.

For the unweathered spoil material, Zn was predominately found the residual form (58% on average). The

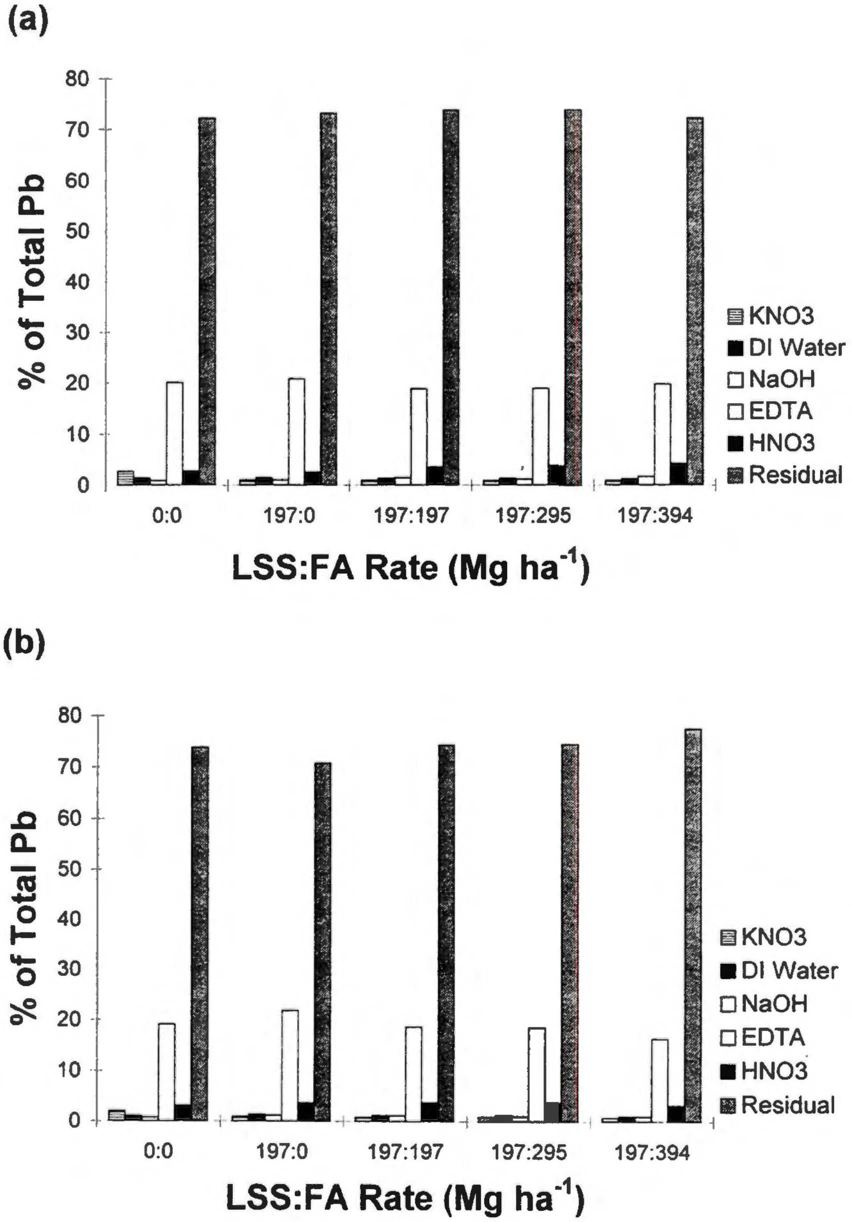

Figure 26. Influence of weathering and lime-stabilized sewage sludge (LSS) and fly ash (FA) amendments on the solid-phase speciation of lead in the mine spoil after (a) 2 cycles and (b) 18 cycles of weathering.

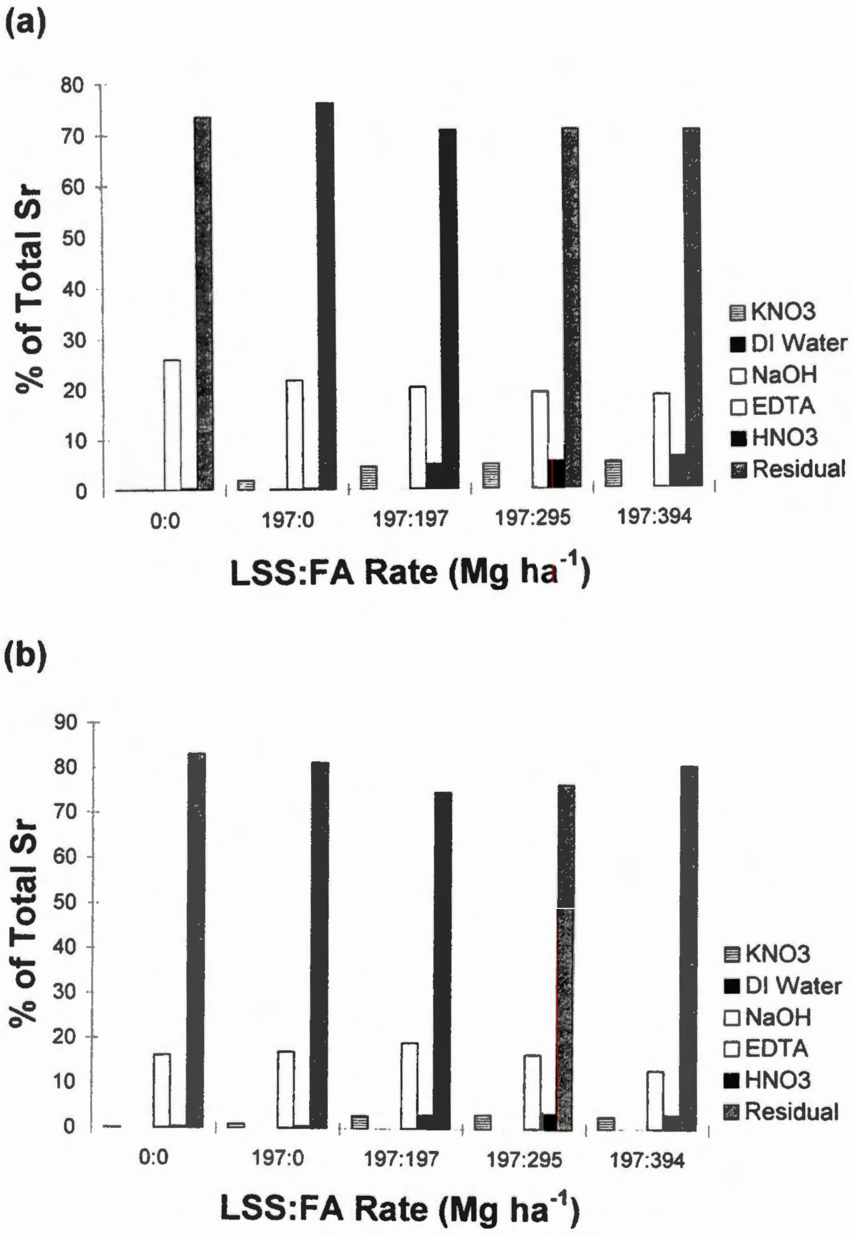

Figure 27. Influence of weathering and lime-stabilized sewage sludge (LSS) and fly ash (FA) amendments on the solid-phase speciation of strontium in the mine spoil after (a) 2 cycles and (b) 18 cycles of weathering.

soluble-exchangeable and residual forms of Zn were influenced by amendment. However, a significant increase in Zn found in the carbonate form was observed with FA amendment (Figure 28). Upon weathering, Zn in all LSS-amended mine spoil increased in the carbonate fraction with a corresponding decrease in the soluble-exchangeable and sulfide forms, generally irrespective of FA rate.

In summary, the SSD procedure used in this study examined the solid-phase speciation of Ba, Co, Cr, Cu, Mn, Ni, Pb, Sr, and Zn. The speciation of Ba increased in the soluble-exchangeable and carbonate fractions with increasing FA rate. Strontium increased in the soluble-exchangeable and sulfide fractions with increasing FA rate. Weathering tended to shift Ba to the carbonate fraction and Sr showed no significant shifts to any other phase. Chromium found in the residual fraction significantly increased upon LSS application. Weathering of the LSS-amended mine spoil increased Cr found in the adsorbed fraction, yet maintained predominance in the residual fraction. Chromium solid-phase speciation was not impacted by FA application or weathering. Although Co was primarily found in the residual fraction, Co showed a significant decrease in the soluble-exchangeable form upon LSS and FA application in the weathered material. In general, FA did not impact Co solid-phase speciation. However, LSS application decreased Co found in the soluble-

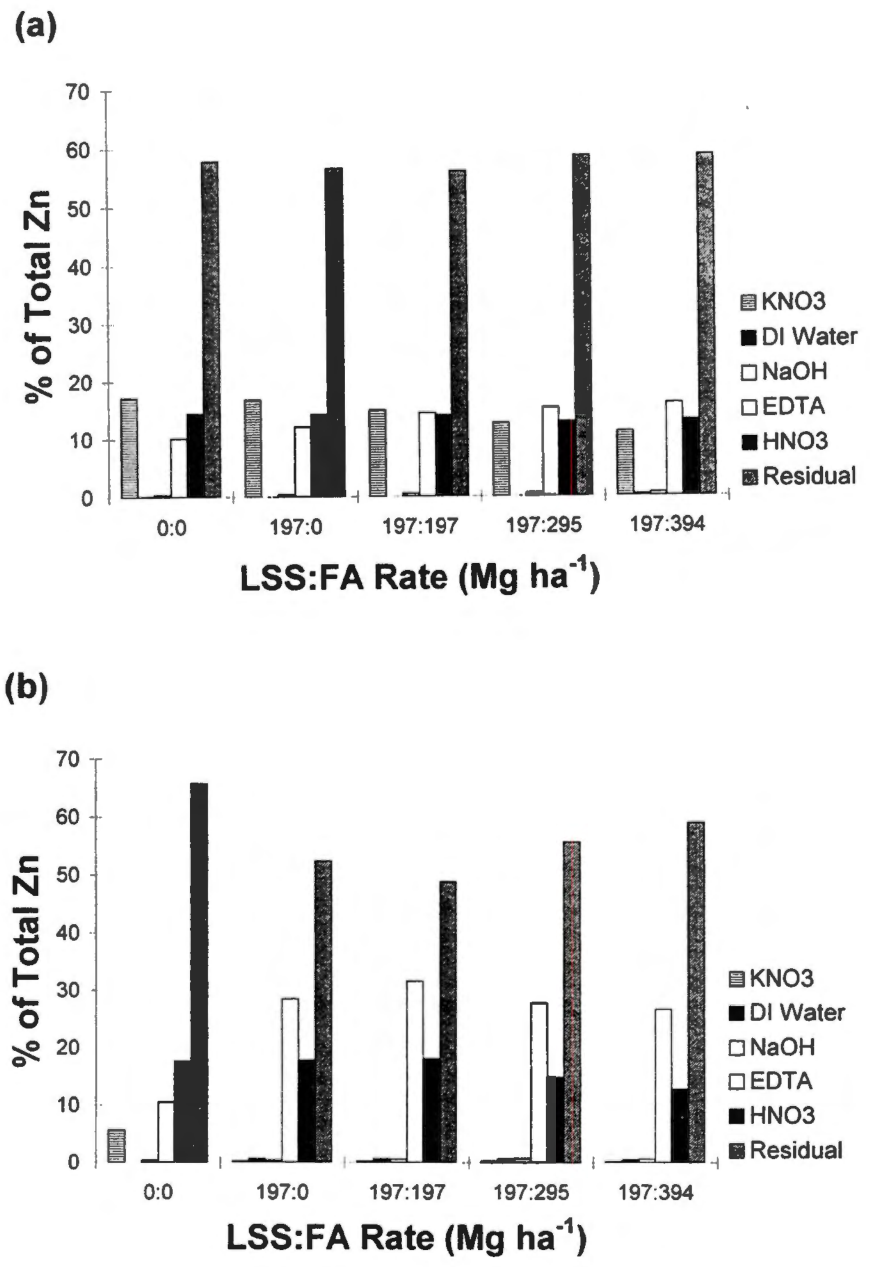

Figure 28. Influence of weathering and lime-stabilized sewage sludge (LSS) and fly ash (FA) amendments on the solid-phase speciation of zinc in the mine spoil after (a) 2 cycles and (b) 18 cycles of weathering.

exchangeable fraction. Copper speciation decreased in the soluble-exchangeable and residual fractions upon LSS application with an increase in the carbonate fraction. Primarily, weathering shifted Cu into the residual forms. Fly ash rate had no influence on Cu speciation for the weathered or unweathered mine spoil. In general, increasing FA rate increased Ni found in the residual fraction. Weathering shifted Ni into the carbonate and sulfide forms which decreased with FA application rate. However, Mn was primarily found in the soluble-exchangeable and residual fractions, irrespective of amendment. Weathering shifted Mn into the carbonate form in the amended mine spoil upon LSS application and into the residual form for the unamended mine spoil. Upon LSS application, Pb decreased in the soluble-exchangeable fraction. However, when weathered, amendment did not influence Pb solid-phase speciation. In general, FA rate increased the carbonate form of Zn in the unweathered material. However, weathering shifted Zn from the soluble-exchangeable and sulfide forms into the carbonate fraction, which was influenced by the LSS.

# Chapter V

# Summary and Conclusions

## Summary

The objectives of this study were to (1) to examine the $HNO_3$-extractable elemental content of LSS, FA, and mine spoil and for comparison to total elemental content, (2) to evaluate the leachate chemistry of LSS and FA amended mine spoil during simulated laboratory weathering, and (3) to examine the solid-phase speciation of elements in LSS and FA amended, weathered and unweathered mine spoil. The clay mineralogy of the mine spoil material was identified as vermiculite, kaolinite, and mica. The bulk mineralogy of the unweathered mine spoil was primarily composed of quartz. The bulk mineralogy of the FA was dominated by quartz and mullite.

The total elemental content of the FA, LSS, and mine spoil was determined by employing both $HNO_3$ extraction and total digestion (aqua regia/HF). The percent recovery of elements by $HNO_3$ digestion was determined by dividing the $HNO_3$-extractable concentrations by the total elemental content determined using the aqua regia/HF method. Variations in $HNO_3$-extractability of metals in the mine spoil, LSS, and FA was a function of element speciation in the mineral phase. In general, $HNO_3$ digestion was more efficient at extracting Al, Ca, Mg, Cr, Cu, Pb, and Zn from

LSS; K and Na from the FA; and Fe, Mg, P, Co, and Mn from mine spoil. Further, $HNO_3$-extractability was not a function of total concentrations and the $HNO_3$ digestion method did not yield a constant percent extractability that could be uniformly applied, irrespective of material

Chemical analysis of leachate collected from simulated laboratory weathering showed that LSS neutralized solution pH for the duration of the study. The EC of all amended and unamended spoil material decreased over time, but the EC of the amended spoil material decreased less rapidly. Calcium and sulfate concentrations mirrored the EC of the solutions. High calcium concentrations were attributed to the LSS amendment. Sulfate concentrations decreased with time for all mine spoil material with greater sulfate concentrations in the amended mine spoil being attributed to LSS application, irrespective of FA treatment. Chloride and fluoride concentrations remained negligible throughout simulated weathering. Nitrate concentrations were did not vary with treatment, although fluctuation was observed during cycles 13 through 15. This fluctuation, irrespective of treatment, was attributed to increased microbial activity, and may have contributed to pH fluctuation during the same time period.

Leachate phosphorus concentrations increased with LSS application and FA treatment. A slight increase was observed as FA rate increased. Leachate potassium concentrations in the unamended mine spoil increased with time, due to the dissolution of K-bearing minerals in the low pH system. In general, B concentrations increased with increasing FA rate, but concentrations were below 0.25 mg $L^{-1}$ for all treatments. Leachate aluminum concentrations were higher for the unamended mine spoil material due to Al hydrolysis in low pH systems. Aluminum concentrations remained at or below detection limits for all amended mine spoil material.

Leachate copper concentrations were highest in the unamended mine spoil. This was attributed to increased mobility in low pH systems. Amended spoil material maintained leachate Cu concentrations at or below detection limits throughout the simulated weathering study, irrespective of FA treatment. Similarly leachate, Mn, Ni, and Zn concentrations were highest for the unamended mine spoil while the amended spoil material maintained a steady fluctuation at or below detectable levels throughout the study. This was attributed to reduced mobility due to LSS application. Leachate concentrations of Mn, Ni, and Zn were also unaffected by FA application rate.

In summary, the SSD procedure used in this study examined the solid-phase speciation of Ba, Co, Cr, Cu, Mn, Ni, Pb, Sr, and Zn. The speciation of Ba increased in the soluble-exchangeable and carbonate fractions with increasing FA rate. Strontium increased in the soluble-exchangeable and sulfide fractions with increasing FA rate. Weathering tended to shift Ba to the carbonate fraction and Sr showed no significant shifts to any other phase. Chromium found in the residual fraction significantly increased upon LSS application. Weathering of the LSS-amended mine spoil increased Cr found in the adsorbed fraction, yet maintained predominance in the residual fraction. Chromium solid-phase speciation was not impacted by FA application or weathering. Although Co was primarily found in the residual fraction, Co showed a significant decrease in the soluble-exchangeable form upon LSS and FA application in the weathered material. In general, FA did not impact Co solid-phase speciation. However, LSS application decreased Co found in the soluble-exchangeable fraction. Copper speciation decreased in the soluble-exchangeable and residual fractions upon LSS application with an increase in the carbonate fraction. Primarily, weathering shifted Cu into the residual forms. Fly ash rate had no influence on Cu speciation for the weathered or unweathered mine spoil. In general, increasing FA rate increased Ni found in the residual fraction. Weathering shifted Ni into the carbonate and sulfide forms which decreased with FA application rate. However, Mn was primarily found in the soluble-exchangeable and residual fractions, irrespective of amendment. Weathering shifted Mn into the carbonate form in the amended mine spoil upon LSS application and into the residual form for the unamended mine spoil. Upon LSS application, Pb decreased in the soluble-exchangeable fraction. However, when weathered, amendment did not influence Pb solid-phase speciation. In general, FA rate increased the carbonate form of Zn in the unweathered material. However, weathering shifted Zn from the soluble-exchangeable and sulfide forms into the carbonate fraction, which was influenced by the LSS.

## Conclusions

The conclusions of this study are as follows:

(1) $HNO_3$-extractability of the amendments was not a function of total concentrations and the $HNO_3$ digestion method did not yield a constant percent extractability that could be uniformly applied, irrespective of material.

(2) LSS was determined to be beneficial to acid mine spoil reclamation by neutralizing solution pH and introducing essential nutrients.

(3) LSS decreased heavy metal mobility and mineral dissolution by increasing the pH of the system.

(4) In general, FA application enhanced phosphorus and boron concentrations.

(5) In general, the impact of FA co-application with LSS was element specific with respect to the solid-phase speciation of elements.

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# Appendices

# Appendix A.

# General Information

3 grams LSS= ~ 2.5 grams (minus water content of LSS)
Acid base account (LSS)= 127.2
$127.2 / 2.625 = X / 3$
$X = 145$

| Material | Neutralization Potential | Acid Potential | Acid-base Accounting |
|---|---|---|---|
| spoil | 0 | 12.5 | -12.5 |
| sludge | 131.89 | 4.69 | 127.2 |

to neutralize spoil:
$0 = (145 * X) - 12.5$
$12.5 = 145 * X$
$X = .086$ (* 1000 tons of spoil)
X = 86 tons of LSS/ 1000 tons spoil

Rounded to 88 tons LSS/ 1000 tons spoil for +- 0.002 error
(water content = 12.5 %)

Acid-base accounting used to determine lime-stabilized sewage sludge application rate.

Notes:
1 hectare= 10,000 $m^2$
1 hectare (18 cm deep)= 10,000 $m^2$ * 0.18 m= 1800 $m^3$
1 hectare (18 cm deep) with bulk density of 1,300 kg/$m^3$ weighs 2,340,000 kg
1 hectare (18 cm deep)= 2,340,000 kg * 2.205 = 5,159,700 lbs
1 acre= 2.471 hectares
5,159,700 / 2.471= 2,088,101 lbs
An accepted estimate is 1 acre= 2,000,000 lb= 1000 tons
88 tons/1000 tons = 88 tons/ acre

# Appendix B.

## Amendment Characteristics

| Amendment characteristics per HNO3 digestion | | | | |
|---|---|---|---|---|
| elem | sam. name | conc(ppm) | final conc | average |
| Al | FA | 256.284 | 25628.363 | 27917.436 |
| Al | FA | 302.065 | 30206.509 | |
| As | FA | 0.100 | 10.000 | 10.000 |
| As | FA | 0.100 | 10.000 | |
| Ca | FA | 67.838 | 6783.834 | 7414.751 |
| Ca | FA | 80.457 | 8045.667 | |
| Cd | FA | 0.015 | 1.539 | 1.264 |
| Cd | FA | 0.010 | 0.988 | |
| Co | FA | 0.226 | 22.606 | 23.830 |
| Co | FA | 0.251 | 25.054 | |
| Cr | FA | 0.149 | 14.882 | 18.153 |
| Cr | FA | 0.214 | 21.423 | |
| Cu | FA | 1.019 | 101.910 | 102.987 |
| Cu | FA | 1.041 | 104.063 | |
| Fe | FA | 89.743 | 8974.250 | 10416.487 |
| Fe | FA | 118.587 | 11858.723 | |
| K | FA | 57.467 | 5746.714 | 5879.171 |
| K | FA | 60.116 | 6011.627 | |
| Mg | FA | 22.492 | 2249.196 | 2355.717 |
| Mg | FA | 24.622 | 2462.238 | |
| Mn | FA | 0.759 | 75.940 | 82.001 |
| Mn | FA | 0.881 | 88.061 | |
| Na | FA | 5.899 | 589.944 | 622.569 |
| Na | FA | 6.552 | 655.193 | |
| Ni | FA | 0.372 | 37.223 | 43.355 |
| Ni | FA | 0.495 | 49.486 | |
| P | FA | 13.126 | 1312.639 | 1492.240 |
| P | FA | 16.718 | 1671.841 | |
| Pb | FA | 0.553 | 55.320 | 60.638 |
| Pb | FA | 0.660 | 65.955 | |
| Se | FA | 0.100 | 10.000 | 10.000 |
| Se | FA | 0.100 | 10.000 | |
| Zn | FA | 0.995 | 99.538 | 105.673 |
| Zn | FA | 1.118 | 111.807 | |
| Al | spoil | 86.965 | 86964.710 | 90025.655 |
| Al | spoil | 93.087 | 93086.600 | |
| As | spoil | 0.100 | 100.000 | 100.000 |
| As | spoil | 0.100 | 100.000 | |
| Ca | spoil | 18.988 | 18987.960 | 18600.915 |
| Ca | spoil | 18.214 | 18213.870 | |
| Cd | spoil | 0.004 | 4.000 | 4.000 |
| Cd | spoil | 0.004 | 4.000 | |
| Co | spoil | 0.115 | 115.380 | 112.690 |
| Co | spoil | 0.110 | 110.000 | |
| Cr | spoil | 0.163 | 163.220 | 164.150 |
| Cr | spoil | 0.165 | 165.080 | |
| Cu | spoil | 0.165 | 165.200 | 166.345 |
| Cu | spoil | 0.167 | 167.490 | |
| Fe | spoil | 498.138 | 498138.360 | 499069.180 |
| Fe | spoil | 500.000 | 500000.000 | |
| K | spoil | 16.395 | 16395.340 | 17209.295 |
| K | spoil | 18.023 | 18023.250 | |
| Mg | spoil | 22.353 | 22353.040 | 22183.795 |
| Mg | spoil | 22.015 | 22014.550 | |
| Mn | spoil | 2.994 | 2994.100 | 2777.880 |
| Mn | spoil | 2.562 | 2561.660 | |
| Na | spoil | 0.855 | 854.800 | 843.195 |
| Na | spoil | 0.832 | 831.590 | |
| Ni | spoil | 0.263 | 262.980 | 263.275 |
| Ni | spoil | 0.264 | 263.570 | |
| P | spoil | 13.642 | 13641.780 | 13643.490 |
| P | spoil | 13.645 | 13645.200 | |
| Pb | spoil | 0.271 | 271.310 | 278.875 |
| Pb | spoil | 0.286 | 286.440 | |
| Se | spoil | 0.101 | 100.700 | 116.925 |
| Se | spoil | 0.133 | 133.150 | |
| Zn | spoil | 0.939 | 939.290 | 929.995 |
| Zn | spoil | 0.921 | 920.700 | |
| Al | SS | 49.376 | 49376.330 | 50039.135 |
| Al | SS | 50.702 | 50701.940 | |
| As | SS | 0.100 | 100.000 | 100.000 |
| As | SS | 0.100 | 100.000 | |
| Ca | SS | 582.150 | 582149.840 | 581783.870 |
| Ca | SS | 581.418 | 581417.900 | |
| Cd | SS | 0.004 | 4.000 | 4.000 |
| Cd | SS | 0.004 | 4.000 | |
| Co | SS | 0.015 | 14.900 | 16.095 |

|  |  |  |  |  |
|---|---|---|---|---|
| Co | SS | 0.017 | 17.290 |  |
| Cr | SS | 0.219 | 219.330 | 215.855 |
| Cr | SS | 0.212 | 212.380 |  |
| Cu | SS | 0.623 | 623.280 | 637.235 |
| Cu | SS | 0.651 | 651.190 |  |
| Fe | SS | 91.044 | 91044.370 | 90630.810 |
| Fe | SS | 90.217 | 90217.250 |  |
| K | SS | 3.488 | 3488.370 | 3372.090 |
| K | SS | 3.256 | 3255.810 |  |
| Mg | SS | 13.751 | 13750.680 | 14026.385 |
| Mg | SS | 14.302 | 14302.090 |  |
| Mn | SS | 2.460 | 2460.370 | 2467.025 |
| Mn | SS | 2.474 | 2473.680 |  |
| Na | SS | 2.216 | 2215.740 | 2195.840 |
| Na | SS | 2.176 | 2175.940 |  |
| Ni | SS | 0.123 | 123.270 | 125.325 |
| Ni | SS | 0.127 | 127.380 |  |
| P | SS | 45.159 | 45158.760 | 45486.725 |
| P | SS | 45.815 | 45814.690 |  |
| Pb | SS | 0.201 | 201.490 | 195.285 |
| Pb | SS | 0.189 | 189.080 |  |
| Se | SS | 0.100 | 100.000 | 100.000 |
| Se | SS | 0.100 | 100.000 |  |
| Zn | SS | 1.770 | 1770.340 | 1777.830 |
| Zn | SS | 1.785 | 1785.320 |  |

| Amendment characteristics per totals analysis | | | | |
|---|---|---|---|---|
| sample name | elem | conc (ppm) | conc w/dil | ave conc |
| FA | Ai | 204.109 | 102054.500 | 105876.538 |
| FA | Al | 215.275 | 107637.745 | |
| FA | Al | 215.875 | 107937.370 | |
| FA | As | 0.100 | 0.100 | 0.100 |
| FA | As | 0.100 | 0.100 | |
| FA | As | 0.100 | 0.100 | |
| FA | Ba | 1.803 | 901.520 | 5019.307 |
| FA | Ba | 26.428 | 13214.055 | |
| FA | Ba | 1.885 | 942.345 | |
| FA | Ca | 17.223 | 8611.565 | 18495.335 |
| FA | Ca | 76.108 | 38054.175 | |
| FA | Ca | 17.641 | 8820.265 | |
| FA | Cd | 0.009 | 4.430 | 7.687 |
| FA | Cd | 0.005 | 2.440 | |
| FA | Cd | 0.032 | 16.190 | |
| FA | Co | 0.105 | 52.300 | 58.493 |
| FA | Co | 0.115 | 57.455 | |
| FA | Co | 0.131 | 65.725 | |
| FA | Cr | 0.185 | 92.385 | 92.830 |
| FA | Cr | 0.182 | 91.050 | |
| FA | Cr | 0.190 | 95.055 | |
| FA | Cu | 0.369 | 184.250 | 193.828 |
| FA | Cu | 0.370 | 184.760 | |
| FA | Cu | 0.425 | 212.475 | |
| FA | Fe | 65.167 | 32583.255 | 32695.082 |
| FA | Fe | 63.561 | 31780.280 | |
| FA | Fe | 67.443 | 33721.710 | |
| FA | K | 12.067 | 6033.375 | 8023.105 |
| FA | K | 25.546 | 12772.785 | |
| FA | K | 10.526 | 5263.155 | |
| FA | Mg | 10.429 | 5214.530 | 10882.232 |
| FA | Mg | 44.122 | 22061.130 | |
| FA | Mg | 10.742 | 5371.035 | |
| FA | Mn | 0.271 | 135.600 | 234.932 |
| FA | Mn | 0.833 | 416.370 | |
| FA | Mn | 0.306 | 152.825 | |
| FA | Mo | 0.010 | 0.010 | 3.827 |
| FA | Mo | 0.010 | 5.190 | |
| FA | Mo | 0.013 | 6.280 | |
| FA | Na | 10.779 | 5389.635 | 31156.368 |
| FA | Na | 151.004 | 75502.135 | |
| FA | Na | 25.155 | 12577.335 | |
| FA | Ni | 0.162 | 80.785 | 81.778 |
| FA | Ni | 0.157 | 78.720 | |
| FA | Ni | 0.172 | 85.830 | |
| FA | P | 4.881 | 2440.415 | 2458.743 |
| FA | P | 4.756 | 2378.215 | |
| FA | P | 5.115 | 2557.600 | |
| FA | Pb | 0.425 | 212.650 | 226.068 |
| FA | Pb | 0.472 | 236.170 | |
| FA | Pb | 0.459 | 229.385 | |
| FA | S | 0.607 | 303.720 | 489.557 |
| FA | S | 1.756 | 877.995 | |
| FA | S | 0.574 | 286.955 | |
| FA | Si | 383.255 | 191627.300 | 270552.493 |
| FA | Si | 700.000 | 350000.000 | |
| FA | Si | 540.060 | 270030.180 | |
| FA | Sr | 1.477 | 738.710 | 811.558 |
| FA | Sr | 1.824 | 912.055 | |
| FA | Sr | 1.568 | 783.910 | |
| FA | Ti | 11.902 | 5950.985 | 6039.933 |
| FA | Ti | 11.986 | 5992.920 | |
| FA | Ti | 12.352 | 6175.895 | |
| FA | Zn | 0.334 | 167.145 | 176.490 |
| FA | Zn | 0.337 | 168.650 | |
| FA | Zn | 0.387 | 193.675 | |
| FA | Zr | 0.320 | 159.970 | 276.885 |
| FA | Zr | 0.401 | 200.685 | |
| FA | Zr | 0.940 | 470.000 | |
| LSS | Al | 30.842 | 15421.210 | 13358.772 |
| LSS | Al | 27.405 | 13702.460 | |
| LSS | Al | 21.905 | 10952.645 | |

| | | | | |
|---|---|---|---|---|
| LSS | As | 0.100 | 0.100 | 0.100 |
| LSS | As | 0.100 | 0.100 | |
| LSS | As | 0.100 | 0.100 | |
| LSS | Ba | 12.023 | 6011.385 | 4033.457 |
| LSS | Ba | 11.937 | 5968.345 | |
| LSS | Ba | 0.241 | 120.640 | |
| LSS | Ca | 142.791 | 71395.605 | 63469.593 |
| LSS | Ca | 131.995 | 65997.715 | |
| LSS | Ca | 106.031 | 53015.460 | |
| LSS | Cd | 0.004 | 0.004 | 0.004 |
| LSS | Cd | 0.004 | 0.004 | |
| LSS | Cd | 0.004 | 0.004 | |
| LSS | Co | 0.013 | 6.640 | 6.030 |
| LSS | Co | 0.014 | 7.190 | |
| LSS | Co | 0.009 | 4.260 | |
| LSS | Cr | 0.051 | 25.640 | 22.862 |
| LSS | Cr | 0.044 | 21.760 | |
| LSS | Cr | 0.042 | 21.185 | |
| LSS | Cu | 0.173 | 86.505 | 75.210 |
| LSS | Cu | 0.121 | 60.605 | |
| LSS | Cu | 0.157 | 78.520 | |
| LSS | Fe | 24.449 | 12224.485 | 10943.055 |
| LSS | Fe | 20.495 | 10247.380 | |
| LSS | Fe | 20.715 | 10357.300 | |
| LSS | K | 10.112 | 5056.180 | 3910.467 |
| LSS | K | 9.628 | 4813.860 | |
| LSS | K | 3.723 | 1861.360 | |
| LSS | Mg | 20.246 | 10123.235 | 7251.903 |
| LSS | Mg | 19.934 | 9966.900 | |
| LSS | Mg | 3.331 | 1665.575 | |
| LSS | Mn | 0.998 | 499.095 | 415.100 |
| LSS | Mn | 0.974 | 487.230 | |
| LSS | Mn | 0.518 | 258.975 | |
| LSS | Mo | 0.010 | 0.010 | 0.010 |
| LSS | Mo | 0.010 | 0.010 | |
| LSS | Mo | 0.010 | 0.010 | |
| LSS | Na | 82.474 | 41237.045 | 27294.773 |
| LSS | Na | 74.572 | 37286.125 | |
| LSS | Na | 6.722 | 3361.150 | |
| LSS | Ni | 0.028 | 0.020 | 0.020 |
| LSS | Ni | 0.020 | 0.020 | |
| LSS | Ni | 0.020 | 0.020 | |
| LSS | P | 10.382 | 5190.830 | 4662.720 |
| LSS | P | 8.666 | 4333.030 | |
| LSS | P | 8.929 | 4464.300 | |
| LSS | Pb | 0.162 | 81.025 | 54.707 |
| LSS | Pb | 0.098 | 49.060 | |
| LSS | Pb | 0.068 | 34.035 | |
| LSS | S | 6.113 | 3056.450 | 2282.818 |
| LSS | S | 4.154 | 2076.865 | |
| LSS | S | 3.430 | 1715.140 | |
| LSS | Si | 207.147 | 103573.570 | 98109.310 |
| LSS | Si | 256.081 | 128040.585 | |
| LSS | Si | 125.428 | 62713.775 | |
| LSS | Sr | 0.241 | 120.560 | 86.025 |
| LSS | Sr | 0.188 | 93.975 | |
| LSS | Sr | 0.087 | 43.540 | |
| LSS | Ti | 0.994 | 496.870 | 415.025 |
| LSS | Ti | 0.850 | 425.000 | |
| LSS | Ti | 0.646 | 323.205 | |
| LSS | Zn | 0.388 | 193.855 | 180.043 |
| LSS | Zn | 0.355 | 177.455 | |
| LSS | Zn | 0.338 | 168.820 | |
| LSS | Zr | 0.143 | 71.315 | 43.797 |
| LSS | Zr | 0.074 | 37.205 | |
| LSS | Zr | 0.046 | 22.870 | |
| SP | Al | 153.994 | 76996.855 | 72739.142 |
| SP | Al | 146.885 | 73442.665 | |
| SP | Al | 135.556 | 67777.905 | |
| SP | As | 0.100 | 0.100 | 0.100 |
| SP | As | 0.100 | 0.100 | |
| SP | As | 0.100 | 0.100 | |
| SP | Ba | 28.833 | 14416.620 | 5075.258 |
| SP | Ba | 0.815 | 407.315 | |

| | | | | |
|---|---|---|---|---|
| SP | Ba | 0.804 | 401.840 | |
| SP | Ca | 73.396 | 36698.125 | 14731.453 |
| SP | Ca | 7.791 | 3895.310 | |
| SP | Ca | 7.202 | 3600.925 | |
| SP | Cd | 0.004 | 0.004 | 0.004 |
| SP | Cd | 0.004 | 0.004 | |
| SP | Cd | 0.021 | 10.385 | |
| SP | Co | 0.039 | 19.715 | 17.267 |
| SP | Co | 0.023 | 11.675 | |
| SP | Co | 0.041 | 20.410 | |
| SP | Cr | 0.135 | 67.380 | 65.915 |
| SP | Cr | 0.134 | 66.805 | |
| SP | Cr | 0.127 | 63.560 | |
| SP | Cu | 0.035 | 17.715 | 22.587 |
| SP | Cu | 0.046 | 22.935 | |
| SP | Cu | 0.054 | 27.110 | |
| SP | Fe | 91.459 | 45729.670 | 44840.942 |
| SP | Fe | 90.951 | 45475.525 | |
| SP | Fe | 86.635 | 43317.630 | |
| SP | K | 25.931 | 12965.340 | 9798.885 |
| SP | K | 18.870 | 9435.170 | |
| SP | K | 13.992 | 6996.145 | |
| SP | Mg | 48.142 | 24070.770 | 11279.418 |
| SP | Mg | 9.963 | 4981.610 | |
| SP | Mg | 9.572 | 4785.875 | |
| SP | Mn | 1.221 | 610.745 | 333.163 |
| SP | Mn | 0.385 | 192.405 | |
| SP | Mn | 0.393 | 196.340 | |
| SP | Mo | 0.010 | 0.010 | 0.010 |
| SP | Mo | 0.011 | 0.010 | |
| SP | Mo | 0.010 | 0.010 | |
| SP | Na | 170.549 | 85274.425 | 40326.588 |
| SP | Na | 39.959 | 19979.585 | |
| SP | Na | 31.452 | 15725.755 | |
| SP | Ni | 0.020 | 0.020 | 0.020 |
| SP | Ni | 0.047 | 0.020 | |
| SP | Ni | 0.020 | 0.020 | |
| SP | P | 2.053 | 1026.725 | 989.875 |
| SP | P | 1.976 | 987.900 | |
| SP | P | 1.910 | 955.000 | |
| SP | Pb | 0.318 | 158.845 | 139.010 |
| SP | Pb | 0.269 | 134.720 | |
| SP | Pb | 0.247 | 123.465 | |
| SP | S | 16.532 | 8266.150 | 7657.773 |
| SP | S | 15.004 | 7502.215 | |
| SP | S | 14.410 | 7204.955 | |
| SP | Si | 700.000 | 350000.000 | 347186.045 |
| SP | Si | 700.000 | 350000.000 | |
| SP | Si | 683.116 | 341558.135 | |
| SP | Sr | 0.461 | 230.525 | 140.732 |
| SP | Sr | 0.184 | 92.045 | |
| SP | Sr | 0.199 | 99.625 | |
| SP | Ti | 4.403 | 2201.430 | 2040.528 |
| SP | Ti | 4.045 | 2022.400 | |
| SP | Ti | 3.796 | 1897.755 | |
| SP | Zn | 0.328 | 164.170 | 109.835 |
| SP | Zn | 0.162 | 80.755 | |
| SP | Zn | 0.169 | 84.580 | |
| SP | Zr | 0.234 | 117.115 | 220.205 |
| SP | Zr | 0.375 | 187.265 | |
| SP | Zr | 0.712 | 356.235 | |

# Appendix C.

# Simulated Laboratory Weathering

| 18 week weathering cycle: Data including replicates | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| week | trt | Rep | Al | B | Ca | Cu | Fe | K | Mg | Mn | Ni | P | Zn | flouride | chloride | nitrate | sulfate | pH | EC |
| 1 | 1 | 1 | 212.4013 | 0.0099 | 459.1682 | 0.8381 | 38.7408 | 0.8000 | 181.9538 | 68.6848 | 3.2134 | 0.0099 | 8.7563 | 8.4300 | 0.5770 | 3.6630 | 4837.0880 | 2.9 | 4.05 |
| 1 | 1 | 2 | 197.3340 | 0.0100 | 440.7213 | 0.8022 | 42.0202 | 0.0800 | 172.7695 | 64.2374 | 2.9724 | 0.0100 | 8.4985 | 8.5010 | 0.5040 | 3.2940 | 4756.9870 | 2.91 | 4.03 |
| 1 | 1 | 3 | 194.7071 | 0.0100 | 440.4415 | 0.8080 | 32.1677 | 0.0800 | 178.0672 | 65.3238 | 2.8772 | 0.0116 | 8.4241 | 18.7730 | 0.5140 | 3.9230 | 4755.0430 | 2.88 | 3.8 |
| 1 | 2 | 1 | 0.3831 | 0.0623 | 960.8594 | 0.0450 | 0.2787 | 1.6543 | 105.3166 | 21.1879 | 0.4515 | 0.3023 | 0.5330 | 10.5570 | 254.0710 | 3.1980 | 3261.3770 | 6.85 | 3.84 |
| 1 | 2 | 2 | 0.2545 | 0.0582 | 817.6050 | 0.0285 | 1.2587 | 2.0942 | 109.3927 | 22.6038 | 0.5372 | 0.2639 | 0.7981 | 9.2220 | 252.2220 | 3.7810 | 2444.5390 | 6.71 | 3.7 |
| 1 | 2 | 3 | 3.8811 | 0.0608 | 918.6019 | 0.1135 | 2.7696 | 1.7452 | 128.9743 | 32.0093 | 1.0205 | 0.2365 | 2.1295 | 11.4960 | 238.0020 | 3.9020 | 3143.4320 | 5.51 | 3.51 |
| 1 | 3 | 1 | 0.3872 | 0.1267 | 931.2983 | 0.0244 | 0.1675 | 1.8349 | 113.0608 | 25.6286 | 0.6300 | 0.2168 | 0.9741 | 13.8030 | 233.8220 | 2.5960 | 3379.9910 | 6.75 | 3.73 |
| 1 | 3 | 2 | 3.4487 | 0.1564 | 838.2707 | 0.0513 | 3.7498 | 2.7051 | 126.0570 | 31.6218 | 1.0050 | 0.2304 | 2.3461 | 11.1230 | 232.8140 | 3.3010 | 2807.9030 | 5.51 | 3.49 |
| 1 | 3 | 3 | 2.4181 | 0.1573 | 857.8644 | 0.0718 | 2.5244 | 2.2688 | 117.6410 | 26.2230 | 0.7238 | 0.2645 | 1.4988 | 12.1110 | 221.3100 | 3.1840 | 2546.0390 | 5.86 | 3.56 |
| 1 | 4 | 1 | 3.2938 | 0.2006 | 781.3269 | 0.0831 | 2.1954 | 1.9024 | 126.2772 | 29.9890 | 0.8811 | 0.2427 | 1.7106 | 10.7020 | 221.8290 | 3.5400 | 2594.7360 | 5.79 | 3.57 |
| 1 | 4 | 2 | 0.6180 | 0.1677 | 924.4987 | 0.0509 | 0.4003 | 2.4433 | 114.4346 | 23.7661 | 0.5636 | 0.2969 | 0.8996 | 8.6800 | 246.6010 | 2.5110 | 3125.3700 | 6.91 | 3.75 |
| 1 | 4 | 3 | 1.0090 | 0.1733 | 832.8806 | 0.0287 | 0.5564 | 2.2727 | 105.3186 | 24.9488 | 0.7505 | 0.2057 | 1.3795 | 10.6040 | 245.0630 | 3.1710 | 2644.8830 | 5.89 | 3.56 |
| 1 | 5 | 1 | 0.4322 | 0.1518 | 993.6190 | 0.0201 | 0.9867 | 2.3325 | 180.0000 | 20.8668 | 0.4419 | 0.3562 | 0.5640 | 11.5260 | 230.7300 | 3.5980 | 3306.7520 | 6.89 | 3.74 |
| 1 | 5 | 2 | 3.3772 | 0.2755 | 811.1765 | 0.0437 | 1.4097 | 2.7923 | 123.1375 | 29.8370 | 0.8942 | 0.2215 | 2.0691 | 10.3250 | 238.2060 | 4.2170 | 2726.0030 | 5.56 | 3.58 |
| 1 | 5 | 3 | 14.9108 | 0.2589 | 814.5267 | 0.0903 | 5.1886 | 1.9024 | 126.1846 | 30.5874 | 1.2478 | 0.2323 | 2.7215 | 10.3750 | 233.2460 | 5.5360 | 2929.8110 | 5.32 | 3.53 |
| 2 | 1 | 1 | 92.9292 | 0.0108 | 320.8852 | 0.3694 | 12.9119 | 0.8000 | 77.0395 | 32.7503 | 1.3512 | 0.0239 | 3.9183 | 3.6060 | 1.9230 | 2.1080 | 2547.4990 | 2.95 | 2.56 |
| 2 | 1 | 2 | 90.5345 | 0.0130 | 338.5809 | 0.4342 | 17.1052 | 0.8000 | 82.7549 | 33.6211 | 1.3377 | 0.0580 | 4.0960 | 1.7110 | 2.1250 | 3.1170 | 2756.0920 | 2.95 | 2.59 |
| 2 | 1 | 3 | 91.6169 | 0.0122 | 356.7225 | 0.4063 | 15.0933 | 0.8000 | 81.3979 | 33.1856 | 1.3189 | 0.0666 | 4.3265 | 3.5710 | 1.8910 | 2.3620 | 2545.1230 | 3.03 | 2.73 |
| 2 | 2 | 1 | 0.0597 | 0.0300 | 680.5156 | 0.0193 | 0.2023 | 0.8000 | 39.4357 | 1.0589 | 0.0200 | 0.1486 | 0.0080 | 2.6110 | 129.2180 | 3.6500 | 2180.6030 | 7.35 | 2.65 |
| 2 | 2 | 2 | 0.0671 | 0.0348 | 658.2205 | 0.0068 | 0.0170 | 0.8726 | 39.8096 | 1.1908 | 0.0200 | 0.1613 | 0.0080 | 2.5430 | 140.9390 | 2.6340 | 2281.6150 | 7.24 | 2.57 |
| 2 | 2 | 3 | 0.0720 | 0.0478 | 686.3187 | 0.0068 | 0.0176 | 0.8000 | 40.8460 | 2.2091 | 0.0200 | 0.2348 | 0.0080 | 2.6830 | 136.0020 | 3.7360 | 2300.8800 | 7.05 | 2.75 |
| 2 | 3 | 1 | 0.0500 | 0.1234 | 666.5807 | 0.0205 | 0.0100 | 1.0830 | 45.8628 | 1.8651 | 0.0200 | 0.2278 | 0.0080 | 2.7380 | 134.2780 | 3.2730 | 2145.8130 | 7.21 | 2.69 |
| 2 | 3 | 2 | 0.0500 | 0.1498 | 696.4906 | 0.0073 | 0.0100 | 1.3112 | 41.9680 | 2.6904 | 0.0200 | 0.1132 | 0.0097 | 2.6620 | 159.1870 | 3.7320 | 2467.0090 | 7 | 2.68 |
| 2 | 3 | 3 | 0.0804 | 0.1373 | 696.4666 | 0.0114 | 0.0263 | 0.8000 | 42.6389 | 1.7513 | 0.0200 | 0.1831 | 0.0080 | 2.7080 | 135.5290 | 3.2480 | 2261.7940 | 7.37 | 2.76 |
| 2 | 4 | 1 | 0.0500 | 0.1712 | 688.9373 | 0.0277 | 0.0100 | 1.0471 | 43.2519 | 1.5110 | 0.0200 | 0.1699 | 0.0080 | 2.6170 | 150.1100 | 2.5350 | 2307.9990 | 7.32 | 2.76 |
| 2 | 4 | 2 | 0.0500 | 0.1582 | 669.1779 | 0.0110 | 0.0100 | 1.1344 | 41.9520 | 1.7583 | 0.0200 | 0.1863 | 0.0080 | 2.6950 | 155.3770 | 3.9670 | 2210.7490 | 7.12 | 2.69 |
| 2 | 4 | 3 | 0.0500 | 0.1556 | 633.3836 | 0.0122 | 0.0100 | 0.8000 | 39.9901 | 1.3908 | 0.0200 | 0.1758 | 0.0080 | 2.5270 | 124.6890 | 2.4160 | 2056.6450 | 7.12 | 1.62 |
| 2 | 5 | 1 | 0.0500 | 0.1465 | 643.7846 | 0.0174 | 0.0100 | 0.9615 | 40.5454 | 1.5997 | 0.0200 | 0.0749 | 0.0080 | 2.6160 | 125.0490 | 2.3580 | 2190.2350 | 7.31 | 2.7 |
| 2 | 5 | 2 | 0.0500 | 0.2495 | 653.4982 | 0.0205 | 0.0100 | 1.0830 | 43.4238 | 1.9494 | 0.0200 | 0.2267 | 0.0080 | 2.6950 | 132.4930 | 1.8970 | 2166.4860 | 7.23 | 2.66 |
| 2 | 5 | 3 | | | | | | | | | | | | | | | | | |
| 3 | 1 | 1 | 50.0587 | 0.0157 | 260.7935 | 0.3163 | 7.3871 | 1.8349 | 45.5366 | 19.7824 | 0.7366 | 0.0337 | 2.3069 | 0.5740 | 1.5870 | 1.5450 | 1885.1470 | 3.08 | 2.03 |
| 3 | 1 | 2 | 47.8739 | 0.0130 | 250.0456 | 0.3057 | 10.2118 | 1.9197 | 46.7218 | 20.1706 | 0.7427 | 0.0159 | 2.4337 | 0.4930 | 1.9370 | 2.4560 | 1743.7280 | 3.09 | 1.97 |
| 3 | 1 | 3 | 50.8600 | 0.0130 | 262.9785 | 0.3178 | 8.5142 | 2.0942 | 47.4918 | 20.5073 | 0.7806 | 0.0617 | 2.5503 | 0.7240 | 1.5940 | 2.0070 | 1837.8040 | 3.13 | 1.9 |
| 3 | 2 | 1 | 0.0500 | 0.0333 | 598.7764 | 0.0194 | 0.0100 | 1.2635 | 33.5944 | 0.3398 | 0.0200 | 0.1715 | 0.0080 | 2.2490 | 55.6560 | 1.9420 | 2028.1480 | 6.98 | 2.54 |
| 3 | 2 | 2 | 0.0500 | 0.0235 | 625.8886 | 0.0068 | 0.0100 | 1.1344 | 35.6187 | 0.4369 | 0.0200 | 0.1572 | 0.0080 | 2.3470 | 60.3780 | 1.9950 | 2206.6730 | 7.13 | 2.53 |
| 3 | 2 | 3 | 0.0763 | 0.0312 | 610.9300 | 0.0086 | 0.0155 | 0.8271 | 35.2422 | 0.4755 | 0.0200 | 0.1642 | 0.0097 | 2.4470 | 55.2620 | 1.6450 | 2101.9860 | 7.22 | 2.46 |
| 3 | 3 | 1 | 0.0637 | 0.0853 | 620.7534 | 0.0121 | 0.0292 | 1.0475 | 37.5522 | 0.6700 | 0.0200 | 0.1653 | 0.0080 | 2.4980 | 59.7000 | 5.1720 | 2293.0810 | 7.3 | 2.53 |
| 3 | 3 | 2 | 0.0703 | 0.1034 | 636.8105 | 0.0053 | 0.0187 | 1.4834 | 38.8081 | 0.6662 | 0.0200 | 0.1771 | 0.0080 | 2.3990 | 55.0450 | 2.2770 | 2268.9510 | 7.18 | 2.52 |
| 3 | 3 | 3 | 0.0500 | 0.0955 | 635.2324 | 0.0225 | 0.0179 | 1.2238 | 36.5716 | 0.4159 | 0.0200 | 0.1533 | 0.0080 | 2.5790 | 59.1400 | 1.6280 | 2251.8600 | 7.47 | 2.46 |
| 3 | 4 | 1 | 0.0548 | 0.1251 | 645.8975 | 0.0183 | 0.0176 | 1.2797 | 39.3019 | 0.4495 | 0.0200 | 0.2046 | 0.0080 | 2.5480 | 67.5710 | 1.8060 | 2244.6290 | 7.47 | 2.47 |
| 3 | 4 | 2 | 0.0583 | 0.1191 | 638.4222 | 0.0061 | 0.0100 | 1.2216 | 37.4194 | 0.6015 | 0.0200 | 0.1886 | 0.0080 | 2.5880 | 59.3000 | 2.3700 | 2187.0990 | 7.26 | 2.46 |
| 3 | 4 | 3 | 0.0987 | 0.1147 | 626.3887 | 0.0163 | 0.0474 | 1.3711 | 38.1110 | 0.5862 | 0.0200 | 0.2171 | 0.0080 | 2.4410 | 55.4670 | 2.2630 | 2236.0210 | 7.28 | 2.52 |
| 3 | 5 | 1 | 0.0500 | 0.1278 | 628.6599 | 0.0302 | 0.0100 | 1.6245 | 40.8731 | 0.5236 | 0.0200 | 0.2198 | 0.0080 | 2.4450 | 56.1090 | 2.1530 | 2215.7460 | 7.28 | 2.56 |
| 3 | 5 | 2 | 0.1617 | 0.1590 | 626.3813 | 0.0251 | 0.4780 | 1.7367 | 39.2871 | 0.5780 | 0.0200 | 0.2729 | 0.0080 | 2.3840 | 60.0040 | 1.6480 | 2147.8770 | 7.35 | 2.52 |
| 3 | 5 | 3 | 0.0500 | 0.1737 | 634.2098 | 0.0052 | 0.0100 | 1.6453 | 39.0078 | 0.6948 | 0.0200 | 0.1318 | 0.0080 | 2.5140 | 60.7830 | 1.8490 | 2192.9270 | 7.2 | 2.57 |
| 4 | 1 | 1 | 31.1897 | 0.0154 | 205.9383 | 0.2101 | 5.0562 | 2.7098 | 27.7793 | 13.1068 | 0.4940 | 0.0100 | 1.5184 | 0.0600 | 1.3000 | 2.0790 | 1213.9760 | 3.13 | 1.59 |
| 4 | 1 | 2 | 26.0688 | 0.0113 | 169.3205 | 0.2088 | 6.2648 | 2.6178 | 27.3697 | 11.9444 | 0.4144 | 0.0270 | 1.4219 | 0.0210 | 1.1890 | 1.5450 | 1077.9820 | 3.13 | 1.43 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1 | 3 | 26.4515 | 0.0122 | 174.3370 | 0.1990 | 4.9435 | 3.2286 | 26.6664 | 12.1890 | 0.4087 | 0.0283 | 1.4873 | 0.3390 | 1.2270 | 1.3910 | 1065.0490 | 3.16 | 1.45 |
| 4 | 2 | 1 | 0.0828 | 0.0304 | 601.8843 | 0.0076 | 0.0222 | 1.6579 | 31.4896 | 0.1952 | 0.0200 | 0.1686 | 0.0080 | 2.3060 | 25.3170 | 1.7650 | 2183.6630 | 7.19 | 2.39 |
| 4 | 2 | 2 | 0.1877 | 0.0272 | 591.1718 | 0.0072 | 0.1105 | 1.3234 | 31.9050 | 0.2340 | 0.0200 | 0.1309 | 0.0080 | 2.2520 | 22.4690 | 1.7130 | 2075.4640 | 7.2 | 2.41 |
| 4 | 2 | 3 | 0.0595 | 0.0261 | 600.2212 | 0.0057 | 0.0100 | 1.3962 | 31.3816 | 0.3416 | 0.0200 | 0.1404 | 0.0080 | 2.3370 | 25.9200 | 1.7530 | 2050.6620 | 7.28 | 2.39 |
| 4 | 3 | 1 | 0.0500 | 0.0911 | 575.1795 | 0.0206 | 0.0253 | 1.5596 | 32.3168 | 0.3673 | 0.0200 | 0.1641 | 0.0080 | 2.2330 | 23.3750 | 2.6110 | 2084.2280 | 7.28 | 2.43 |
| 4 | 3 | 2 | 0.0500 | 0.0980 | 596.4121 | 0.0069 | 0.0179 | 1.5734 | 31.5652 | 0.4745 | 0.0200 | 0.0928 | 0.0080 | 2.1680 | 23.3120 | 2.2260 | 2128.5600 | 7.17 | 2.36 |
| 4 | 3 | 3 | 0.0998 | 0.0991 | 591.9451 | 0.0159 | 0.0357 | 1.5707 | 32.3121 | 0.2430 | 0.0200 | 0.1829 | 0.0080 | 2.5280 | 25.0070 | 1.8080 | 2037.7760 | 7.4 | 2.35 |
| 4 | 4 | 1 | 0.0500 | 0.1243 | 606.3448 | 0.0194 | 0.0100 | 1.7452 | 32.8988 | 0.2374 | 0.0200 | 0.2185 | 0.0080 | 2.5020 | 28.9140 | 1.8350 | 2119.7590 | 7.36 | 2.42 |
| 4 | 4 | 2 | 0.0851 | 0.1217 | 596.6569 | 0.0076 | 0.0316 | 1.9197 | 31.8937 | 0.2879 | 0.0200 | 0.1108 | 0.0080 | 2.1840 | 29.3310 | 1.8530 | 2112.4880 | 7.29 | 2.36 |
| 4 | 4 | 3 | 0.0517 | 0.1182 | 607.1904 | 0.0134 | 0.0309 | 1.7483 | 31.2205 | 0.3287 | 0.0200 | 0.0712 | 0.0080 | 2.2650 | 22.5460 | 1.6210 | 2088.5800 | 7.17 | 2.42 |
| 4 | 5 | 1 | 0.1067 | 0.1252 | 573.7018 | 0.0197 | 0.0398 | 2.0070 | 31.7083 | 0.2927 | 0.0200 | 0.1428 | 0.0080 | 2.4130 | 24.1160 | 2.2310 | 2088.5480 | 7.28 | 2.38 |
| 4 | 5 | 2 | 0.0500 | 0.1538 | 617.4052 | 0.0309 | 0.0179 | 2.0105 | 33.0432 | 0.3150 | 0.0200 | 0.1093 | 0.0096 | 2.3500 | 27.5330 | 2.4210 | 2222.3070 | 7.28 | 2.37 |
| 4 | 5 | 3 | 0.1221 | 0.1703 | 611.3262 | 0.0049 | 0.0451 | 2.1815 | 33.6831 | 0.4576 | 0.0200 | 0.1739 | 0.0080 | 2.4540 | 25.3110 | 1.8230 | 2125.2490 | 7.14 | 2.36 |
| 5 | 1 | 1 | 16.1528 | 0.0166 | 135.9611 | 0.1463 | 3.0879 | 3.1180 | 17.2040 | 8.1411 | 0.2841 | 0.0100 | 0.9479 | 0.7920 | 1.0990 | 1.1980 | 814.4710 | 3.21 | 1.17 |
| 5 | 1 | 2 | 15.4882 | 0.0190 | 126.5400 | 0.1404 | 5.0489 | 3.8508 | 16.6082 | 8.0987 | 0.2197 | 0.0601 | 0.9312 | 0.7070 | 1.1060 | 1.6440 | 743.2810 | 3.2 | 1.12 |
| 5 | 1 | 3 | 13.3501 | 0.0207 | 110.9215 | 0.1320 | 3.2162 | 3.3408 | 15.3573 | 7.5592 | 0.2368 | 0.0100 | 0.9030 | 0.7230 | 1.0940 | 1.1940 | 681.8240 | 3.23 | 1.05 |
| 5 | 2 | 1 | 0.0500 | 0.0221 | 520.8073 | 0.0183 | 0.0100 | 1.4477 | 24.7430 | 0.1385 | 0.0200 | 0.0534 | 0.0080 | 2.0400 | 9.6090 | 1.6380 | 1825.0120 | 7.05 | 2.12 |
| 5 | 2 | 2 | 0.0500 | 0.0221 | 549.7419 | 0.0061 | 0.0100 | 1.6704 | 25.3270 | 0.1651 | 0.0200 | 0.0701 | 0.0080 | 2.2820 | 8.0360 | 2.1450 | 1919.9890 | 7.09 | 2.22 |
| 5 | 2 | 3 | 0.0500 | 0.0270 | 531.2108 | 0.0073 | 0.0100 | 1.7115 | 25.0254 | 0.2187 | 0.0200 | 0.0742 | 0.0080 | 2.0400 | 11.2860 | 1.4700 | 1920.6890 | 7.34 | 2.1 |
| 5 | 3 | 1 | 0.0500 | 0.0903 | 541.6803 | 0.0080 | 0.0100 | 1.5644 | 27.1588 | 0.2256 | 0.0200 | 0.0850 | 0.0080 | 2.1470 | 11.5980 | 1.7960 | 2062.0890 | 7.27 | 2.24 |
| 5 | 3 | 2 | 0.0500 | 0.0946 | 581.4752 | 0.0040 | 0.0100 | 2.0656 | 25.6034 | 0.2990 | 0.0200 | 0.0493 | 0.0080 | 2.1390 | 12.3280 | 1.8800 | 1933.7860 | 7.34 | 2.19 |
| 5 | 3 | 3 | 0.0500 | 0.1024 | 531.4540 | 0.0206 | 0.0100 | 2.0457 | 25.7260 | 0.1531 | 0.0200 | 0.1036 | 0.0080 | 2.0330 | 10.8480 | 1.2820 | 1871.0410 | 7.46 | 2.15 |
| 5 | 4 | 1 | 0.0500 | 0.1320 | 584.0563 | 0.0185 | 0.0100 | 3.0968 | 26.0726 | 0.0151 | 0.0200 | 0.1293 | 0.0080 | 2.1520 | 11.7360 | 1.0660 | 1925.7020 | 7.42 | 2.17 |
| 5 | 4 | 2 | 0.0500 | 0.1267 | 541.8290 | 0.0126 | 0.0100 | 2.6474 | 25.5741 | 0.1458 | 0.0200 | 0.0961 | 0.0080 | 1.9750 | 13.9010 | 1.5610 | 1893.7720 | 7.36 | 2.12 |
| 5 | 4 | 3 | 0.0500 | 0.1203 | 576.0961 | 0.0125 | 0.0100 | 2.4516 | 27.1480 | 0.2009 | 0.0200 | 0.1335 | 0.0080 | 2.0340 | 10.8250 | 1.5100 | 1920.8780 | 7.15 | 2.26 |
| 5 | 5 | 1 | 0.0500 | 0.1286 | 523.5970 | 0.0153 | 0.0100 | 2.5806 | 26.6660 | 0.1917 | 0.0200 | 0.1214 | 0.0080 | 2.0990 | 13.2280 | 1.6370 | 1887.6480 | 7.27 | 2.16 |
| 5 | 5 | 2 | 0.0500 | 0.1556 | 549.1949 | 0.0129 | 0.0100 | 1.9560 | 27.3865 | 0.1237 | 0.0200 | 0.1117 | 0.0080 | 2.0270 | 11.6100 | 1.5800 | 1941.3300 | 7.3 | 2.21 |
| 5 | 5 | 3 | 0.0500 | 0.1492 | 535.1378 | 0.0065 | 0.0100 | 2.3385 | 25.9854 | 0.2766 | 0.0200 | 0.0814 | 0.0080 | 2.1730 | 12.9510 | 1.5790 | 1931.9680 | 7.16 | 2.2 |
| 6 | 1 | 1 | 10.4867 | 0.0191 | 95.4561 | 0.1078 | 2.5791 | 4.2527 | 11.3679 | 5.5571 | 0.1313 | 0.0100 | 0.6573 | 0.5790 | 0.8140 | 1.3360 | 559.4390 | 3.23 | 0.89 |
| 6 | 1 | 2 | 9.9103 | 0.0168 | 85.7911 | 0.0995 | 3.9233 | 4.2527 | 11.4527 | 5.6307 | 0.1300 | 0.0100 | 0.6597 | 0.5390 | 0.9280 | 1.9310 | 519.5580 | 3.24 | 0.84 |
| 6 | 1 | 3 | 9.4819 | 0.0251 | 81.8728 | 0.1062 | 2.7326 | 4.6452 | 10.9610 | 5.5615 | 0.0737 | 0.0194 | 0.6654 | 0.6680 | 0.8810 | 1.1680 | 500.4550 | 3.23 | 0.82 |
| 6 | 2 | 1 | 0.0500 | 0.0249 | 448.7300 | 0.0081 | 0.0100 | 2.3385 | 18.9113 | 0.0815 | 0.0200 | 0.0231 | 0.0080 | 2.0700 | 4.1860 | 2.1450 | 1647.6130 | 7.29 | 1.84 |
| 6 | 2 | 2 | 0.0500 | 0.0270 | 503.8762 | 0.0163 | 0.0100 | 2.2005 | 21.8075 | 0.1178 | 0.0200 | 0.0867 | 0.0080 | 2.0520 | 3.8840 | 1.4230 | 1848.7120 | 7.26 | 1.99 |
| 6 | 2 | 3 | 0.0500 | 0.0221 | 478.0244 | 0.0046 | 0.0100 | 3.0377 | 19.0235 | 0.1219 | 0.0200 | 0.0575 | 0.0080 | 1.8770 | 4.2340 | 1.4320 | 1666.7060 | 7.42 | 1.79 |
| 6 | 3 | 1 | 0.0500 | 0.0888 | 480.1373 | 0.0046 | 0.0100 | 2.5271 | 21.8212 | 0.1542 | 0.0200 | 0.1339 | 0.0080 | 2.0600 | 4.3520 | 1.4350 | 1743.1960 | 7.28 | 1.92 |
| 6 | 3 | 2 | 0.0500 | 0.0831 | 483.7761 | 0.0040 | 0.0100 | 2.6731 | 20.9360 | 0.1923 | 0.0200 | 0.0384 | 0.0080 | 1.9190 | 4.2840 | 1.3220 | 1701.7720 | 7.29 | 1.84 |
| 6 | 3 | 3 | 0.0500 | 0.0923 | 492.1754 | 0.0095 | 0.0100 | 2.6731 | 20.3061 | 0.1095 | 0.0200 | 0.0738 | 0.0080 | 1.8950 | 4.5170 | 1.2120 | 1671.1630 | 7.36 | 1.83 |
| 6 | 4 | 1 | 0.0500 | 0.1354 | 479.8874 | 0.0204 | 0.0100 | 2.5612 | 21.2172 | 0.1153 | 0.0200 | 0.0800 | 0.0080 | 2.0690 | 4.9660 | 1.2660 | 1906.2030 | 7.38 | 1.96 |
| 6 | 4 | 2 | 0.0500 | 0.1182 | 479.6790 | 0.0075 | 0.0100 | 2.4301 | 20.5055 | 0.1031 | 0.0200 | 0.0574 | 0.0080 | 1.9120 | 5.4040 | 1.4370 | 1661.4220 | 7.27 | 1.84 |
| 6 | 4 | 3 | 0.0500 | 0.1270 | 492.5659 | 0.0176 | 0.0100 | 2.5806 | 22.8896 | 0.1326 | 0.0200 | 0.1073 | 0.0080 | 1.9460 | 4.5050 | 1.7810 | 1753.5560 | 7.29 | 1.98 |
| 6 | 5 | 1 | 0.0500 | 0.1206 | 415.8092 | 0.0050 | 0.0100 | 1.8051 | 19.9160 | 0.1264 | 0.0200 | 0.0912 | 0.0080 | 1.9450 | 4.8660 | 1.1220 | 1734.0370 | 7.29 | 1.74 |
| 6 | 5 | 2 | 0.0500 | 0.1630 | 488.2195 | 0.0073 | 0.0100 | 2.2272 | 21.8727 | 0.0997 | 0.0200 | 0.1016 | 0.0080 | 0.6530 | 5.5700 | 2.4390 | 1823.8710 | 7.29 | 1.92 |
| 6 | 5 | 3 | 0.0500 | 0.1580 | 533.3128 | 0.0069 | 0.0100 | 2.2005 | 23.8668 | 0.1968 | 0.0200 | 0.0941 | 0.0080 | 2.2630 | 5.0680 | 1.4280 | 1952.3680 | 7.2 | 2.07 |
| 7 | 1 | 1 | 6.2564 | 0.0166 | 67.6818 | 0.0770 | 1.7598 | 4.1203 | 7.8292 | 3.8281 | 0.1049 | 0.0100 | 0.4567 | 0.7090 | 0.8780 | 1.6390 | 357.7800 | 3.29 | 0.7 |
| 7 | 1 | 2 | 6.2625 | 0.0190 | 61.0134 | 0.0824 | 2.9125 | 4.8135 | 7.8869 | 3.8918 | 0.0450 | 0.0200 | 0.4587 | 0.6960 | 0.7620 | 1.4400 | 322.5200 | 3.29 | 0.71 |
| 7 | 1 | 3 | 6.6977 | 0.0183 | 66.4860 | 0.0713 | 2.1873 | 4.9818 | 7.9139 | 4.4703 | 0.0730 | 0.0527 | 0.5329 | 0.5980 | 0.7780 | 0.9990 | 350.5800 | 3.3 | 0.68 |
| 7 | 2 | 1 | 0.0500 | 0.0166 | 351.4373 | 0.0053 | 0.0100 | 2.2272 | 15.0368 | 0.0485 | 0.0200 | 0.0100 | 0.0080 | 1.5900 | 2.5730 | 1.3100 | 1148.0000 | 7.2 | 1.51 |
| 7 | 2 | 2 | 0.0500 | 0.0234 | 424.4579 | 0.0111 | 0.0100 | 2.7097 | 16.4763 | 0.0776 | 0.0200 | 0.1146 | 0.0080 | 1.3180 | 2.1520 | 1.3500 | 1246.1000 | 7.18 | 1.62 |
| 7 | 2 | 3 | 0.0500 | 0.0229 | 389.6750 | 0.0040 | 0.0100 | 2.3086 | 14.7564 | 0.1129 | 0.0200 | 0.0457 | 0.0080 | 1.6310 | 2.5550 | 1.1470 | 1181.6000 | 7.26 | 1.48 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 3 | 1 | 0.0500 | 0.0843 | 380.3949 | 0.0040 | 0.0100 | 2.1158 | 16.3507 | 0.1016 | 0.0200 | 0.0452 | 0.0080 | 1.4780 | 2.9100 | 1.4070 | 1261.5000 | 7.27 | 1.59 |
| 7 | 3 | 2 | 0.0500 | 0.0969 | 358.6072 | 0.0124 | 0.0100 | 2.1871 | 15.7366 | 0.1287 | 0.0200 | 0.0333 | 0.0080 | 2.2050 | 2.5420 | 1.7420 | 1190.5000 | 7.19 | 1.52 |
| 7 | 3 | 3 | 0.0500 | 0.1002 | 386.4147 | 0.0134 | 0.0138 | 2.5806 | 16.3856 | 0.0947 | 0.0200 | 0.1245 | 0.0080 | 1.5500 | 2.9420 | 1.1730 | 1195.1000 | 7.4 | 1.57 |
| 7 | 4 | 1 | 0.0800 | 0.1358 | 418.4567 | 0.0059 | 0.0100 | 2.6474 | 16.8359 | 0.0782 | 0.0200 | 0.1530 | 0.0080 | 1.3850 | 2.8650 | 1.1680 | 1333.9000 | 7.39 | 1.64 |
| 7 | 4 | 2 | 0.0500 | 0.1174 | 374.8445 | 0.0040 | 0.0100 | 2.1158 | 15.4368 | 0.0621 | 0.0200 | 0.0330 | 0.0080 | 1.6870 | 3.2190 | 1.3900 | 1198.7000 | 7.34 | 1.51 |
| 7 | 4 | 3 | 0.0500 | 0.1228 | 407.5645 | 0.0070 | 0.0100 | 2.4301 | 17.3171 | 0.0852 | 0.0200 | 0.0574 | 0.0080 | 2.2420 | 2.8760 | 1.4080 | 1321.8000 | 7.3 | 1.61 |
| 7 | 5 | 1 | 0.0500 | 0.1343 | 341.5221 | 0.0067 | 0.0100 | 3.0084 | 14.6565 | 0.0978 | 0.0200 | 0.1852 | 0.0080 | 1.0950 | 2.7310 | 1.4500 | 1082.0000 | 7.23 | 1.41 |
| 7 | 5 | 2 | 0.0500 | 0.1661 | 406.7878 | 0.0063 | 0.0100 | 2.4067 | 16.6775 | 0.0697 | 0.0200 | 0.1303 | 0.0080 | 1.5400 | 3.0760 | 1.3940 | 1287.8000 | 7.35 | 1.56 |
| 7 | 5 | 3 | 0.0500 | 0.1616 | 490.7976 | 0.0040 | 0.0100 | 3.3694 | 19.2283 | 0.1502 | 0.0200 | 0.1034 | 0.0080 | 1.8190 | 3.1990 | 1.7930 | 1539.4000 | 7.22 | 1.78 |
| 8 | 1 | 1 | 4.6879 | 0.0317 | 51.3646 | 0.0900 | 1.7067 | 5.8065 | 5.8130 | 2.9804 | 0.0200 | 0.0468 | 0.3723 | 0.5710 | 0.7670 | 1.2670 | 259.3800 | 3.32 | 0.58 |
| 8 | 1 | 2 | 4.3650 | 0.0160 | 45.8259 | 0.0668 | 2.4659 | 4.3742 | 5.8131 | 2.9606 | 0.0200 | 0.0100 | 0.3572 | 0.5850 | 0.7510 | 1.2190 | 263.8700 | 3.33 | 0.57 |
| 8 | 1 | 3 | 4.6748 | 0.0217 | 49.5774 | 0.0649 | 1.6232 | 6.0645 | 5.7424 | 3.3394 | 0.0200 | 0.0250 | 0.3921 | 0.5490 | 0.7000 | 1.0020 | 262.4500 | 3.37 | 0.55 |
| 8 | 2 | 1 | 0.0620 | 0.0200 | 271.9602 | 0.0111 | 0.0198 | 2.8387 | 11.3982 | 0.0376 | 0.0200 | 0.1115 | 0.0080 | 0.8810 | 1.4850 | 1.0380 | 857.4600 | 7.21 | 1.21 |
| 8 | 2 | 2 | 0.0542 | 0.0190 | 316.4833 | 0.0040 | 0.0198 | 2.1661 | 12.4808 | 0.0520 | 0.0200 | 0.1113 | 0.0080 | 1.1060 | 1.3440 | 1.2630 | 1000.2000 | 7.25 | 1.37 |
| 8 | 2 | 3 | 0.0553 | 0.0220 | 279.4463 | 0.0040 | 0.0198 | 2.6474 | 10.9935 | 0.0716 | 0.0200 | 0.1017 | 0.0080 | 1.3090 | 1.6670 | 1.0750 | 871.7900 | 7.34 | 1.18 |
| 8 | 3 | 1 | 0.0500 | 0.0902 | 286.3522 | 0.0097 | 0.0250 | 3.0968 | 12.5259 | 0.0760 | 0.0200 | 0.1046 | 0.0080 | 1.3430 | 1.7870 | 0.9580 | 920.9600 | 7.26 | 1.25 |
| 8 | 3 | 2 | 0.0741 | 0.0831 | 282.2317 | 0.0040 | 0.0435 | 2.4301 | 11.7005 | 0.0880 | 0.0200 | 0.0420 | 0.0080 | 1.4550 | 1.6940 | 1.0830 | 892.5300 | 7.23 | 1.21 |
| 8 | 3 | 3 | 0.0620 | 0.0900 | 305.9488 | 0.0087 | 0.0311 | 2.9162 | 11.8455 | 0.0624 | 0.0200 | 0.0829 | 0.0080 | 1.4400 | 1.7870 | 0.9810 | 923.9600 | 7.31 | 1.23 |
| 8 | 4 | 1 | 0.0500 | 0.1188 | 298.7730 | 0.0069 | 0.0275 | 2.6726 | 12.2365 | 0.0535 | 0.0200 | 0.0668 | 0.0080 | 1.0970 | 1.9470 | 1.0880 | 974.7600 | 7.36 | 1.31 |
| 8 | 4 | 2 | 0.0500 | 0.1147 | 272.2723 | 0.0045 | 0.0132 | 2.0045 | 11.3204 | 0.0357 | 0.0200 | 0.0685 | 0.0080 | 0.9500 | 1.8860 | 1.6120 | 889.2200 | 7.3 | 1.21 |
| 8 | 4 | 3 | 0.0500 | 0.1320 | 308.9719 | 0.0153 | 0.0215 | 2.9677 | 12.9550 | 0.0692 | 0.0200 | 0.1374 | 0.0080 | 1.3660 | 1.8480 | 1.7410 | 954.3400 | 7.21 | 1.3 |
| 8 | 5 | 1 | 0.0699 | 0.1202 | 227.8046 | 0.0040 | 0.0374 | 2.1158 | 10.5154 | 0.0590 | 0.0200 | 0.0653 | 0.0080 | 0.8270 | 1.7730 | 1.2060 | 751.1800 | 7.3 | 1.09 |
| 8 | 5 | 2 | 0.0678 | 0.1480 | 316.0301 | 0.0040 | 0.0428 | 3.0377 | 12.0331 | 0.0473 | 0.0200 | 0.0272 | 0.0080 | 1.3600 | 1.7880 | 1.1660 | 937.5900 | 7.37 | 1.26 |
| 8 | 5 | 3 | 0.0613 | 0.1479 | 351.7645 | 0.0040 | 0.0243 | 2.5271 | 14.0868 | 0.0884 | 0.0200 | 0.0747 | 0.0080 | 1.5670 | 1.8490 | 1.1830 | 1112.6000 | 7.22 | 1.41 |
| 9 | 1 | 1 | 3.5413 | 0.0180 | 39.9066 | 0.0687 | 1.6804 | 5.5319 | 4.9265 | 2.3983 | 0.0200 | 0.0967 | 0.2986 | 0.5900 | 0.7300 | 1.4980 | 239.9830 | 3.3 | 0.54 |
| 9 | 1 | 2 | 3.3334 | 0.0133 | 36.0409 | 0.0607 | 2.4415 | 5.5319 | 4.8982 | 2.3951 | 0.0200 | 0.0812 | 0.2989 | 0.6080 | 0.6910 | 1.5100 | 214.9310 | 3.3 | 0.52 |
| 9 | 1 | 3 | 3.3678 | 0.0118 | 36.1811 | 0.0536 | 1.0115 | 5.2128 | 4.7723 | 2.6132 | 0.0200 | 0.0685 | 0.3190 | 0.4860 | 0.7010 | 0.9820 | 233.7630 | 3.4 | 0.49 |
| 9 | 2 | 1 | 0.0500 | 0.0202 | 197.1921 | 0.0087 | 0.0100 | 2.2954 | 7.8957 | 0.0202 | 0.0200 | 0.0100 | 0.0080 | 0.7050 | 1.2250 | 1.5280 | 721.8040 | 7.39 | 1 |
| 9 | 2 | 2 | 0.0500 | 0.0110 | 232.0504 | 0.0097 | 0.0100 | 1.8085 | 9.4775 | 0.0295 | 0.0200 | 0.0934 | 0.0080 | 1.0090 | 1.2710 | 1.2490 | 844.3610 | 7.46 | 1.07 |
| 9 | 2 | 3 | 0.0500 | 0.0149 | 211.6367 | 0.0104 | 0.0100 | 3.1277 | 9.0017 | 0.0550 | 0.0200 | 0.0672 | 0.0080 | 0.8190 | 1.5080 | 1.4670 | 773.6210 | 7.36 | 1.01 |
| 9 | 3 | 1 | 0.0500 | 0.0910 | 215.1080 | 0.0104 | 0.0100 | 2.6596 | 9.6196 | 0.0494 | 0.0200 | 0.1338 | 0.0080 | 0.9590 | 1.5860 | 1.8820 | 796.1130 | 7.33 | 1.08 |
| 9 | 3 | 2 | 0.0500 | 0.1004 | 208.9652 | 0.0111 | 0.0100 | 2.4468 | 9.3262 | 0.0566 | 0.0200 | 0.1317 | 0.0080 | 1.2160 | 1.5360 | 1.8030 | 752.7440 | 7.26 | 1.03 |
| 9 | 3 | 3 | 0.0500 | 0.0957 | 216.0270 | 0.0111 | 0.0100 | 2.0213 | 9.1855 | 0.0390 | 0.0200 | 0.0856 | 0.0080 | 0.8770 | 1.5030 | 1.4220 | 763.4260 | 7.51 | 1.02 |
| 9 | 4 | 1 | 0.0500 | 0.1349 | 255.5642 | 0.0115 | 0.0100 | 2.3404 | 10.4256 | 0.0486 | 0.0200 | 0.1461 | 0.0080 | 1.0770 | 1.8520 | 1.6710 | 872.2360 | 7.44 | 1.17 |
| 9 | 4 | 2 | 0.0500 | 0.1294 | 214.4952 | 0.0122 | 0.0100 | 2.2340 | 9.2633 | 0.0258 | 0.0200 | 0.0999 | 0.0080 | 0.7950 | 1.5120 | 1.3300 | 781.2040 | 7.45 | 1.04 |
| 9 | 4 | 3 | 0.0500 | 0.1538 | 232.1708 | 0.0101 | 0.0100 | 2.3404 | 10.5204 | 0.0377 | 0.0200 | 0.0979 | 0.0080 | 1.2400 | 1.6750 | 1.6540 | 841.4800 | 7.39 | 1.1 |
| 9 | 5 | 1 | 0.0500 | 0.1373 | 183.8802 | 0.0086 | 0.0100 | 1.7021 | 8.4326 | 0.0401 | 0.0200 | 0.1124 | 0.0161 | 0.7310 | 1.6940 | 1.6450 | 666.8320 | 7.4 | 0.92 |
| 9 | 5 | 2 | 0.0500 | 0.1726 | 223.9411 | 0.0101 | 0.0100 | 2.1277 | 9.9583 | 0.0354 | 0.0200 | 0.1451 | 0.0080 | 0.9680 | 1.4890 | 1.5330 | 844.4530 | 7.47 | 1.14 |
| 9 | 5 | 3 | 0.0500 | 0.1828 | 272.7560 | 0.0111 | 0.0100 | 3.0851 | 11.2076 | 0.0645 | 0.0200 | 0.1184 | 0.0080 | 1.2360 | 1.6770 | 1.6490 | 984.2230 | 7.27 | 1.16 |
| 10 | 1 | 1 | 2.7819 | 0.0100 | 32.8955 | 0.0439 | 1.1985 | 5.6383 | 3.9692 | 1.9863 | 0.0200 | 0.0674 | 0.2523 | 0.5590 | 0.6880 | 1.1860 | 213.8590 | 3.39 | 0.44 |
| 10 | 1 | 2 | 2.6375 | 0.0118 | 30.2869 | 0.0464 | 1.8181 | 5.2128 | 4.0194 | 1.9955 | 0.0200 | 0.0299 | 0.2502 | 0.5800 | 0.6970 | 2.0250 | 196.6610 | 3.4 | 0.43 |
| 10 | 1 | 3 | 2.6715 | 0.0133 | 30.8155 | 0.0492 | 0.5052 | 5.4255 | 3.9013 | 2.1783 | 0.0200 | 0.0341 | 0.1271 | 0.6080 | 0.6570 | 0.9580 | 200.1620 | 3.4 | 0.43 |
| 10 | 2 | 1 | 0.0500 | 0.0110 | 147.2670 | 0.0075 | 0.0100 | 1.5957 | 6.1736 | 0.0146 | 0.0200 | 0.0786 | 0.0080 | 0.4780 | 0.9450 | 1.8730 | 529.5770 | 7.31 | 0.72 |
| 10 | 2 | 2 | 0.0500 | 0.0100 | 178.3693 | 0.0083 | 0.0100 | 1.7021 | 7.1769 | 0.0241 | 0.0200 | 0.1103 | 0.0080 | 0.6080 | 1.0140 | 1.5640 | 620.6470 | 7.37 | 0.86 |
| 10 | 2 | 3 | 0.0500 | 0.0196 | 163.2504 | 0.0111 | 0.0100 | 2.2340 | 6.4678 | 0.0374 | 0.0200 | 0.1246 | 0.0080 | 0.6280 | 1.1480 | 1.0780 | 570.2390 | 7.49 | 0.8 |
| 10 | 3 | 1 | 0.0500 | 0.0800 | 168.2436 | 0.0216 | 0.0100 | 2.3404 | 7.5304 | 0.0439 | 0.0200 | 0.1026 | 0.0848 | 1.0410 | 1.2580 | 1.4170 | 588.7070 | 7.43 | 0.82 |
| 10 | 3 | 2 | 0.0500 | 0.0847 | 153.4759 | 0.0129 | 0.0100 | 2.3404 | 6.8517 | 0.0364 | 0.0200 | 0.0876 | 0.0080 | 0.4910 | 1.5750 | 1.9790 | 540.8740 | 7.23 | 0.74 |
| 10 | 3 | 3 | 0.0500 | 0.0879 | 171.1259 | 0.0129 | 0.0100 | 2.5532 | 7.1430 | 0.0289 | 0.0200 | 0.1101 | 0.0080 | 0.6150 | 1.1970 | 1.1480 | 615.6060 | 7.55 | 0.84 |
| 10 | 4 | 1 | 0.0500 | 0.1302 | 187.2854 | 0.0119 | 0.0100 | 2.3404 | 7.7665 | 0.0308 | 0.0200 | 0.1440 | 0.0080 | 0.8040 | 1.2890 | 1.0820 | 666.3830 | 7.47 | 0.9 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 4 | 2 | 0.0500 | 0.1153 | 168.2919 | 0.0104 | 0.0100 | 1.8085 | 7.3791 | 0.0167 | 0.0200 | 0.0856 | 0.0080 | 0.8570 | 1.3360 | 1.2130 | 585.2110 | 7.45 | 0.8 |
| 10 | 4 | 3 | 0.0500 | 0.1145 | 168.1680 | 0.0090 | 0.0100 | 2.1277 | 7.4463 | 0.0233 | 0.0200 | 0.1072 | 0.0080 | 0.5840 | 1.2330 | 1.7570 | 609.8810 | 7.4 | 0.81 |
| 10 | 5 | 1 | 0.0500 | 0.1294 | 140.1331 | 0.0122 | 0.0100 | 1.8085 | 6.6608 | 0.0292 | 0.0200 | 0.1050 | 0.0080 | 0.4880 | 1.4090 | 1.5240 | 505.8830 | 7.27 | 0.7 |
| 10 | 5 | 2 | 0.0500 | 0.1396 | 161.0959 | 0.0100 | 0.0100 | 2.2954 | 6.7001 | 0.0225 | 0.0200 | 0.0270 | 0.0080 | 0.5900 | 1.1660 | 1.6250 | 586.5720 | 7.45 | 0.81 |
| 10 | 5 | 3 | 0.0500 | 0.1404 | 195.6852 | 0.0097 | 0.0100 | 2.2340 | 7.9581 | 0.0393 | 0.0200 | 0.1154 | 0.0080 | 0.7110 | 1.1530 | 1.4950 | 715.9050 | 7.41 | 0.91 |
| 11 | 1 | 1 | 2.3667 | 0.0157 | 28.1108 | 0.0496 | 1.1161 | 5.6383 | 3.4396 | 1.7334 | 0.0200 | 0.0821 | 0.2251 | 0.5010 | 0.6700 | 2.6690 | 187.5470 | 3.39 | 0.42 |
| 11 | 1 | 2 | 2.5085 | 0.0149 | 27.7669 | 0.0428 | 1.6912 | 5.6383 | 3.8214 | 1.8662 | 0.0200 | 0.0137 | 0.2414 | 0.5680 | 0.6530 | 1.2020 | 177.0170 | 3.41 | 0.42 |
| 11 | 1 | 3 | 2.2503 | 0.0187 | 27.7775 | 0.0416 | 0.2024 | 6.0878 | 3.3346 | 1.9371 | 0.0200 | 0.0100 | 0.2437 | 0.5100 | 0.6070 | 0.9280 | 145.3720 | 3.41 | 0.41 |
| 11 | 2 | 1 | 0.0500 | 0.0102 | 103.8620 | 0.0079 | 0.0100 | 1.8085 | 4.3764 | 0.0082 | 0.0200 | 0.0888 | 0.0080 | 0.3560 | 0.8720 | 1.7120 | 366.2080 | 7.33 | 0.56 |
| 11 | 2 | 2 | 0.0500 | 0.0100 | 132.3057 | 0.0083 | 0.0100 | 1.4894 | 5.3846 | 0.0138 | 0.0200 | 0.0775 | 0.0080 | 0.3930 | 0.8790 | 1.1890 | 456.9620 | 7.41 | 0.68 |
| 11 | 2 | 3 | 0.0500 | 0.0165 | 127.2267 | 0.0097 | 0.0141 | 2.1277 | 5.0608 | 0.0274 | 0.0200 | 0.1102 | 0.0080 | 0.4510 | 1.0930 | 1.2010 | 413.2300 | 7.54 | 0.64 |
| 11 | 3 | 1 | 0.0500 | 0.0784 | 136.2382 | 0.0072 | 0.0100 | 1.9149 | 5.9029 | 0.0247 | 0.0200 | 0.0991 | 0.0080 | 0.4590 | 1.1190 | 1.2050 | 468.4030 | 7.47 | 0.69 |
| 11 | 3 | 2 | 0.0500 | 0.0808 | 123.4323 | 0.0083 | 0.0100 | 2.1277 | 5.3457 | 0.0252 | 0.0200 | 0.0950 | 0.0080 | 0.5320 | 1.0160 | 1.8230 | 416.0230 | 7.24 | 0.65 |
| 11 | 3 | 3 | 0.0500 | 0.0933 | 135.3658 | 0.0104 | 0.0100 | 2.3952 | 5.4718 | 0.0221 | 0.0200 | 0.0975 | 0.0080 | 0.5110 | 1.0790 | 1.1520 | 464.2270 | 7.57 | 0.72 |
| 11 | 4 | 1 | 0.0500 | 0.1247 | 142.9883 | 0.0208 | 0.0100 | 2.5532 | 5.7714 | 0.0292 | 0.0200 | 0.1252 | 0.0080 | 0.4950 | 1.1100 | 1.2430 | 491.0050 | 7.56 | 0.73 |
| 11 | 4 | 2 | 0.0500 | 0.1067 | 133.7957 | 0.0212 | 0.0114 | 2.5532 | 5.9135 | 0.0250 | 0.0200 | 0.1364 | 0.0082 | 0.4500 | 1.0660 | 1.3430 | 459.1640 | 7.45 | 0.71 |
| 11 | 4 | 3 | 0.0500 | 0.1145 | 134.8940 | 0.0208 | 0.0100 | 2.4468 | 6.0393 | 0.0292 | 0.0200 | 0.0985 | 0.0082 | 0.4250 | 1.0600 | 1.6860 | 477.1700 | 7.5 | 0.7 |
| 11 | 5 | 1 | 0.0500 | 0.1271 | 117.7482 | 0.0093 | 0.0417 | 2.1277 | 5.3118 | 0.0263 | 0.0200 | 0.1000 | 0.0080 | 0.4140 | 1.1110 | 1.6650 | 391.6550 | 7.41 | 0.62 |
| 11 | 5 | 2 | 0.0500 | 0.1451 | 134.7533 | 0.0115 | 0.0100 | 2.6596 | 5.8378 | 0.0168 | 0.0200 | 0.1932 | 0.0080 | 0.4350 | 1.0720 | 1.2760 | 477.2110 | 7.52 | 0.69 |
| 11 | 5 | 3 | 0.0500 | 0.1366 | 137.0494 | 0.0191 | 0.0100 | 2.1956 | 5.5066 | 0.0366 | 0.0200 | 0.0321 | 0.0080 | 0.4690 | 1.0950 | 2.8350 | 497.6790 | 7.33 | 0.71 |
| 12 | 1 | 1 | 1.9964 | 0.0100 | 23.8981 | 0.0410 | 1.0690 | 5.7447 | 2.9419 | 1.4943 | 0.0200 | 0.0768 | 0.1961 | 0.4960 | 0.6510 | 3.6930 | 164.5510 | 3.42 | 0.37 |
| 12 | 1 | 2 | 2.0245 | 0.0149 | 23.0222 | 0.0410 | 1.5351 | 6.1702 | 3.1243 | 1.5561 | 0.0200 | 0.0691 | 0.2946 | 0.4730 | 0.6450 | 1.5740 | 153.6370 | 3.43 | 0.37 |
| 12 | 1 | 3 | 2.2174 | 0.0173 | 25.0982 | 0.0327 | 0.1203 | 6.4894 | 3.0868 | 1.7317 | 0.0200 | 0.0768 | 0.2202 | 0.5080 | 0.6310 | 0.8470 | 168.7860 | 3.43 | 0.36 |
| 12 | 2 | 1 | 0.0500 | 0.0100 | 90.1637 | 0.0205 | 0.0173 | 2.1277 | 3.9465 | 0.0181 | 0.0200 | 0.0985 | 0.0080 | 0.3440 | 0.8200 | 7.4990 | 300.7710 | 7.06 | 0.47 |
| 12 | 2 | 2 | 0.0500 | 0.0149 | 102.9635 | 0.0075 | 0.0100 | 1.8085 | 4.2060 | 0.0099 | 0.0200 | 0.0868 | 0.0080 | 0.3280 | 0.8320 | 3.6230 | 342.1510 | 7.34 | 0.54 |
| 12 | 2 | 3 | 0.0500 | 0.0133 | 96.4158 | 0.0075 | 0.0103 | 2.1277 | 3.8589 | 0.0189 | 0.0200 | 0.0796 | 0.0080 | 0.5230 | 1.0600 | 1.0850 | 321.9120 | 7.33 | 0.5 |
| 12 | 3 | 1 | 0.0500 | 0.0737 | 102.2381 | 0.0196 | 0.0146 | 2.0213 | 4.5383 | 0.0271 | 0.0200 | 0.1078 | 0.0080 | 0.3670 | 0.9900 | 1.8770 | 363.6980 | 7.39 | 0.55 |
| 12 | 3 | 2 | 0.0551 | 0.0777 | 91.9705 | 0.0097 | 0.0201 | 2.2340 | 4.0936 | 0.0212 | 0.0200 | 0.0713 | 0.0080 | 0.3340 | 0.8850 | 5.1870 | 323.6700 | 7.13 | 0.5 |
| 12 | 3 | 3 | 0.0500 | 0.0855 | 107.8223 | 0.0097 | 0.0100 | 2.2340 | 4.6677 | 0.0159 | 0.0200 | 0.1902 | 0.0080 | 0.3970 | 1.0070 | 1.0790 | 356.2000 | 7.52 | 0.57 |
| 12 | 4 | 1 | 0.0500 | 0.1208 | 106.1297 | 0.0122 | 0.0125 | 0.0201 | 4.4422 | 0.0162 | 0.0200 | 0.1174 | 0.0080 | 0.4070 | 0.9770 | 1.1910 | 361.8140 | 7.41 | 0.57 |
| 12 | 4 | 2 | 0.0500 | 0.1090 | 107.0264 | 0.0122 | 0.0146 | 2.0213 | 4.5892 | 0.0120 | 0.0200 | 0.1368 | 0.0080 | 0.4470 | 1.0110 | 3.7320 | 354.7570 | 7.34 | 0.56 |
| 12 | 4 | 3 | 0.0500 | 0.1185 | 100.6264 | 0.0086 | 0.0173 | 2.3404 | 4.6090 | 0.0143 | 0.0200 | 0.1564 | 0.0080 | 0.3670 | 0.9710 | 3.4920 | 356.1810 | 7.26 | 0.55 |
| 12 | 5 | 1 | 0.0500 | 0.1263 | 90.6262 | 0.0093 | 0.0190 | 1.8085 | 4.3849 | 0.0156 | 0.0200 | 0.1513 | 0.0080 | 0.5720 | 0.9700 | 2.2370 | 298.8560 | 7.27 | 0.48 |
| 12 | 5 | 2 | 0.0500 | 0.1436 | 104.7579 | 0.0108 | 0.0100 | 2.4468 | 4.5687 | 0.0117 | 0.0200 | 0.1615 | 0.0080 | 0.3770 | 0.9770 | 1.9580 | 357.0430 | 7.38 | 0.57 |
| 12 | 5 | 3 | 0.0500 | 0.1514 | 113.7215 | 0.0201 | 0.0100 | 1.9149 | 4.7844 | 0.0311 | 0.0200 | 0.1057 | 0.0080 | 0.3930 | 0.9820 | 5.4160 | 386.2540 | 7.13 | 0.59 |
| 13 | 1 | 1 | 1.9625 | 0.0224 | 22.3377 | 0.0334 | 0.8587 | 5.9666 | 2.5505 | 1.3932 | 0.0200 | 0.0100 | 0.1921 | 0.1860 | 0.7440 | 15.7053 | 134.3710 | 3.27 | 0.43 |
| 13 | 1 | 2 | 1.7788 | 0.0178 | 19.9346 | 0.0279 | 0.9824 | 4.9769 | 2.6323 | 1.3422 | 0.0200 | 0.0100 | 0.1815 | 0.1780 | 0.6110 | 3.8990 | 134.4630 | 3.39 | 0.37 |
| 13 | 1 | 3 | 2.3117 | 0.0308 | 23.4825 | 0.0327 | 0.0765 | 6.3246 | 2.8561 | 1.6257 | 0.0200 | 0.0100 | 0.2191 | 0.1980 | 0.6450 | 1.0340 | 141.4590 | 3.54 | 0.34 |
| 13 | 2 | 1 | 0.0500 | 0.0178 | 76.5777 | 0.0068 | 0.0100 | 2.1480 | 3.0709 | 0.0020 | 0.0200 | 0.0455 | 0.0080 | 0.2790 | 0.8020 | 6.5170 | 218.3960 | 7.08 | 0.42 |
| 13 | 2 | 2 | 0.0500 | 0.0119 | 70.2056 | 0.0040 | 0.0100 | 1.3889 | 2.8370 | 0.0020 | 0.0200 | 0.0215 | 0.0080 | 0.2590 | 0.8610 | 3.1050 | 219.7840 | 7.42 | 0.42 |
| 13 | 2 | 3 | 0.0500 | 0.0141 | 74.3555 | 0.0040 | 0.0100 | 2.0833 | 2.9978 | 0.0020 | 0.0200 | 0.0392 | 0.0080 | 0.2760 | 1.0200 | 1.5260 | 222.9620 | 7.56 | 0.43 |
| 13 | 3 | 1 | 0.0500 | 0.0841 | 87.4200 | 0.0076 | 0.0100 | 1.9093 | 3.6693 | 0.0126 | 0.0200 | 0.0286 | 0.0080 | 0.3280 | 1.0210 | 14.2970 | 253.0520 | 6.9 | 0.49 |
| 13 | 3 | 2 | 0.0500 | 0.0652 | 69.5357 | 0.0040 | 0.0100 | 1.3889 | 3.0626 | 0.0020 | 0.0200 | 0.0299 | 0.0080 | 0.2670 | 0.8410 | 3.3820 | 214.9480 | 7.32 | 0.42 |
| 13 | 3 | 3 | 0.0500 | 0.0953 | 87.5101 | 0.0084 | 0.0100 | 1.9093 | 3.5877 | 0.0020 | 0.0200 | 0.0165 | 0.0080 | 0.3530 | 1.0990 | 1.5140 | 243.8090 | 7.63 | 0.48 |
| 13 | 4 | 1 | 0.0500 | 0.1112 | 84.3067 | 0.0054 | 0.0100 | 1.9209 | 3.4278 | 0.0020 | 0.0200 | 0.0581 | 0.0080 | 0.3640 | 1.1090 | 1.6820 | 255.4820 | 7.57 | 0.49 |
| 13 | 4 | 2 | 0.0500 | 0.0941 | 83.1216 | 0.0040 | 0.0100 | 1.5046 | 3.4410 | 0.0020 | 0.0200 | 0.0186 | 0.0080 | 0.3090 | 0.9500 | 4.5510 | 256.4620 | 7.34 | 0.47 |
| 13 | 4 | 3 | 0.0500 | 0.0926 | 75.8443 | 0.0040 | 0.0100 | 1.8519 | 3.3410 | 0.0034 | 0.0200 | 0.0430 | 0.0080 | 0.3150 | 0.9180 | 24.9410 | 236.8560 | 6.28 | 0.47 |
| 13 | 5 | 1 | 0.0500 | 0.1364 | 80.4491 | 0.0076 | 0.0100 | 2.0286 | 3.6263 | 0.0170 | 0.0200 | 0.0624 | 0.0080 | 0.3580 | 1.0750 | 18.5970 | 224.4080 | 6.66 | 0.43 |
| 13 | 5 | 2 | 0.0500 | 0.1404 | 80.4295 | 0.0043 | 0.0100 | 2.2599 | 3.4147 | 0.0020 | 0.0200 | 0.0504 | 0.0080 | 0.3250 | 0.9880 | 2.3310 | 240.8450 | 7.43 | 0.46 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | 5 | 3 | 0.0500 | 0.1208 | 83.2758 | 0.0044 | 0.0100 | 2.0833 | 3.4214 | 0.0044 | 0.0200 | 0.0382 | 0.0080 | 0.3100 | 0.8790 | 11.3130 | 257.1870 | 7.02 | 0.5 |
| 14 | 1 | 1 | 1.5234 | 0.0221 | 18.1582 | 0.0229 | 0.6587 | 5.7627 | 2.1444 | 1.1541 | 0.0200 | 0.0100 | 0.1553 | 0.1740 | 0.5420 | 12.7440 | 120.2990 | 3.27 | 0.38 |
| 14 | 1 | 2 | 1.5135 | 0.0178 | 17.2174 | 0.0350 | 1.4049 | 5.6086 | 2.1804 | 1.1712 | 0.0200 | 0.0100 | 0.1623 | 0.1520 | 0.5580 | 23.3390 | 118.3430 | 3.1 | 0.43 |
| 14 | 1 | 3 | 1.6821 | 0.0187 | 18.4806 | 0.0247 | 0.0751 | 5.9666 | 2.2312 | 1.2632 | 0.0200 | 0.0100 | 0.1692 | 0.1510 | 0.5400 | 0.8650 | 113.8580 | 3.52 | 0.31 |
| 14 | 2 | 1 | 0.0500 | 0.0187 | 61.2654 | 0.0182 | 0.0100 | 1.5513 | 2.5132 | 0.0195 | 0.0200 | 0.0137 | 0.0123 | 0.3790 | 0.7440 | 37.1420 | 167.7170 | 4.93 | 0.36 |
| 14 | 2 | 2 | 0.0500 | 0.1185 | 55.0039 | 0.0040 | 0.0100 | 1.3889 | 2.2248 | 0.0030 | 0.0200 | 0.0505 | 0.0080 | 0.2770 | 0.6920 | 22.7450 | 164.3950 | 6.54 | 0.35 |
| 14 | 2 | 3 | 0.0500 | 0.1333 | 57.6585 | 0.0040 | 0.0100 | 0.9259 | 2.3154 | 0.0020 | 0.0200 | 0.0225 | 0.0080 | 0.2610 | 0.8310 | 1.2880 | 165.7230 | 7.45 | 0.36 |
| 14 | 3 | 1 | 0.0500 | 0.0939 | 70.3792 | 0.1287 | 0.0100 | 2.0339 | 3.1437 | 0.0142 | 0.0200 | 0.0588 | 0.0080 | 0.3190 | 0.9860 | 20.4940 | 205.3030 | 6.46 | 0.43 |
| 14 | 3 | 2 | 0.0500 | 0.0770 | 61.7368 | 0.0040 | 0.0100 | 1.5046 | 2.7674 | 0.0053 | 0.0200 | 0.0560 | 0.0080 | 0.2800 | 0.8410 | 20.8310 | 185.2410 | 6.1 | 0.39 |
| 14 | 3 | 3 | 0.0500 | 0.1065 | 75.2833 | 0.0114 | 0.0100 | 1.7900 | 3.1503 | 0.0025 | 0.0200 | 0.0610 | 0.0080 | 0.3450 | 0.8950 | 1.1760 | 199.2410 | 7.53 | 0.41 |
| 14 | 4 | 1 | 0.0800 | 0.1448 | 77.1237 | 0.0080 | 0.0100 | 1.9093 | 3.1253 | 0.0035 | 0.0200 | 0.0660 | 0.0080 | 0.3630 | 0.1012 | 1.3030 | 199.5270 | 7.28 | 0.37 |
| 14 | 4 | 2 | 0.0500 | 0.0919 | 70.8590 | 0.0040 | 0.0100 | 1.3889 | 2.9674 | 0.0020 | 0.0200 | 0.0561 | 0.0080 | 0.3180 | 0.9100 | 4.6590 | 213.2110 | 7.57 | 0.39 |
| 14 | 4 | 3 | 0.0500 | 0.1183 | 66.7872 | 0.0064 | 0.0100 | 2.0339 | 2.9446 | 0.0020 | 0.0200 | 0.0100 | 0.0080 | 0.3090 | 0.8610 | 7.4960 | 194.1090 | 7.25 | 0.4 |
| 14 | 5 | 1 | 0.0500 | 0.1533 | 67.4174 | 0.0182 | 0.0100 | 1.9093 | 3.1439 | 0.0159 | 0.0200 | 0.0197 | 0.0104 | 0.3260 | 0.9480 | 4.9870 | 177.9050 | 7.23 | 0.37 |
| 14 | 5 | 2 | 0.0500 | 0.1719 | 70.3512 | 0.0873 | 0.0100 | 1.6706 | 3.0086 | 0.0099 | 0.0200 | 0.0925 | 0.0080 | 0.3520 | 0.9030 | 20.0340 | 187.4950 | 6.71 | 0.4 |
| 14 | 5 | 3 | 0.0500 | 0.1333 | 63.3054 | 0.0125 | 0.0100 | 2.1469 | 2.6506 | 0.0079 | 0.0200 | 0.0384 | 0.0080 | 0.3130 | 1.0160 | 9.1350 | 182.7470 | 7.14 | 0.38 |
| 15 | 1 | 1 | 1.2728 | 0.0159 | 15.5200 | 0.0255 | 0.7014 | 5.2506 | 1.7853 | 1.0175 | 0.0200 | 0.0100 | 0.1447 | 0.1480 | 0.4970 | 10.4440 | 103.3020 | 3.36 | 0.32 |
| 15 | 1 | 2 | 1.4282 | 0.0193 | 16.1837 | 0.0435 | 0.8941 | 5.0926 | 2.1066 | 1.1407 | 0.0200 | 0.0100 | 0.1674 | 0.3670 | 0.7480 | 51.6290 | 112.9370 | 3.04 | 0.34 |
| 15 | 1 | 3 | 1.3073 | 0.0197 | 14.9258 | 0.0125 | 0.0323 | 5.9887 | 1.8334 | 0.9968 | 0.0200 | 0.0100 | 0.1305 | 0.1600 | 0.5310 | 0.8140 | 104.9960 | 3.51 | 0.28 |
| 15 | 2 | 1 | 0.0500 | 0.0134 | 51.0618 | 0.0040 | 0.0100 | 2.1469 | 2.1615 | 0.0027 | 0.0200 | 0.0252 | 0.0080 | 0.6040 | 0.7210 | 24.8900 | 147.6630 | 5.42 | 0.31 |
| 15 | 2 | 2 | 0.0500 | 0.0104 | 43.6755 | 0.0040 | 0.0100 | 0.9259 | 1.8060 | 0.0020 | 0.0200 | 0.0100 | 0.0080 | 0.7550 | 0.6340 | 4.2450 | 124.8450 | 7.45 | 0.27 |
| 15 | 2 | 3 | 0.0500 | 0.0119 | 47.3242 | 0.0040 | 0.0100 | 1.1574 | 1.9350 | 0.0020 | 0.0200 | 0.0141 | 0.0080 | 0.2740 | 0.8970 | 1.4770 | 139.7590 | 7.53 | 0.29 |
| 15 | 3 | 1 | 0.0500 | 0.0916 | 59.6663 | 0.0076 | 0.0100 | 1.9093 | 2.6385 | 0.0083 | 0.0200 | 0.0322 | 0.0080 | 0.2940 | 0.8990 | 17.8290 | 161.0450 | 6.65 | 0.34 |
| 15 | 3 | 2 | 0.0500 | 0.0934 | 54.0071 | 0.0110 | 0.0100 | 2.0286 | 2.4109 | 0.0105 | 0.0200 | 0.0586 | 0.0080 | 0.2700 | 0.8920 | 13.0410 | 147.2750 | 7 | 0.32 |
| 15 | 3 | 3 | 0.0500 | 0.0770 | 47.9567 | 0.0040 | 0.0100 | 1.1577 | 2.0492 | 0.0020 | 0.0200 | 0.0252 | 0.0080 | 0.3480 | 0.8290 | 1.4090 | 134.4310 | 7.62 | 0.29 |
| 15 | 4 | 1 | 0.0500 | 0.1037 | 49.4834 | 0.0040 | 0.0100 | 1.0417 | 2.0918 | 0.0020 | 0.0200 | 0.0653 | 0.0080 | 0.3030 | 0.8710 | 1.2940 | 143.1660 | 7.61 | 0.3 |
| 15 | 4 | 2 | 0.0500 | 0.0985 | 54.5614 | 0.0040 | 0.0100 | 1.2731 | 2.3586 | 0.0020 | 0.0200 | 0.0373 | 0.0080 | 0.2940 | 0.7260 | 13.3270 | 158.3050 | 7.02 | 0.32 |
| 15 | 4 | 3 | 0.0500 | 0.1159 | 54.0592 | 0.0040 | 0.0154 | 1.6706 | 2.3601 | 0.0106 | 0.0200 | 0.1056 | 0.0080 | 0.3890 | 0.9110 | 61.0100 | 154.3140 | 3.51 | 0.43 |
| 15 | 5 | 1 | 0.0500 | 0.1141 | 45.7036 | 0.0040 | 0.0100 | 1.2731 | 2.2701 | 0.0091 | 0.0200 | 0.0130 | 0.0080 | 0.3150 | 0.7550 | 11.0400 | 134.4880 | 6.91 | 0.28 |
| 15 | 5 | 2 | 0.0500 | 0.1325 | 47.5523 | 0.0043 | 0.0120 | 2.0339 | 2.0600 | 0.0025 | 0.0200 | 0.1243 | 0.0080 | 0.3770 | 0.8370 | 31.4740 | 141.9760 | 4.41 | 0.33 |
| 15 | 5 | 3 | 0.0500 | 0.1533 | 53.0662 | 0.0080 | 0.0100 | 1.5513 | 2.2713 | 0.0097 | 0.0200 | 0.0648 | 0.0080 | 0.8330 | 0.8610 | 22.3250 | 140.3670 | 5.64 | 0.3 |
| 16 | 1 | 1 | 0.9124 | 0.0158 | 12.1292 | 0.0197 | 0.6001 | 6.1017 | 1.4412 | 0.8005 | 0.0200 | 0.0208 | 0.1107 | 0.1010 | 0.5840 | 4.8620 | 88.6640 | 3.47 | 0.29 |
| 16 | 1 | 2 | 1.3093 | 0.0150 | 14.5964 | 0.0239 | 0.9106 | 4.8926 | 1.8296 | 1.0117 | 0.0200 | 0.0100 | 0.1448 | 0.1420 | 0.6160 | 4.7190 | 98.4910 | 3.46 | 0.27 |
| 16 | 1 | 3 | 1.4484 | 0.0187 | 15.6530 | 0.0209 | 0.0330 | 6.3246 | 1.9034 | 1.0522 | 0.0200 | 0.0100 | 0.1500 | 0.1510 | 0.5550 | 0.7590 | 96.7850 | 3.53 | 0.25 |
| 16 | 2 | 1 | 0.0500 | 0.1656 | 44.4601 | 0.0054 | 0.0100 | 2.0339 | 1.9415 | 0.0041 | 0.0200 | 0.0231 | 0.0080 | 0.7700 | 0.7260 | 8.0160 | 127.7980 | 7.37 | 0.3 |
| 16 | 2 | 2 | 0.0500 | 0.0119 | 31.6576 | 0.0065 | 0.0100 | 0.8000 | 1.3654 | 0.0020 | 0.0200 | 0.0100 | 0.0080 | 0.6950 | 0.6470 | 2.5570 | 91.0000 | 7.6 | 0.22 |
| 16 | 2 | 3 | 0.0500 | 0.0134 | 40.5127 | 0.0040 | 0.0100 | 1.6949 | 1.7175 | 0.0020 | 0.0200 | 0.0427 | 0.0080 | 0.2610 | 0.7790 | 1.3030 | 111.9770 | 7.44 | 0.26 |
| 16 | 3 | 1 | 0.0500 | 0.0815 | 50.2372 | 0.0040 | 0.0100 | 1.3889 | 2.3093 | 0.0020 | 0.0200 | 0.0524 | 0.0080 | 0.2910 | 0.7380 | 19.0640 | 140.5320 | 6.8 | 0.29 |
| 16 | 3 | 2 | 0.0500 | 0.0869 | 47.2369 | 0.0068 | 0.0100 | 2.0286 | 2.1224 | 0.0027 | 0.0200 | 0.0600 | 0.0080 | 0.5130 | 0.7890 | 3.2630 | 119.1530 | 7.57 | 0.25 |
| 16 | 3 | 3 | 0.0500 | 0.0888 | 40.8986 | 0.0110 | 0.0100 | 1.9093 | 1.7974 | 0.0033 | 0.0200 | 0.0538 | 0.0080 | 0.3370 | 0.8140 | 0.9730 | 100.3840 | 7.63 | 0.25 |
| 16 | 4 | 1 | 0.0500 | 0.1104 | 43.4145 | 0.0057 | 0.0100 | 2.1469 | 1.8596 | 0.0020 | 0.0200 | 0.0591 | 0.0080 | 0.3110 | 0.7500 | 1.0050 | 115.8930 | 7.7 | 0.26 |
| 16 | 4 | 2 | 0.0500 | 0.1120 | 45.5822 | 0.0046 | 0.0100 | 2.0339 | 2.0083 | 0.0020 | 0.0200 | 0.0689 | 0.0080 | 0.3330 | 0.7180 | 6.2920 | 112.0190 | 7.47 | 0.3 |
| 16 | 4 | 3 | 0.0500 | 0.1093 | 48.5371 | 0.0076 | 0.0100 | 2.1480 | 2.1782 | 0.0023 | 0.0200 | 0.0551 | 0.0080 | 0.4460 | 0.7760 | 2.1280 | 121.4930 | 7.6 | 0.27 |
| 16 | 5 | 1 | 0.0500 | 0.1223 | 38.5957 | 0.0040 | 0.0100 | 1.6949 | 1.8832 | 0.0020 | 0.0200 | 0.0514 | 0.0080 | 0.3320 | 0.7660 | 12.1940 | 100.7460 | 7.01 | 0.24 |
| 16 | 5 | 2 | 0.0500 | 0.1396 | 46.6348 | 0.0046 | 0.0100 | 1.8079 | 2.1052 | 0.0020 | 0.0200 | 0.0708 | 0.0080 | 0.3400 | 0.7470 | 9.6770 | 127.1810 | 7.4 | 0.26 |
| 16 | 5 | 3 | 0.0500 | 0.1289 | 44.7783 | 0.0040 | 0.0100 | 1.6204 | 1.9614 | 0.0020 | 0.0200 | 0.0654 | 0.0080 | 0.3030 | 0.6230 | 6.5600 | 120.2740 | 7.43 | 0.26 |
| 17 | 1 | 1 | 0.9848 | 0.0238 | 12.1666 | 0.0112 | 0.7977 | 5.6629 | 1.4777 | 0.8303 | 0.0200 | 0.0164 | 0.1136 | 0.4070 | 0.8790 | 2.5990 | 78.3560 | 3.53 | 0.24 |
| 17 | 1 | 2 | 1.1995 | 0.0277 | 13.3120 | 0.0335 | 0.6474 | 5.4630 | 1.7228 | 0.9376 | 0.0200 | 0.0100 | 0.1394 | 0.2920 | 1.0860 | 1.7540 | 95.2640 | 3.56 | 0.24 |
| 17 | 1 | 3 | 0.9829 | 0.0246 | 11.7640 | 0.0303 | 0.0400 | 6.8707 | 1.4763 | 0.7774 | 0.0200 | 0.0100 | 0.1150 | 0.5300 | 0.9060 | 3.9130 | 83.5690 | 3.49 | 0.24 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 2 | 1 | 0.0500 | 0.0148 | 46.2105 | 0.0056 | 0.0100 | 2.3129 | 1.8959 | 0.0020 | 0.0200 | 0.0127 | 0.0080 | 0.7340 | 1.0740 | 2.9710 | 103.0250 | 7.49 | 0.24 |
| 17 | 2 | 2 | 0.0500 | 0.0131 | 33.7126 | 0.0040 | 0.0100 | 1.7322 | 1.4410 | 0.0020 | 0.0200 | 0.0379 | 0.0080 | 1.0430 | 1.2690 | 6.9980 | 75.9620 | 7.23 | 0.21 |
| 17 | 2 | 3 | 0.0500 | 0.0173 | 39.1796 | 0.0059 | 0.0100 | 2.5850 | 1.6063 | 0.0020 | 0.0200 | 0.0765 | 0.0080 | 0.7190 | 1.1200 | 1.2450 | 88.0300 | 7.42 | 0.22 |
| 17 | 3 | 1 | 0.0500 | 0.0748 | 41.9736 | 0.0162 | 0.0100 | 2.6531 | 1.9434 | 0.0095 | 0.0200 | 0.0761 | 0.0080 | 0.9230 | 1.1950 | 4.3210 | 104.7990 | 7.08 | 0.24 |
| 17 | 3 | 2 | 0.0500 | 0.0830 | 37.4514 | 0.0079 | 0.0100 | 2.7211 | 1.6877 | 0.0020 | 0.0200 | 0.0645 | 0.0080 | 0.7490 | 1.1180 | 9.9100 | 90.9350 | 7.11 | 0.22 |
| 17 | 3 | 3 | 0.0500 | 0.0854 | 41.7093 | 0.0071 | 0.0100 | 2.5850 | 1.7870 | 0.0020 | 0.0200 | 0.0808 | 0.0080 | 0.3810 | 1.1710 | 1.6590 | 84.9140 | 7.6 | 0.22 |
| 17 | 4 | 1 | 0.0500 | 0.1241 | 44.1145 | 0.0103 | 0.0100 | 2.4490 | 1.8851 | 0.0074 | 0.0200 | 0.0806 | 0.0080 | 0.3000 | 1.0360 | 1.6440 | 95.9630 | 7.63 | 0.24 |
| 17 | 4 | 2 | 0.0500 | 0.1002 | 42.8984 | 0.0091 | 0.0100 | 2.6531 | 1.8915 | 0.0106 | 0.0200 | 0.1023 | 0.0080 | 0.7770 | 1.1040 | 2.4450 | 102.1060 | 7.56 | 0.25 |
| 17 | 4 | 3 | 0.0500 | 0.0978 | 39.8790 | 0.0068 | 0.0100 | 2.3810 | 1.7422 | 0.0020 | 0.0200 | 0.0646 | 0.0080 | 0.9440 | 1.2450 | 3.1500 | 92.9390 | 7.4 | 0.22 |
| 17 | 5 | 1 | 0.0500 | 0.1199 | 35.5965 | 0.0071 | 0.0100 | 2.1088 | 1.6537 | 0.0020 | 0.0200 | 0.1424 | 0.0080 | 0.8820 | 1.2040 | 4.9660 | 81.5560 | 7.23 | 0.2 |
| 17 | 5 | 2 | 0.0500 | 0.1331 | 38.5995 | 0.0076 | 0.0100 | 2.4490 | 1.7044 | 0.0020 | 0.0200 | 0.1251 | 0.0080 | 0.8500 | 1.1970 | 6.4660 | 93.6720 | 7.27 | 0.22 |
| 17 | 5 | 3 | 0.0500 | 0.1208 | 40.4555 | 0.0082 | 0.0100 | 2.3129 | 1.6928 | 0.0020 | 0.0200 | 0.0548 | 0.0080 | 1.1240 | 1.3200 | 6.0770 | 94.1950 | 7.3 | 0.23 |
| 18 | 1 | 1 | 1.2704 | 0.0222 | 13.9253 | 0.0229 | 0.6504 | 6.8707 | 1.6794 | 0.9552 | 0.0200 | 0.0347 | 0.1425 | 0.5140 | 1.0030 | 1.4490 | 87.8500 | 3.61 | 0.24 |
| 18 | 1 | 2 | 1.0901 | 0.0181 | 11.7871 | 0.0244 | 0.6343 | 6.1224 | 1.5288 | 0.8114 | 0.0200 | 0.0100 | 0.1281 | 0.6490 | 0.9140 | 3.9600 | 79.9720 | 3.52 | 0.26 |
| 18 | 1 | 3 | 1.0161 | 0.0177 | 10.7718 | 0.0089 | 0.0772 | 5.7295 | 1.3524 | 0.7040 | 0.0200 | 0.0100 | 0.0964 | 0.1450 | 0.8130 | 2.6430 | 79.5870 | 3.52 | 0.24 |
| 18 | 2 | 1 | 0.0500 | 0.0164 | 42.2807 | 0.0074 | 0.0100 | 2.7211 | 1.7845 | 0.0025 | 0.0200 | 0.0937 | 0.0080 | 0.2740 | 0.8590 | 4.6430 | 88.1200 | 7.53 | 0.25 |
| 18 | 2 | 2 | 0.0500 | 0.0123 | 34.5115 | 0.0040 | 0.0100 | 1.7322 | 1.4578 | 0.0020 | 0.0200 | 0.0974 | 0.0080 | 0.2930 | 1.0840 | 2.5960 | 68.7330 | 7.45 | 0.21 |
| 18 | 2 | 3 | 0.0500 | 0.0177 | 33.8032 | 0.0040 | 0.0100 | 1.6656 | 1.4048 | 0.0020 | 0.0200 | 0.0786 | 0.0080 | 0.7510 | 1.2460 | 1.2600 | 72.6100 | 7.06 | 0.21 |
| 18 | 3 | 1 | 0.0500 | 0.0748 | 36.3066 | 0.0079 | 0.0100 | 2.7211 | 1.6839 | 0.0020 | 0.0200 | 0.1056 | 0.0080 | 0.5360 | 1.1480 | 5.5000 | 85.4160 | 7 | 0.23 |
| 18 | 3 | 2 | 0.0500 | 0.0668 | 28.2132 | 0.0040 | 0.0100 | 2.0653 | 1.3091 | 0.0020 | 0.0200 | 0.0853 | 0.0080 | 0.5640 | 1.0990 | 1.5420 | 72.0050 | 7.51 | 0.19 |
| 18 | 3 | 3 | 0.0500 | 0.0904 | 38.7081 | 0.0085 | 0.0100 | 2.4490 | 1.6678 | 0.0020 | 0.0200 | 0.0991 | 0.0080 | 0.6880 | 1.1770 | 1.3590 | 76.4580 | 7.62 | 0.22 |
| 18 | 4 | 1 | 0.0500 | 0.1208 | 37.0110 | 0.0106 | 0.0100 | 2.5170 | 1.6018 | 0.0020 | 0.0200 | 0.0904 | 0.0080 | 0.7610 | 1.2680 | 1.4420 | 81.1690 | 7.5 | 0.22 |
| 18 | 4 | 2 | 0.0500 | 0.1084 | 43.3059 | 0.0103 | 0.0100 | 2.5170 | 1.9017 | 0.0113 | 0.0200 | 0.1758 | 0.0080 | 0.3200 | 1.0160 | 1.5410 | 87.0570 | 7.8 | 0.24 |
| 18 | 4 | 3 | 0.0500 | 0.1084 | 32.0598 | 0.0094 | 0.0100 | 2.5170 | 1.4481 | 0.0062 | 0.0200 | 0.1391 | 0.0080 | 0.3620 | 1.0100 | 9.1080 | 80.9510 | 6.91 | 0.2 |
| 18 | 5 | 1 | 0.0500 | 0.1175 | 30.4010 | 0.0040 | 0.0100 | 1.3991 | 1.4687 | 0.0020 | 0.0200 | 0.1490 | 0.0080 | 0.6300 | 1.2190 | 6.7740 | 74.5910 | 7.18 | 0.2 |
| 18 | 5 | 2 | 0.0500 | 0.1249 | 32.9325 | 0.0203 | 0.0100 | 2.6531 | 1.4993 | 0.0143 | 0.0200 | 0.1721 | 0.0102 | 0.4570 | 1.1480 | 2.3640 | 71.7060 | 7.47 | 0.2 |
| 18 | 5 | 3 | 0.0500 | 0.1183 | 36.3845 | 0.0040 | 0.0100 | 1.8654 | 1.5951 | 0.0020 | 0.0200 | 0.1042 | 0.0080 | 0.4570 | 1.1920 | 3.5680 | 80.3090 | 7.47 | 0.23 |

| 18 week weathering cycle: plotted data: averaged by triplicate and replicate | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| week | trt | Rep | Al | B | Ca | Cu | Fe | K | Mg | Mn | Ni | P | Zn | flouride | chloride | nitrate | sulfate | pH | EC |
| 1 | 1 | 1 | 201.4808 | 0.01 | 446.777 | 0.8161 | 37.6429 | 0.32 | 177.5968 | 66.082 | 3.021 | 0.0105 | 8.5596 | 11.9013 | 0.5317 | 3.6267 | 4783.0393 | 2.8967 | 3.96 |
| 1 | 2 | 1 | 1.5063 | 0.0605 | 899.0221 | 0.0623 | 1.4357 | 1.8312 | 114.5612 | 25.267 | 0.6697 | 0.2676 | 1.1535 | 10.425 | 248.0983 | 3.627 | 2949.7827 | 6.3567 | 3.6833 |
| 1 | 3 | 1 | 2.0847 | 0.1468 | 875.8111 | 0.0491 | 2.1472 | 2.2696 | 118.9196 | 27.8245 | 0.7862 | 0.2372 | 1.6063 | 12.3457 | 229.3153 | 3.027 | 2911.311 | 6.04 | 3.5933 |
| 1 | 4 | 1 | 1.6403 | 0.1805 | 846.2354 | 0.0542 | 1.0507 | 2.2061 | 115.3435 | 26.2347 | 0.7317 | 0.2484 | 1.3299 | 9.9953 | 237.831 | 3.074 | 2788.3297 | 6.1967 | 3.6267 |
| 1 | 5 | 1 | 6.24 | 0.2288 | 873.1074 | 0.0514 | 2.5283 | 2.3424 | 143.1074 | 27.0971 | 0.8613 | 0.27 | 1.7849 | 10.742 | 234.0607 | 4.4503 | 2987.522 | 5.9233 | 3.6167 |
| 2 | 1 | 1 | 91.6935 | 0.012 | 338.7295 | 0.4033 | 15.0368 | 0.8 | 80.3974 | 33.1857 | 1.3359 | 0.0495 | 4.1136 | 2.9627 | 1.9797 | 2.529 | 2616.238 | 2.9767 | 2.6267 |
| 2 | 2 | 1 | 0.0662 | 0.0375 | 675.0182 | 0.011 | 0.0789 | 0.8242 | 40.0304 | 1.4863 | 0.02 | 0.1815 | 0.008 | 2.6123 | 135.3863 | 3.34 | 2254.366 | 7.2133 | 2.6567 |
| 2 | 3 | 1 | 0.0601 | 0.1368 | 686.5126 | 0.0131 | 0.0154 | 1.0647 | 43.4899 | 2.1023 | 0.02 | 0.1747 | 0.0086 | 2.7027 | 142.998 | 3.4177 | 2291.5387 | 7.1933 | 2.71 |
| 2 | 4 | 1 | 0.05 | 0.1616 | 663.8329 | 0.017 | 0.01 | 0.9938 | 41.7313 | 1.5534 | 0.02 | 0.1773 | 0.008 | 2.613 | 143.392 | 2.9727 | 2191.7977 | 7.1867 | 2.3567 |
| 2 | 5 | 1 | 0.05 | 0.198 | 648.6414 | 0.019 | 0.01 | 1.0223 | 41.9846 | 1.7746 | 0.02 | 0.1508 | 0.008 | 2.6555 | 128.771 | 2.1275 | 2178.3605 | 7.27 | 2.68 |
| 3 | 1 | 1 | 49.5975 | 0.0139 | 257.9392 | 0.3133 | 8.7044 | 1.9496 | 46.5834 | 20.1535 | 0.7533 | 0.0371 | 2.4303 | 0.597 | 1.706 | 2.0027 | 1822.2263 | 3.1 | 1.9667 |
| 3 | 2 | 1 | 0.0588 | 0.0293 | 611.865 | 0.0116 | 0.0118 | 1.075 | 34.8184 | 0.4174 | 0.02 | 0.1643 | 0.0086 | 2.3477 | 57.0987 | 1.8607 | 2112.269 | 7.11 | 2.51 |
| 3 | 3 | 1 | 0.0613 | 0.0948 | 630.9321 | 0.0133 | 0.0219 | 1.2516 | 37.6439 | 0.584 | 0.02 | 0.1652 | 0.008 | 2.492 | 57.9617 | 3.0257 | 2271.2973 | 7.3167 | 2.5033 |
| 3 | 4 | 1 | 0.0706 | 0.1196 | 636.9028 | 0.0136 | 0.025 | 1.2908 | 38.2774 | 0.5457 | 0.02 | 0.2034 | 0.008 | 2.5257 | 60.7793 | 2.1463 | 2222.583 | 7.3367 | 2.4833 |
| 3 | 5 | 1 | 0.0872 | 0.1535 | 629.7503 | 0.0201 | 0.166 | 1.6689 | 39.7227 | 0.5988 | 0.02 | 0.2081 | 0.008 | 2.4477 | 58.9653 | 1.8833 | 2185.5167 | 7.2767 | 2.55 |
| 4 | 1 | 1 | 27.9033 | 0.0129 | 183.1986 | 0.206 | 5.4215 | 2.8521 | 27.2718 | 12.4134 | 0.439 | 0.0218 | 1.4759 | 0.14 | 1.2387 | 1.6717 | 1119.0023 | 3.14 | 1.49 |
| 4 | 2 | 1 | 0.11 | 0.0279 | 597.7591 | 0.0068 | 0.0476 | 1.4592 | 31.5921 | 0.257 | 0.02 | 0.1466 | 0.008 | 2.2983 | 24.5687 | 1.7437 | 2103.263 | 7.2233 | 2.3967 |
| 4 | 3 | 1 | 0.0666 | 0.096 | 587.8456 | 0.0145 | 0.0263 | 1.5679 | 32.0647 | 0.3616 | 0.02 | 0.1466 | 0.008 | 2.3097 | 23.898 | 2.215 | 2083.5213 | 7.2833 | 2.38 |
| 4 | 4 | 1 | 0.0623 | 0.1214 | 603.3974 | 0.0135 | 0.0242 | 1.8044 | 32.0044 | 0.2847 | 0.02 | 0.1335 | 0.008 | 2.317 | 26.9303 | 1.7697 | 2106.9423 | 7.2733 | 2.4 |
| 4 | 5 | 1 | 0.0929 | 0.1498 | 600.8111 | 0.0185 | 0.0342 | 2.0663 | 32.8115 | 0.3551 | 0.02 | 0.142 | 0.0085 | 2.4057 | 25.6533 | 2.1583 | 2145.368 | 7.2333 | 2.37 |
| 5 | 1 | 1 | 14.997 | 0.0188 | 124.4742 | 0.1395 | 3.7844 | 3.4365 | 16.3898 | 7.933 | 0.2469 | 0.0267 | 0.9274 | 0.7407 | 1.0997 | 1.3453 | 746.5253 | 3.2133 | 1.1133 |
| 5 | 2 | 1 | 0.05 | 0.0237 | 533.92 | 0.0106 | 0.01 | 1.6098 | 25.0318 | 0.1741 | 0.02 | 0.0659 | 0.008 | 2.1207 | 9.6437 | 1.751 | 1888.5633 | 7.16 | 2.1467 |
| 5 | 3 | 1 | 0.05 | 0.0958 | 551.5365 | 0.0109 | 0.01 | 1.8919 | 26.1627 | 0.2259 | 0.02 | 0.0793 | 0.008 | 2.1063 | 11.5913 | 1.6527 | 1955.6387 | 7.3567 | 2.1933 |
| 5 | 4 | 1 | 0.05 | 0.1263 | 567.3271 | 0.0146 | 0.01 | 2.7319 | 26.2649 | 0.1206 | 0.02 | 0.1196 | 0.008 | 2.0537 | 12.154 | 1.379 | 1913.4507 | 7.31 | 2.1833 |
| 5 | 5 | 1 | 0.05 | 0.1445 | 535.9766 | 0.0116 | 0.01 | 2.2917 | 26.6793 | 0.1973 | 0.02 | 0.1048 | 0.008 | 2.0997 | 12.5963 | 1.5987 | 1920.3153 | 7.2433 | 2.19 |
| 6 | 1 | 1 | 9.9596 | 0.0203 | 87.7067 | 0.1045 | 3.0783 | 4.3835 | 11.2606 | 5.5831 | 0.1117 | 0.0131 | 0.6608 | 0.5953 | 0.8743 | 1.4783 | 526.484 | 3.2333 | 0.85 |
| 6 | 2 | 1 | 0.05 | 0.0247 | 476.8769 | 0.0097 | 0.01 | 2.5256 | 19.9141 | 0.1071 | 0.02 | 0.0558 | 0.008 | 1.9997 | 4.1013 | 1.6667 | 1721.0103 | 7.3233 | 1.8733 |
| 6 | 3 | 1 | 0.05 | 0.0881 | 485.3629 | 0.0061 | 0.01 | 2.6245 | 21.0211 | 0.152 | 0.02 | 0.082 | 0.008 | 1.958 | 4.3843 | 1.323 | 1705.377 | 7.31 | 1.8633 |
| 6 | 4 | 1 | 0.05 | 0.1269 | 484.0441 | 0.0151 | 0.01 | 2.524 | 21.5374 | 0.117 | 0.02 | 0.0816 | 0.008 | 1.9757 | 4.9583 | 1.4947 | 1773.727 | 7.3133 | 1.9267 |
| 6 | 5 | 1 | 0.05 | 0.1472 | 479.1138 | 0.0064 | 0.01 | 2.0776 | 21.8851 | 0.1409 | 0.02 | 0.0956 | 0.008 | 1.6203 | 5.168 | 1.663 | 1836.7587 | 7.26 | 1.91 |
| 7 | 1 | 1 | 6.4055 | 0.0179 | 65.0604 | 0.0769 | 2.2865 | 4.6385 | 7.8767 | 4.0634 | 0.0743 | 0.0276 | 0.4828 | 0.6677 | 0.806 | 1.3593 | 343.6267 | 3.2933 | 0.6967 |
| 7 | 2 | 1 | 0.05 | 0.0209 | 388.5234 | 0.0068 | 0.01 | 2.4152 | 15.4232 | 0.0796 | 0.02 | 0.0568 | 0.008 | 1.513 | 2.4267 | 1.269 | 1191.9 | 7.2133 | 1.5367 |
| 7 | 3 | 1 | 0.05 | 0.0938 | 375.1389 | 0.01 | 0.0113 | 2.2945 | 16.1576 | 0.1083 | 0.02 | 0.0677 | 0.008 | 1.7443 | 2.798 | 1.4407 | 1215.7 | 7.2867 | 1.56 |
| 7 | 4 | 1 | 0.06 | 0.1253 | 400.2886 | 0.0056 | 0.01 | 2.3978 | 16.5299 | 0.0752 | 0.02 | 0.0811 | 0.008 | 1.7713 | 2.9867 | 1.322 | 1284.8 | 7.3433 | 1.5867 |
| 7 | 5 | 1 | 0.05 | 0.154 | 413.0358 | 0.0057 | 0.01 | 2.9282 | 16.8541 | 0.1059 | 0.02 | 0.1396 | 0.008 | 1.4847 | 3.002 | 1.5457 | 1303.0667 | 7.2667 | 1.5833 |
| 8 | 1 | 1 | 4.5759 | 0.0232 | 48.9227 | 0.0739 | 1.9319 | 5.4151 | 5.7895 | 3.0935 | 0.02 | 0.0273 | 0.3739 | 0.5683 | 0.7393 | 1.1627 | 261.9 | 3.34 | 0.5667 |
| 8 | 2 | 1 | 0.0572 | 0.0203 | 289.2966 | 0.0064 | 0.0198 | 2.5507 | 11.6242 | 0.0537 | 0.02 | 0.1082 | 0.008 | 1.0987 | 1.4987 | 1.1253 | 909.8167 | 7.2667 | 1.2533 |
| 8 | 3 | 1 | 0.062 | 0.0878 | 291.5109 | 0.0075 | 0.0332 | 2.8144 | 12.024 | 0.0755 | 0.02 | 0.0765 | 0.008 | 1.4127 | 1.756 | 1.0073 | 912.4833 | 7.2667 | 1.23 |
| 8 | 4 | 1 | 0.05 | 0.1218 | 293.339 | 0.0089 | 0.0208 | 2.5483 | 12.1706 | 0.0528 | 0.02 | 0.0909 | 0.008 | 1.1377 | 1.8937 | 1.4803 | 939.44 | 7.29 | 1.2733 |
| 8 | 5 | 1 | 0.0663 | 0.1387 | 298.533 | 0.004 | 0.0349 | 2.5602 | 12.2118 | 0.0649 | 0.02 | 0.0557 | 0.008 | 1.2513 | 1.8033 | 1.185 | 933.79 | 7.2967 | 1.2533 |
| 9 | 1 | 1 | 3.4142 | 0.0144 | 37.3762 | 0.061 | 1.7111 | 5.4255 | 4.8657 | 2.4689 | 0.02 | 0.0821 | 0.3055 | 0.5613 | 0.7073 | 1.33 | 229.559 | 3.3333 | 0.5167 |
| 9 | 2 | 1 | 0.05 | 0.0153 | 213.6264 | 0.0096 | 0.01 | 2.4105 | 8.7916 | 0.0349 | 0.02 | 0.0569 | 0.008 | 0.8443 | 1.3347 | 1.4147 | 779.9287 | 7.4033 | 1.0267 |
| 9 | 3 | 1 | 0.05 | 0.0957 | 213.3667 | 0.0109 | 0.01 | 2.3759 | 9.3771 | 0.0483 | 0.02 | 0.1171 | 0.008 | 1.0173 | 1.5417 | 1.7023 | 770.761 | 7.3667 | 1.0433 |
| 9 | 4 | 1 | 0.05 | 0.1394 | 234.0768 | 0.0113 | 0.01 | 2.305 | 10.0698 | 0.0374 | 0.02 | 0.1146 | 0.008 | 1.0373 | 1.6797 | 1.5517 | 831.64 | 7.4267 | 1.1033 |
| 9 | 5 | 1 | 0.05 | 0.1642 | 226.8591 | 0.0099 | 0.01 | 2.305 | 9.8661 | 0.0467 | 0.02 | 0.1253 | 0.0107 | 0.9783 | 1.62 | 1.609 | 831.836 | 7.38 | 1.0733 |
| 10 | 1 | 1 | 2.697 | 0.0117 | 31.3326 | 0.0465 | 1.1739 | 5.4255 | 3.9633 | 2.0534 | 0.02 | 0.0438 | 0.2099 | 0.5823 | 0.6807 | 1.3897 | 203.5607 | 3.3967 | 0.4333 |
| 10 | 2 | 1 | 0.05 | 0.0135 | 162.9623 | 0.009 | 0.01 | 1.844 | 6.6061 | 0.0253 | 0.02 | 0.1045 | 0.008 | 0.5713 | 1.0357 | 1.505 | 573.4877 | 7.39 | 0.7933 |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 3 | 1 | 0.05 | 0.0842 | 164.2818 | 0.0158 | 0.01 | 2.4113 | 7.175 | 0.0364 | 0.02 | 0.1001 | 0.0336 | 0.7157 | 1.3433 | 1.5147 | 581.729 | 7.4033 | 0.8 |
| 10 | 4 | 1 | 0.05 | 0.12 | 174.5818 | 0.0104 | 0.01 | 2.0922 | 7.5306 | 0.0236 | 0.02 | 0.1123 | 0.008 | 0.7483 | 1.286 | 1.3507 | 620.4917 | 7.44 | 0.8367 |
| 10 | 5 | 1 | 0.05 | 0.1365 | 165.638 | 0.0107 | 0.01 | 2.1127 | 7.1063 | 0.0303 | 0.02 | 0.0825 | 0.008 | 0.5963 | 1.2427 | 1.548 | 602.7867 | 7.3767 | 0.8067 |
| 11 | 1 | 1 | 2.3751 | 0.0164 | 27.8851 | 0.0446 | 1.0033 | 5.7881 | 3.5319 | 1.8456 | 0.02 | 0.0353 | 0.2367 | 0.5263 | 0.6433 | 1.5997 | 169.9787 | 3.4033 | 0.4167 |
| 11 | 2 | 1 | 0.05 | 0.0122 | 121.1315 | 0.0086 | 0.0114 | 1.8085 | 4.9406 | 0.0165 | 0.02 | 0.0922 | 0.008 | 0.4 | 0.948 | 1.3673 | 412.1333 | 7.4267 | 0.6267 |
| 11 | 3 | 1 | 0.05 | 0.0842 | 131.6788 | 0.0086 | 0.01 | 2.1459 | 5.5735 | 0.024 | 0.02 | 0.0972 | 0.008 | 0.5007 | 1.0713 | 1.3933 | 449.551 | 7.4267 | 0.6867 |
| 11 | 4 | 1 | 0.05 | 0.1153 | 137.226 | 0.021 | 0.0105 | 2.5177 | 5.908 | 0.0278 | 0.02 | 0.12 | 0.0081 | 0.4567 | 1.0787 | 1.424 | 475.7797 | 7.5033 | 0.7133 |
| 11 | 5 | 1 | 0.05 | 0.1363 | 129.8503 | 0.0133 | 0.0206 | 2.3276 | 5.5521 | 0.0266 | 0.02 | 0.1084 | 0.008 | 0.4393 | 1.0927 | 1.9253 | 455.515 | 7.42 | 0.6733 |
| 12 | 1 | 1 | 2.0794 | 0.014 | 24.0062 | 0.0382 | 0.9081 | 6.1347 | 3.051 | 1.594 | 0.02 | 0.0742 | 0.2369 | 0.4923 | 0.6423 | 2.038 | 162.3247 | 3.4267 | 0.3667 |
| 12 | 2 | 1 | 0.05 | 0.0127 | 96.5143 | 0.0119 | 0.0125 | 2.0213 | 4.0038 | 0.0157 | 0.02 | 0.0883 | 0.008 | 0.3983 | 0.904 | 4.069 | 321.6113 | 7.2433 | 0.5033 |
| 12 | 3 | 1 | 0.0517 | 0.079 | 100.677 | 0.013 | 0.0149 | 2.1631 | 4.4332 | 0.0214 | 0.02 | 0.1231 | 0.008 | 0.366 | 0.9607 | 2.7143 | 347.856 | 7.3467 | 0.54 |
| 12 | 4 | 1 | 0.05 | 0.1161 | 104.5941 | 0.011 | 0.0148 | 1.4606 | 4.5468 | 0.0142 | 0.02 | 0.1369 | 0.008 | 0.407 | 0.9863 | 2.805 | 357.584 | 7.3367 | 0.56 |
| 12 | 5 | 1 | 0.05 | 0.1404 | 103.0352 | 0.0134 | 0.013 | 2.0567 | 4.5793 | 0.0195 | 0.02 | 0.1395 | 0.008 | 0.4473 | 0.9763 | 3.2037 | 347.3843 | 7.26 | 0.5467 |
| 13 | 1 | 1 | 2.0176 | 0.0237 | 21.9183 | 0.0313 | 0.6392 | 5.756 | 2.6796 | 1.4537 | 0.02 | 0.01 | 0.1976 | 0.1873 | 0.6667 | 6.8794 | 136.7643 | 3.4 | 0.38 |
| 13 | 2 | 1 | 0.05 | 0.0146 | 73.7129 | 0.0049 | 0.01 | 1.8734 | 2.9685 | 0.002 | 0.02 | 0.0354 | 0.008 | 0.2713 | 0.8943 | 3.716 | 220.3807 | 7.3533 | 0.4233 |
| 13 | 3 | 1 | 0.05 | 0.0815 | 81.4886 | 0.0066 | 0.01 | 1.7358 | 3.4399 | 0.0055 | 0.02 | 0.025 | 0.008 | 0.316 | 0.987 | 6.3977 | 237.2697 | 7.2833 | 0.4633 |
| 13 | 4 | 1 | 0.05 | 0.0993 | 81.0909 | 0.0045 | 0.01 | 1.7591 | 3.4033 | 0.0025 | 0.02 | 0.0399 | 0.008 | 0.3293 | 0.9923 | 10.3913 | 249.6 | 7.0633 | 0.4767 |
| 13 | 5 | 1 | 0.05 | 0.1325 | 81.3848 | 0.0054 | 0.01 | 2.1239 | 3.4875 | 0.0078 | 0.02 | 0.0503 | 0.008 | 0.331 | 0.9807 | 10.747 | 240.8133 | 7.0367 | 0.4633 |
| 14 | 1 | 1 | 1.573 | 0.0195 | 17.952 | 0.0275 | 0.7129 | 5.7793 | 2.1853 | 1.1962 | 0.02 | 0.01 | 0.1622 | 0.159 | 0.5467 | 12.316 | 117.5 | 3.2967 | 0.3733 |
| 14 | 2 | 1 | 0.05 | 0.0902 | 57.9759 | 0.0087 | 0.01 | 1.2887 | 2.3512 | 0.0082 | 0.02 | 0.0289 | 0.0094 | 0.3057 | 0.7557 | 20.3917 | 165.945 | 6.3067 | 0.3567 |
| 14 | 3 | 1 | 0.05 | 0.0925 | 69.1331 | 0.048 | 0.01 | 1.7762 | 3.0205 | 0.0073 | 0.02 | 0.0586 | 0.008 | 0.3147 | 0.9073 | 14.167 | 196.595 | 6.6967 | 0.41 |
| 14 | 4 | 1 | 0.06 | 0.1183 | 71.59 | 0.0061 | 0.01 | 1.7774 | 3.0124 | 0.0025 | 0.02 | 0.044 | 0.008 | 0.33 | 0.6241 | 4.486 | 202.2823 | 7.3667 | 0.3867 |
| 14 | 5 | 1 | 0.05 | 0.1528 | 67.0247 | 0.0394 | 0.01 | 1.9089 | 2.9343 | 0.0112 | 0.02 | 0.0502 | 0.0088 | 0.3303 | 0.9557 | 11.3853 | 182.7157 | 7.0267 | 0.3833 |
| 15 | 1 | 1 | 1.3361 | 0.0183 | 15.5432 | 0.0271 | 0.5426 | 5.444 | 1.9084 | 1.0517 | 0.02 | 0.01 | 0.1475 | 0.225 | 0.592 | 20.9623 | 107.0783 | 3.3033 | 0.3133 |
| 15 | 2 | 1 | 0.05 | 0.0119 | 47.3538 | 0.004 | 0.01 | 1.4101 | 1.9675 | 0.0022 | 0.02 | 0.0164 | 0.008 | 0.5443 | 0.7507 | 10.204 | 137.4223 | 6.8 | 0.29 |
| 15 | 3 | 1 | 0.05 | 0.0874 | 53.8767 | 0.0075 | 0.01 | 1.6986 | 2.3662 | 0.0069 | 0.02 | 0.0387 | 0.008 | 0.304 | 0.8733 | 10.7597 | 147.5837 | 7.09 | 0.3167 |
| 15 | 4 | 1 | 0.05 | 0.106 | 52.7013 | 0.004 | 0.0118 | 1.3285 | 2.2701 | 0.0049 | 0.02 | 0.0694 | 0.008 | 0.3287 | 0.836 | 25.2103 | 151.9283 | 6.0467 | 0.35 |
| 15 | 5 | 1 | 0.05 | 0.1333 | 48.7741 | 0.0054 | 0.0107 | 1.6194 | 2.2005 | 0.0071 | 0.02 | 0.0674 | 0.008 | 0.5083 | 0.8177 | 21.613 | 138.9437 | 5.6533 | 0.3033 |
| 16 | 1 | 1 | 1.2234 | 0.0165 | 14.1262 | 0.0215 | 0.5146 | 5.773 | 1.7247 | 0.9548 | 0.02 | 0.0136 | 0.1352 | 0.1313 | 0.585 | 3.4467 | 94.6467 | 3.4867 | 0.27 |
| 16 | 2 | 1 | 0.05 | 0.0636 | 38.8768 | 0.0053 | 0.01 | 1.5096 | 1.6748 | 0.0027 | 0.02 | 0.0253 | 0.008 | 0.5753 | 0.7173 | 3.9587 | 110.2583 | 7.47 | 0.26 |
| 16 | 3 | 1 | 0.05 | 0.0857 | 46.1242 | 0.0073 | 0.01 | 1.7756 | 2.0763 | 0.0027 | 0.02 | 0.0554 | 0.008 | 0.3803 | 0.7803 | 7.7667 | 120.023 | 7.3333 | 0.2633 |
| 16 | 4 | 1 | 0.05 | 0.1106 | 45.8446 | 0.006 | 0.01 | 2.1096 | 2.0154 | 0.0021 | 0.02 | 0.061 | 0.008 | 0.3633 | 0.748 | 3.1417 | 116.4683 | 7.59 | 0.2767 |
| 16 | 5 | 1 | 0.05 | 0.1303 | 43.3362 | 0.0042 | 0.01 | 1.7077 | 1.9832 | 0.002 | 0.02 | 0.0625 | 0.008 | 0.325 | 0.712 | 9.477 | 116.067 | 7.28 | 0.2533 |
| 17 | 1 | 1 | 1.0557 | 0.0254 | 12.4142 | 0.025 | 0.495 | 5.9989 | 1.5589 | 0.8484 | 0.02 | 0.0121 | 0.1227 | 0.4097 | 0.957 | 2.7553 | 85.7297 | 3.5267 | 0.24 |
| 17 | 2 | 1 | 0.05 | 0.015 | 39.7009 | 0.0052 | 0.01 | 2.21 | 1.6477 | 0.002 | 0.02 | 0.0424 | 0.008 | 0.832 | 1.1543 | 3.738 | 89.0057 | 7.38 | 0.2233 |
| 17 | 3 | 1 | 0.05 | 0.0811 | 40.3781 | 0.0104 | 0.01 | 2.6531 | 1.806 | 0.0045 | 0.02 | 0.0738 | 0.008 | 0.6843 | 1.1613 | 5.2967 | 93.5493 | 7.2633 | 0.2267 |
| 17 | 4 | 1 | 0.05 | 0.1073 | 42.2973 | 0.0087 | 0.01 | 2.4943 | 1.8396 | 0.0067 | 0.02 | 0.0825 | 0.008 | 0.6737 | 1.1283 | 2.413 | 97.0027 | 7.53 | 0.2367 |
| 17 | 5 | 1 | 0.05 | 0.1246 | 38.2172 | 0.0076 | 0.01 | 2.2902 | 1.6836 | 0.002 | 0.02 | 0.1074 | 0.008 | 0.952 | 1.2403 | 5.8363 | 89.8077 | 7.2667 | 0.2167 |
| 18 | 1 | 1 | 1.1255 | 0.0193 | 12.1614 | 0.0187 | 0.454 | 6.2409 | 1.5202 | 0.8235 | 0.02 | 0.0182 | 0.1224 | 0.436 | 0.91 | 2.684 | 82.4697 | 3.55 | 0.2467 |
| 18 | 2 | 1 | 0.05 | 0.0155 | 36.8651 | 0.0051 | 0.01 | 2.0396 | 1.549 | 0.0022 | 0.02 | 0.0899 | 0.008 | 0.4393 | 1.063 | 2.833 | 76.4877 | 7.3467 | 0.2233 |
| 18 | 3 | 1 | 0.05 | 0.0773 | 34.4093 | 0.0068 | 0.01 | 2.4118 | 1.5536 | 0.002 | 0.02 | 0.0967 | 0.008 | 0.596 | 1.1413 | 2.8003 | 77.9597 | 7.3767 | 0.2133 |
| 18 | 4 | 1 | 0.05 | 0.1125 | 37.4589 | 0.0101 | 0.01 | 2.517 | 1.6505 | 0.0065 | 0.02 | 0.1351 | 0.008 | 0.481 | 1.098 | 4.0303 | 83.059 | 7.4033 | 0.22 |
| 18 | 5 | 1 | 0.05 | 0.1202 | 33.2393 | 0.0094 | 0.01 | 1.9725 | 1.521 | 0.0061 | 0.02 | 0.1418 | 0.0087 | 0.5147 | 1.1863 | 4.2353 | 75.5353 | 7.3733 | 0.21 |

# Appendix D.

# $HNO_3$ and Aqua Regia/HF Analyses

| | 2 week weathering cycle: HNO3 digestion | | | TRT1 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| | | | mg kg-1 | |
| Al | 2 | 9490.21 | 9880.16 | 9828.10 |
| Al | 2 | 10081.03 | | |
| Al | 2 | 10069.24 | | |
| Al | 5 | 10954.57 | 10258.19 | |
| Al | 5 | 9527.25 | | |
| Al | 5 | 10292.75 | | |
| Al | 9 | 9420.63 | 9345.95 | |
| Al | 9 | 10394.99 | | |
| Al | 9 | 8222.23 | | |
| Ca | 2 | 858.66 | 994.05 | 1174.69 |
| Ca | 2 | 1277.21 | | |
| Ca | 2 | 846.27 | | |
| Ca | 5 | 1076.98 | 1184.96 | |
| Ca | 5 | 1090.49 | | |
| Ca | 5 | 1387.42 | | |
| Ca | 9 | 1723.57 | 1345.05 | |
| Ca | 9 | 1055.12 | | |
| Ca | 9 | 1256.47 | | |
| Cd | 2 | 0.41 | 0.62 | 0.70 |
| Cd | 2 | 0.99 | | |
| Cd | 2 | 0.47 | | |
| Cd | 5 | 0.40 | 0.77 | |
| Cd | 5 | 1.33 | | |
| Cd | 5 | 0.59 | | |
| Cd | 9 | 0.56 | 0.69 | |
| Cd | 9 | 1.10 | | |
| Cd | 9 | 0.40 | | |
| Co | 2 | 15.29 | 12.27 | 11.45 |
| Co | 2 | 11.02 | | |
| Co | 2 | 10.49 | | |
| Co | 5 | 10.26 | 11.21 | |
| Co | 5 | 12.26 | | |
| Co | 5 | 11.10 | | |
| Co | 9 | 11.01 | 10.88 | |
| Co | 9 | 11.30 | | |
| Co | 9 | 10.34 | | |
| Cr | 2 | 14.88 | 19.18 | 17.22 |
| Cr | 2 | 25.23 | | |
| Cr | 2 | 17.43 | | |
| Cr | 5 | 19.07 | 17.55 | |
| Cr | 5 | 15.76 | | |
| Cr | 5 | 17.81 | | |
| Cr | 9 | 15.19 | 14.92 | |
| Cr | 9 | 16.32 | | |
| Cr | 9 | 13.23 | | |
| Cu | 2 | 18.52 | 17.73 | 17.89 |
| Cu | 2 | 18.02 | | |
| Cu | 2 | 16.65 | | |
| Cu | 5 | 16.82 | 17.50 | |
| Cu | 5 | 18.96 | | |
| Cu | 5 | 16.74 | | |
| Cu | 9 | 17.99 | 18.44 | |
| Cu | 9 | 19.01 | | |
| Cu | 9 | 18.33 | | |
| Fe | 2 | 44995.29 | 47808.43 | 48807.95 |
| Fe | 2 | 50000.00 | | |
| Fe | 2 | 48429.99 | | |
| Fe | 5 | 50000.00 | 49949.10 | |
| Fe | 5 | 49847.30 | | |
| Fe | 5 | 50000.00 | | |
| Fe | 9 | 49741.95 | 48666.32 | |
| Fe | 9 | 46257.01 | | |
| Fe | 9 | 50000.00 | | |
| K | 2 | 2222.22 | 2119.24 | 2229.34 |
| K | 2 | 2031.43 | | |
| K | 2 | 2104.07 | | |
| K | 5 | 2531.07 | 2394.33 | |
| K | 5 | 2389.49 | | |
| K | 5 | 2262.44 | | |
| K | 9 | 2102.75 | 2174.43 | |
| K | 9 | 2544.80 | | |

| | | | | |
|---|---|---|---|---|
| K | 9 | 1875.75 | | |
| Mg | 2 | 2155.32 | 2117.22 | 2126.71 |
| Mg | 2 | 2092.27 | | |
| Mg | 2 | 2104.06 | | |
| Mg | 5 | 2165.17 | 2176.08 | |
| Mg | 5 | 2222.61 | | |
| Mg | 5 | 2140.46 | | |
| Mg | 9 | 2090.17 | 2086.83 | |
| Mg | 9 | 2217.74 | | |
| Mg | 9 | 1952.58 | | |
| Mn | 2 | 396.43 | 270.37 | 233.86 |
| Mn | 2 | 196.58 | | |
| Mn | 2 | 218.09 | | |
| Mn | 5 | 251.50 | 249.65 | |
| Mn | 5 | 211.98 | | |
| Mn | 5 | 285.48 | | |
| Mn | 9 | 182.33 | 181.56 | |
| Mn | 9 | 188.61 | | |
| Mn | 9 | 173.73 | | |
| Na | 2 | 124.29 | 131.79 | 119.01 |
| Na | 2 | 149.18 | | |
| Na | 2 | 121.88 | | |
| Na | 5 | 111.02 | 107.85 | |
| Na | 5 | 103.79 | | |
| Na | 5 | 108.75 | | |
| Na | 9 | 112.74 | 117.39 | |
| Na | 9 | 139.96 | | |
| Na | 9 | 99.47 | | |
| Ni | 2 | 23.56 | 24.63 | 22.62 |
| Ni | 2 | 27.02 | | |
| Ni | 2 | 23.30 | | |
| Ni | 5 | 25.66 | 24.14 | |
| Ni | 5 | 22.61 | | |
| Ni | 5 | 24.16 | | |
| Ni | 9 | 19.59 | 19.11 | |
| Ni | 9 | 19.46 | | |
| Ni | 9 | 18.27 | | |
| P | 2 | 1197.37 | 1389.28 | 1409.90 |
| P | 2 | 1738.27 | | |
| P | 2 | 1232.20 | | |
| P | 5 | 1410.40 | 1533.72 | |
| P | 5 | 1328.08 | | |
| P | 5 | 1862.68 | | |
| P | 9 | 1352.92 | 1306.70 | |
| P | 9 | 1239.27 | | |
| P | 9 | 1327.90 | | |
| Pb | 2 | 30.68 | 27.63 | 28.79 |
| Pb | 2 | 24.06 | | |
| Pb | 2 | 28.15 | | |
| Pb | 5 | 29.89 | 31.38 | |
| Pb | 5 | 35.27 | | |
| Pb | 5 | 28.99 | | |
| Pb | 9 | 24.02 | 27.37 | |
| Pb | 9 | 30.73 | | |
| Pb | 9 | 27.37 | | |
| Zn | 2 | 87.74 | 87.22 | 89.40 |
| Zn | 2 | 87.46 | | |
| Zn | 2 | 86.47 | | |
| Zn | 5 | 91.68 | 90.90 | |
| Zn | 5 | 93.91 | | |
| Zn | 5 | 87.10 | | |
| Zn | 9 | 93.67 | 90.09 | |
| Zn | 9 | 89.32 | | |
| Zn | 9 | 87.27 | | |

|  | 2 week weathering cycle: HNO3 digestion |  |  | TRT2 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
|  |  |  | mg kg-1 |  |
| Al | 3 | 10332.02 | 10920.63 | 10402.24 |
| Al | 3 | 10385.78 |  |  |
| Al | 3 | 12044.08 |  |  |
| Al | 4 | 9745.49 | 10041.29 |  |
| Al | 4 | 10335.58 |  |  |
| Al | 4 | 10042.78 |  |  |
| Al | 7 | 10925.64 | 10244.82 |  |
| Al | 7 | 10123.02 |  |  |
| Al | 7 | 9685.79 |  |  |
| Ca | 3 | 3665.95 | 3916.59 | 3968.19 |
| Ca | 3 | 3897.86 |  |  |
| Ca | 3 | 4185.95 |  |  |
| Ca | 4 | 3483.90 | 3511.17 |  |
| Ca | 4 | 3589.46 |  |  |
| Ca | 4 | 3460.14 |  |  |
| Ca | 7 | 5700.68 | 4476.82 |  |
| Ca | 7 | 3372.52 |  |  |
| Ca | 7 | 4357.26 |  |  |
| Cd | 3 | 0.54 | 0.65 | 0.60 |
| Cd | 3 | 1.00 |  |  |
| Cd | 3 | 0.40 |  |  |
| Cd | 4 | 0.40 | 0.62 |  |
| Cd | 4 | 1.06 |  |  |
| Cd | 4 | 0.40 |  |  |
| Cd | 7 | 0.65 | 0.55 |  |
| Cd | 7 | 0.40 |  |  |
| Cd | 7 | 0.59 |  |  |
| Co | 3 | 9.80 | 10.61 | 11.25 |
| Co | 3 | 11.33 |  |  |
| Co | 3 | 10.70 |  |  |
| Co | 4 | 10.38 | 12.66 |  |
| Co | 4 | 11.82 |  |  |
| Co | 4 | 15.78 |  |  |
| Co | 7 | 10.51 | 10.48 |  |
| Co | 7 | 9.71 |  |  |
| Co | 7 | 11.23 |  |  |
| Cr | 3 | 17.15 | 17.57 | 17.72 |
| Cr | 3 | 18.93 |  |  |
| Cr | 3 | 16.64 |  |  |
| Cr | 4 | 19.18 | 18.53 |  |
| Cr | 4 | 18.88 |  |  |
| Cr | 4 | 17.53 |  |  |
| Cr | 7 | 17.77 | 17.04 |  |
| Cr | 7 | 17.41 |  |  |
| Cr | 7 | 15.96 |  |  |
| Cu | 3 | 21.39 | 21.85 | 21.48 |
| Cu | 3 | 22.17 |  |  |
| Cu | 3 | 22.00 |  |  |
| Cu | 4 | 20.96 | 21.01 |  |
| Cu | 4 | 22.12 |  |  |
| Cu | 4 | 19.93 |  |  |
| Cu | 7 | 21.98 | 21.57 |  |
| Cu | 7 | 19.57 |  |  |
| Cu | 7 | 23.17 |  |  |
| Fe | 3 | 49155.05 | 49718.35 | 49190.77 |
| Fe | 3 | 50000.00 |  |  |
| Fe | 3 | 50000.00 |  |  |
| Fe | 4 | 50000.00 | 50000.00 |  |
| Fe | 4 | 50000.00 |  |  |
| Fe | 4 | 50000.00 |  |  |
| Fe | 7 | 47642.97 | 47853.97 |  |
| Fe | 7 | 50000.00 |  |  |
| Fe | 7 | 45918.94 |  |  |
| K | 3 | 2154.88 | 2082.58 | 2129.22 |
| K | 3 | 2171.95 |  |  |
| K | 3 | 1920.90 |  |  |
| K | 4 | 2036.20 | 2080.66 |  |
| K | 4 | 2115.38 |  |  |
| K | 4 | 2090.40 |  |  |
| K | 7 | 2278.34 | 2224.43 |  |
| K | 7 | 2112.99 |  |  |

| | | | | |
|---|---|---|---|---|
| K | 7 | 2281.96 | | |
| Mg | 3 | 2086.65 | 2116.73 | 2141.41 |
| Mg | 3 | 2141.32 | | |
| Mg | 3 | 2122.22 | | |
| Mg | 4 | 2137.16 | 2132.52 | |
| Mg | 4 | 2160.38 | | |
| Mg | 4 | 2100.01 | | |
| Mg | 7 | 2171.50 | 2174.99 | |
| Mg | 7 | 2127.45 | | |
| Mg | 7 | 2226.02 | | |
| Mn | 3 | 230.61 | 232.33 | 246.63 |
| Mn | 3 | 192.90 | | |
| Mn | 3 | 273.49 | | |
| Mn | 4 | 212.21 | 288.69 | |
| Mn | 4 | 263.40 | | |
| Mn | 4 | 390.46 | | |
| Mn | 7 | 199.67 | 218.87 | |
| Mn | 7 | 240.99 | | |
| Mn | 7 | 215.94 | | |
| Na | 3 | 103.83 | 103.70 | 100.20 |
| Na | 3 | 106.04 | | |
| Na | 3 | 101.24 | | |
| Na | 4 | 98.16 | 104.74 | |
| Na | 4 | 103.41 | | |
| Na | 4 | 112.65 | | |
| Na | 7 | 95.29 | 92.15 | |
| Na | 7 | 89.07 | | |
| Na | 7 | 92.10 | | |
| Ni | 3 | 22.74 | 23.88 | 24.13 |
| Ni | 3 | 24.53 | | |
| Ni | 3 | 24.37 | | |
| Ni | 4 | 25.06 | 25.43 | |
| Ni | 4 | 27.56 | | |
| Ni | 4 | 23.67 | | |
| Ni | 7 | 24.12 | 23.09 | |
| Ni | 7 | 24.43 | | |
| Ni | 7 | 20.72 | | |
| P | 3 | 1526.72 | 1580.08 | 1613.99 |
| P | 3 | 1569.92 | | |
| P | 3 | 1643.59 | | |
| P | 4 | 1541.03 | 1565.54 | |
| P | 4 | 1589.25 | | |
| P | 4 | 1566.33 | | |
| P | 7 | 2113.79 | 1696.34 | |
| P | 7 | 1468.41 | | |
| P | 7 | 1506.83 | | |
| Pb | 3 | 27.03 | 27.58 | 29.90 |
| Pb | 3 | 28.53 | | |
| Pb | 3 | 27.19 | | |
| Pb | 4 | 40.68 | 33.34 | |
| Pb | 4 | 29.14 | | |
| Pb | 4 | 30.19 | | |
| Pb | 7 | 27.38 | 28.77 | |
| Pb | 7 | 30.82 | | |
| Pb | 7 | 28.13 | | |
| Zn | 3 | 89.09 | 95.14 | 96.51 |
| Zn | 3 | 96.92 | | |
| Zn | 3 | 99.41 | | |
| Zn | 4 | 99.23 | 98.68 | |
| Zn | 4 | 103.93 | | |
| Zn | 4 | 92.87 | | |
| Zn | 7 | 93.96 | 95.70 | |
| Zn | 7 | 92.58 | | |
| Zn | 7 | 100.55 | | |

| | 2 week weathering cycle: HNO3 digestion | | | TRT3 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| | | | mg kg-1 | |
| Al | 6 | 11877.91 | 11514.46 | 11227.60 |
| Al | 6 | 11359.86 | | |
| Al | 6 | 11305.63 | | |
| Al | 14 | 11003.93 | 11016.54 | |
| Al | 14 | 10151.81 | | |
| Al | 14 | 11893.90 | | |
| Al | 15 | 11798.24 | 11151.79 | |
| Al | 15 | 11051.57 | | |
| Al | 15 | 10605.57 | | |
| Ca | 6 | 4260.77 | 4489.32 | 4006.49 |
| Ca | 6 | 5680.67 | | |
| Ca | 6 | 3526.51 | | |
| Ca | 14 | 3266.22 | 3588.42 | |
| Ca | 14 | 3746.94 | | |
| Ca | 14 | 3752.10 | | |
| Ca | 15 | 4267.68 | 3941.74 | |
| Ca | 15 | 4372.77 | | |
| Ca | 15 | 3184.76 | | |
| Cd | 6 | 0.40 | 0.55 | 0.64 |
| Cd | 6 | 0.61 | | |
| Cd | 6 | 0.64 | | |
| Cd | 14 | 0.40 | 0.78 | |
| Cd | 14 | 0.64 | | |
| Cd | 14 | 1.30 | | |
| Cd | 15 | 0.67 | 0.58 | |
| Cd | 15 | 0.51 | | |
| Cd | 15 | 0.56 | | |
| Co | 6 | 12.48 | 12.30 | 11.89 |
| Co | 6 | 11.80 | | |
| Co | 6 | 12.63 | | |
| Co | 14 | 11.48 | 12.22 | |
| Co | 14 | 12.56 | | |
| Co | 14 | 12.64 | | |
| Co | 15 | 12.16 | 11.13 | |
| Co | 15 | 10.60 | | |
| Co | 15 | 10.64 | | |
| Cr | 6 | 16.48 | 17.23 | 16.67 |
| Cr | 6 | 18.74 | | |
| Cr | 6 | 16.48 | | |
| Cr | 14 | 14.26 | 15.55 | |
| Cr | 14 | 14.88 | | |
| Cr | 14 | 17.51 | | |
| Cr | 15 | 18.46 | 17.22 | |
| Cr | 15 | 17.81 | | |
| Cr | 15 | 15.40 | | |
| Cu | 6 | 32.79 | 31.49 | 29.09 |
| Cu | 6 | 29.95 | | |
| Cu | 6 | 31.73 | | |
| Cu | 14 | 27.58 | 28.29 | |
| Cu | 14 | 28.59 | | |
| Cu | 14 | 28.72 | | |
| Cu | 15 | 28.13 | 27.50 | |
| Cu | 15 | 27.37 | | |
| Cu | 15 | 26.99 | | |
| Fe | 6 | 43290.30 | 45550.77 | 45557.11 |
| Fe | 6 | 48174.98 | | |
| Fe | 6 | 45187.03 | | |
| Fe | 14 | 47433.31 | 46364.53 | |
| Fe | 14 | 43675.09 | | |
| Fe | 14 | 47985.19 | | |
| Fe | 15 | 50000.00 | 44756.03 | |
| Fe | 15 | 42349.62 | | |
| Fe | 15 | 41918.46 | | |
| K | 6 | 2795.70 | 2628.31 | 2376.88 |
| K | 6 | 2413.02 | | |
| K | 6 | 2676.22 | | |
| K | 14 | 2289.56 | 2328.42 | |
| K | 14 | 2293.91 | | |
| K | 14 | 2401.80 | | |
| K | 15 | 2319.00 | 2173.92 | |
| K | 15 | 2092.76 | | |

| | | | | |
|---|---|---|---|---|
| K | 15 | 2109.99 | | |
| Mg | 6 | 2330.41 | 2207.45 | 2148.88 |
| Mg | 6 | 2135.46 | | |
| Mg | 6 | 2156.49 | | |
| Mg | 14 | 2087.92 | 2132.74 | |
| Mg | 14 | 2118.61 | | |
| Mg | 14 | 2191.69 | | |
| Mg | 15 | 2187.33 | 2106.44 | |
| Mg | 15 | 2139.24 | | |
| Mg | 15 | 1992.76 | | |
| Mn | 6 | 213.20 | 214.66 | 211.40 |
| Mn | 6 | 242.69 | | |
| Mn | 6 | 188.10 | | |
| Mn | 14 | 177.24 | 199.97 | |
| Mn | 14 | 202.16 | | |
| Mn | 14 | 220.50 | | |
| Mn | 15 | 275.21 | 219.58 | |
| Mn | 15 | 196.01 | | |
| Mn | 15 | 187.54 | | |
| Na | 6 | 156.06 | 147.57 | 142.51 |
| Na | 6 | 141.71 | | |
| Na | 6 | 144.95 | | |
| Na | 14 | 136.61 | 134.91 | |
| Na | 14 | 135.25 | | |
| Na | 14 | 132.86 | | |
| Na | 15 | 146.10 | 145.06 | |
| Na | 15 | 141.36 | | |
| Na | 15 | 147.71 | | |
| Ni | 6 | 23.62 | 23.58 | 25.08 |
| Ni | 6 | 24.37 | | |
| Ni | 6 | 22.74 | | |
| Ni | 14 | 26.08 | 25.45 | |
| Ni | 14 | 26.33 | | |
| Ni | 14 | 23.93 | | |
| Ni | 15 | 26.82 | 26.22 | |
| Ni | 15 | 26.98 | | |
| Ni | 15 | 24.88 | | |
| P | 6 | 1478.83 | 1525.92 | 1539.98 |
| P | 6 | 1671.60 | | |
| P | 6 | 1427.34 | | |
| P | 14 | 1572.21 | 1547.04 | |
| P | 14 | 1431.29 | | |
| P | 14 | 1637.63 | | |
| P | 15 | 1717.89 | 1546.97 | |
| P | 15 | 1534.97 | | |
| P | 15 | 1388.06 | | |
| Pb | 6 | 34.41 | 33.33 | 31.08 |
| Pb | 6 | 32.43 | | |
| Pb | 6 | 33.16 | | |
| Pb | 14 | 32.84 | 31.42 | |
| Pb | 14 | 31.79 | | |
| Pb | 14 | 29.64 | | |
| Pb | 15 | 30.07 | 28.47 | |
| Pb | 15 | 30.33 | | |
| Pb | 15 | 25.00 | | |
| Zn | 6 | 100.10 | 99.35 | 96.63 |
| Zn | 6 | 98.43 | | |
| Zn | 6 | 99.51 | | |
| Zn | 14 | 95.46 | 97.94 | |
| Zn | 14 | 102.47 | | |
| Zn | 14 | 95.91 | | |
| Zn | 15 | 98.11 | 92.60 | |
| Zn | 15 | 94.44 | | |
| Zn | 15 | 85.26 | | |

| 2 week weathering cycle: HNO3 digestion | | | | TRT4 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| | | | mg kg-1 | |
| Al | 8 | 11470.80 | 11493.65 | 12058.18 |
| Al | 8 | 11442.54 | | |
| Al | 8 | 11567.62 | | |
| Al | 10 | 12394.42 | 12455.14 | |
| Al | 10 | 12468.56 | | |
| Al | 10 | 12502.43 | | |
| Al | 13 | 12992.38 | 12225.75 | |
| Al | 13 | 11957.79 | | |
| Al | 13 | 11727.06 | | |
| Ca | 8 | 5186.51 | 5418.45 | 5132.89 |
| Ca | 8 | 7523.38 | | |
| Ca | 8 | 3545.45 | | |
| Ca | 10 | 5285.21 | 4739.47 | |
| Ca | 10 | 4508.61 | | |
| Ca | 10 | 4424.59 | | |
| Ca | 13 | 7306.65 | 5240.76 | |
| Ca | 13 | 3240.11 | | |
| Ca | 13 | 5175.50 | | |
| Cd | 8 | 0.62 | 0.61 | 0.65 |
| Cd | 8 | 0.69 | | |
| Cd | 8 | 0.52 | | |
| Cd | 10 | 0.47 | 0.68 | |
| Cd | 10 | 0.82 | | |
| Cd | 10 | 0.74 | | |
| Cd | 13 | 0.90 | 0.67 | |
| Cd | 13 | 0.61 | | |
| Cd | 13 | 0.51 | | |
| Co | 8 | 14.04 | 12.61 | 12.66 |
| Co | 8 | 12.19 | | |
| Co | 8 | 11.61 | | |
| Co | 10 | 12.10 | 13.19 | |
| Co | 10 | 13.22 | | |
| Co | 10 | 14.26 | | |
| Co | 13 | 12.63 | 12.17 | |
| Co | 13 | 11.54 | | |
| Co | 13 | 12.34 | | |
| Cr | 8 | 17.20 | 16.62 | 17.12 |
| Cr | 8 | 16.74 | | |
| Cr | 8 | 15.91 | | |
| Cr | 10 | 19.40 | 17.52 | |
| Cr | 10 | 16.02 | | |
| Cr | 10 | 17.15 | | |
| Cr | 13 | 18.33 | 17.23 | |
| Cr | 13 | 17.15 | | |
| Cr | 13 | 16.22 | | |
| Cu | 8 | 33.08 | 31.93 | 32.93 |
| Cu | 8 | 32.89 | | |
| Cu | 8 | 29.81 | | |
| Cu | 10 | 31.56 | 33.96 | |
| Cu | 10 | 35.16 | | |
| Cu | 10 | 35.16 | | |
| Cu | 13 | 34.82 | 32.89 | |
| Cu | 13 | 30.95 | | |
| Cu | 13 | 32.89 | | |
| Fe | 8 | 40703.74 | 41252.35 | 42528.53 |
| Fe | 8 | 39600.81 | | |
| Fe | 8 | 43452.48 | | |
| Fe | 10 | 45251.04 | 43921.78 | |
| Fe | 10 | 42853.46 | | |
| Fe | 10 | 43660.83 | | |
| Fe | 13 | 42576.87 | 42411.48 | |
| Fe | 13 | 44766.25 | | |
| Fe | 13 | 39891.33 | | |
| K | 8 | 2473.12 | 2397.21 | 2585.39 |
| K | 8 | 2485.07 | | |
| K | 8 | 2233.45 | | |
| K | 10 | 2488.69 | 2741.15 | |
| K | 10 | 2771.80 | | |
| K | 10 | 2962.96 | | |
| K | 13 | 2843.49 | 2617.81 | |
| K | 13 | 2345.68 | | |

| | | | | |
|---|---|---|---|---|
| K | 13 | 2664.28 | | |
| Mg | 8 | 2196.32 | 2141.85 | 2192.35 |
| Mg | 8 | 2218.91 | | |
| Mg | 8 | 2010.32 | | |
| Mg | 10 | 2240.45 | 2263.84 | |
| Mg | 10 | 2313.27 | | |
| Mg | 10 | 2237.80 | | |
| Mg | 13 | 2296.04 | 2171.36 | |
| Mg | 13 | 1998.73 | | |
| Mg | 13 | 2219.30 | | |
| Mn | 8 | 234.50 | 205.90 | 216.44 |
| Mn | 8 | 193.18 | | |
| Mn | 8 | 190.01 | | |
| Mn | 10 | 203.23 | 249.03 | |
| Mn | 10 | 242.09 | | |
| Mn | 10 | 301.76 | | |
| Mn | 13 | 207.07 | 194.40 | |
| Mn | 13 | 185.32 | | |
| Mn | 13 | 190.82 | | |
| Na | 8 | 160.81 | 179.44 | 180.48 |
| Na | 8 | 192.55 | | |
| Na | 8 | 184.97 | | |
| Na | 10 | 174.39 | 174.83 | |
| Na | 10 | 173.84 | | |
| Na | 10 | 176.26 | | |
| Na | 13 | 192.81 | 187.16 | |
| Na | 13 | 205.99 | | |
| Na | 13 | 162.69 | | |
| Ni | 8 | 23.75 | 24.06 | 24.97 |
| Ni | 8 | 23.87 | | |
| Ni | 8 | 24.56 | | |
| Ni | 10 | 27.19 | 26.57 | |
| Ni | 10 | 25.76 | | |
| Ni | 10 | 26.77 | | |
| Ni | 13 | 22.61 | 24.27 | |
| Ni | 13 | 25.76 | | |
| Ni | 13 | 24.44 | | |
| P | 8 | 1538.75 | 1660.66 | 1606.83 |
| P | 8 | 1832.43 | | |
| P | 8 | 1610.82 | | |
| P | 10 | 1662.64 | 1577.27 | |
| P | 10 | 1531.81 | | |
| P | 10 | 1537.36 | | |
| P | 13 | 1752.94 | 1582.56 | |
| P | 13 | 1488.14 | | |
| P | 13 | 1506.59 | | |
| Pb | 8 | 38.97 | 33.87 | 33.34 |
| Pb | 8 | 34.36 | | |
| Pb | 8 | 28.27 | | |
| Pb | 10 | 32.30 | 33.71 | |
| Pb | 10 | 30.29 | | |
| Pb | 10 | 38.55 | | |
| Pb | 13 | 32.46 | 32.45 | |
| Pb | 13 | 30.54 | | |
| Pb | 13 | 34.36 | | |
| Zn | 8 | 111.45 | 100.94 | 100.96 |
| Zn | 8 | 104.50 | | |
| Zn | 8 | 86.86 | | |
| Zn | 10 | 101.62 | 103.83 | |
| Zn | 10 | 103.78 | | |
| Zn | 10 | 106.11 | | |
| Zn | 13 | 106.51 | 98.11 | |
| Zn | 13 | 88.49 | | |
| Zn | 13 | 99.32 | | |

|  | 2 week weathering cycle: $HNO_3$ digestion |  |  | TRT5 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
|  |  |  | mg kg$^{-1}$ |  |
| Al | 1 | 11729.54 | 12475.36 | 12525.99 |
| Al | 1 | 12643.68 |  |  |
| Al | 1 | 13052.85 |  |  |
| Al | 11 | 11551.58 | 12331.20 |  |
| Al | 11 | 13506.65 |  |  |
| Al | 11 | 11935.37 |  |  |
| Al | 12 | 13398.30 | 12771.42 |  |
| Al | 12 | 12443.63 |  |  |
| Al | 12 | 12472.35 |  |  |
| Ca | 1 | 4335.52 | 5402.25 | 5817.43 |
| Ca | 1 | 4573.44 |  |  |
| Ca | 1 | 7297.80 |  |  |
| Ca | 11 | 4284.99 | 5101.16 |  |
| Ca | 11 | 5595.94 |  |  |
| Ca | 11 | 5422.54 |  |  |
| Ca | 12 | 6382.14 | 6948.89 |  |
| Ca | 12 | 10200.36 |  |  |
| Ca | 12 | 4264.16 |  |  |
| Cd | 1 | 0.64 | 0.67 | 0.64 |
| Cd | 1 | 0.67 |  |  |
| Cd | 1 | 0.70 |  |  |
| Cd | 11 | 0.90 | 0.61 |  |
| Cd | 11 | 0.40 |  |  |
| Cd | 11 | 0.53 |  |  |
| Cd | 12 | 0.40 | 0.65 |  |
| Cd | 12 | 0.80 |  |  |
| Cd | 12 | 0.74 |  |  |
| Co | 1 | 13.07 | 12.57 | 13.31 |
| Co | 1 | 12.27 |  |  |
| Co | 1 | 12.38 |  |  |
| Co | 11 | 17.58 | 14.07 |  |
| Co | 11 | 12.41 |  |  |
| Co | 11 | 12.22 |  |  |
| Co | 12 | 12.35 | 13.29 |  |
| Co | 12 | 14.62 |  |  |
| Co | 12 | 12.89 |  |  |
| Cr | 1 | 16.02 | 18.11 | 17.83 |
| Cr | 1 | 19.57 |  |  |
| Cr | 1 | 18.74 |  |  |
| Cr | 11 | 15.65 | 17.76 |  |
| Cr | 11 | 19.50 |  |  |
| Cr | 11 | 18.11 |  |  |
| Cr | 12 | 19.12 | 17.62 |  |
| Cr | 12 | 17.77 |  |  |
| Cr | 12 | 15.96 |  |  |
| Cu | 1 | 33.91 | 34.71 | 35.48 |
| Cu | 1 | 32.36 |  |  |
| Cu | 1 | 37.87 |  |  |
| Cu | 11 | 35.65 | 35.18 |  |
| Cu | 11 | 35.89 |  |  |
| Cu | 11 | 34.01 |  |  |
| Cu | 12 | 35.98 | 36.53 |  |
| Cu | 12 | 38.26 |  |  |
| Cu | 12 | 35.36 |  |  |
| Fe | 1 | 42617.08 | 42339.10 | 43558.82 |
| Fe | 1 | 43657.64 |  |  |
| Fe | 1 | 40742.58 |  |  |
| Fe | 11 | 39386.51 | 43231.35 |  |
| Fe | 11 | 44377.19 |  |  |
| Fe | 11 | 45930.35 |  |  |
| Fe | 12 | 46055.68 | 45106.00 |  |
| Fe | 12 | 43726.17 |  |  |
| Fe | 12 | 45536.17 |  |  |
| K | 1 | 2473.12 | 2529.18 | 2568.85 |
| K | 1 | 2420.81 |  |  |
| K | 1 | 2693.60 |  |  |
| K | 11 | 2473.12 | 2452.30 |  |
| K | 11 | 2734.46 |  |  |
| K | 11 | 2149.32 |  |  |
| K | 12 | 2836.16 | 2725.07 |  |
| K | 12 | 2724.01 |  |  |

| | | | | |
|---|---|---|---|---|
| K | 12 | 2615.04 | | |
| Mg | 1 | 2055.90 | 2133.22 | 2196.84 |
| Mg | 1 | 2119.75 | | |
| Mg | 1 | 2224.01 | | |
| Mg | 11 | 2074.98 | 2119.59 | |
| Mg | 11 | 2228.94 | | |
| Mg | 11 | 2054.85 | | |
| Mg | 12 | 2244.01 | 2337.70 | |
| Mg | 12 | 2669.49 | | |
| Mg | 12 | 2099.60 | | |
| Mn | 1 | 224.49 | 215.99 | 246.22 |
| Mn | 1 | 204.32 | | |
| Mn | 1 | 219.16 | | |
| Mn | 11 | 352.44 | 261.26 | |
| Mn | 11 | 217.19 | | |
| Mn | 11 | 214.15 | | |
| Mn | 12 | 203.24 | 261.40 | |
| Mn | 12 | 320.47 | | |
| Mn | 12 | 260.50 | | |
| Na | 1 | 209.77 | 205.15 | 194.46 |
| Na | 1 | 211.00 | | |
| Na | 1 | 194.69 | | |
| Na | 11 | 159.34 | 184.40 | |
| Na | 11 | 211.69 | | |
| Na | 11 | 182.16 | | |
| Na | 12 | 198.46 | 193.84 | |
| Na | 12 | 182.07 | | |
| Na | 12 | 200.97 | | |
| Ni | 1 | 25.32 | 25.52 | 27.14 |
| Ni | 1 | 25.86 | | |
| Ni | 1 | 25.38 | | |
| Ni | 11 | 27.78 | 26.50 | |
| Ni | 11 | 26.57 | | |
| Ni | 11 | 25.17 | | |
| Ni | 12 | 30.22 | 29.41 | |
| Ni | 12 | 30.11 | | |
| Ni | 12 | 27.90 | | |
| P | 1 | 1623.13 | 1703.44 | 1729.44 |
| P | 1 | 1742.85 | | |
| P | 1 | 1744.32 | | |
| P | 11 | 1629.34 | 1664.61 | |
| P | 11 | 1690.30 | | |
| P | 11 | 1674.19 | | |
| P | 12 | 1781.19 | 1820.26 | |
| P | 12 | 1947.18 | | |
| P | 12 | 1732.42 | | |
| Pb | 1 | 31.54 | 32.09 | 32.96 |
| Pb | 1 | 32.35 | | |
| Pb | 1 | 32.37 | | |
| Pb | 11 | 33.64 | 32.99 | |
| Pb | 11 | 34.07 | | |
| Pb | 11 | 31.26 | | |
| Pb | 12 | 34.98 | 33.81 | |
| Pb | 12 | 35.82 | | |
| Pb | 12 | 30.63 | | |
| Zn | 1 | 101.43 | 99.03 | 99.96 |
| Zn | 1 | 95.61 | | |
| Zn | 1 | 100.05 | | |
| Zn | 11 | 91.85 | 95.41 | |
| Zn | 11 | 98.04 | | |
| Zn | 11 | 96.35 | | |
| Zn | 12 | 102.40 | 105.44 | |
| Zn | 12 | 122.46 | | |
| Zn | 12 | 91.46 | | |

| | | 18 week weathering cycle: HNO3 digestion | | TRT1 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| | | | mg kg-1 | |
| Al | 2 | 10856.22 | 10995.83 | 10169.93 |
| Al | 2 | 11180.46 | | |
| Al | 2 | 10950.81 | | |
| Al | 5 | 9789.30 | 9056.99 | |
| Al | 5 | 8321.69 | | |
| Al | 5 | 9059.99 | | |
| Al | 9 | 10313.74 | 10456.97 | |
| Al | 9 | 10847.07 | | |
| Al | 9 | 10210.09 | | |
| Ca | 2 | 366.09 | 416.36 | 378.95 |
| Ca | 2 | 406.03 | | |
| Ca | 2 | 476.95 | | |
| Ca | 5 | 399.22 | 350.02 | |
| Ca | 5 | 306.26 | | |
| Ca | 5 | 344.58 | | |
| Ca | 9 | 363.50 | 370.46 | |
| Ca | 9 | 352.25 | | |
| Ca | 9 | 395.65 | | |
| Cd | 2 | 0.40 | 0.40 | 0.40 |
| Cd | 2 | 0.40 | | |
| Cd | 2 | 0.40 | | |
| Cd | 5 | 0.40 | 0.41 | |
| Cd | 5 | 0.44 | | |
| Cd | 5 | 0.40 | | |
| Cd | 9 | 0.40 | 0.40 | |
| Cd | 9 | 0.40 | | |
| Cd | 9 | 0.40 | | |
| Co | 2 | 8.91 | 9.27 | 9.01 |
| Co | 2 | 9.03 | | |
| Co | 2 | 9.86 | | |
| Co | 5 | 8.49 | 8.62 | |
| Co | 5 | 8.42 | | |
| Co | 5 | 8.94 | | |
| Co | 9 | 8.91 | 9.15 | |
| Co | 9 | 9.09 | | |
| Co | 9 | 9.45 | | |
| Cr | 2 | 20.13 | 20.20 | 18.17 |
| Cr | 2 | 20.36 | | |
| Cr | 2 | 20.13 | | |
| Cr | 5 | 18.27 | 14.96 | |
| Cr | 5 | 12.98 | | |
| Cr | 5 | 13.65 | | |
| Cr | 9 | 19.01 | 19.35 | |
| Cr | 9 | 21.05 | | |
| Cr | 9 | 17.99 | | |
| Cu | 2 | 14.74 | 15.24 | 15.16 |
| Cu | 2 | 15.06 | | |
| Cu | 2 | 15.93 | | |
| Cu | 5 | 14.14 | 15.53 | |
| Cu | 5 | 16.25 | | |
| Cu | 5 | 16.20 | | |
| Cu | 9 | 14.69 | 14.70 | |
| Cu | 9 | 14.37 | | |
| Cu | 9 | 15.06 | | |
| Fe | 2 | 50000.00 | 50000.00 | 48220.48 |
| Fe | 2 | 50000.00 | | |
| Fe | 2 | 50000.00 | | |
| Fe | 5 | 50000.00 | 44661.45 | |
| Fe | 5 | 42440.44 | | |
| Fe | 5 | 41543.92 | | |
| Fe | 9 | 50000.00 | 50000.00 | |
| Fe | 9 | 50000.00 | | |
| Fe | 9 | 50000.00 | | |
| K | 2 | 2465.12 | 2480.62 | 2341.87 |
| K | 2 | 2511.63 | | |
| K | 2 | 2465.12 | | |
| K | 5 | 2139.53 | 2250.41 | |
| K | 5 | 2198.33 | | |
| K | 5 | 2413.38 | | |
| K | 9 | 2255.81 | 2294.57 | |
| K | 9 | 2418.60 | | |

|  |  |  |  |  |
|---|---|---|---|---|
| K | 9 | 2209.30 |  |  |
| Mg | 2 | 2129.12 | 2116.80 | 2016.62 |
| Mg | 2 | 2116.92 |  |  |
| Mg | 2 | 2104.37 |  |  |
| Mg | 5 | 1932.03 | 1906.97 |  |
| Mg | 5 | 1877.11 |  |  |
| Mg | 5 | 1911.77 |  |  |
| Mg | 9 | 2020.20 | 2026.08 |  |
| Mg | 9 | 2057.32 |  |  |
| Mg | 9 | 2000.73 |  |  |
| Mn | 2 | 139.93 | 148.35 | 155.89 |
| Mn | 2 | 149.82 |  |  |
| Mn | 2 | 155.31 |  |  |
| Mn | 5 | 138.83 | 134.87 |  |
| Mn | 5 | 132.05 |  |  |
| Mn | 5 | 133.72 |  |  |
| Mn | 9 | 162.12 | 184.47 |  |
| Mn | 9 | 146.50 |  |  |
| Mn | 9 | 244.78 |  |  |
| Na | 2 | 93.07 | 84.10 | 84.59 |
| Na | 2 | 67.18 |  |  |
| Na | 2 | 92.06 |  |  |
| Na | 5 | 68.60 | 90.39 |  |
| Na | 5 | 96.32 |  |  |
| Na | 5 | 106.24 |  |  |
| Na | 9 | 84.61 | 79.27 |  |
| Na | 9 | 65.87 |  |  |
| Na | 9 | 87.34 |  |  |
| Ni | 2 | 21.95 | 23.01 | 20.91 |
| Ni | 2 | 22.54 |  |  |
| Ni | 2 | 24.54 |  |  |
| Ni | 5 | 19.43 | 17.27 |  |
| Ni | 5 | 15.68 |  |  |
| Ni | 5 | 16.69 |  |  |
| Ni | 9 | 22.31 | 22.44 |  |
| Ni | 9 | 21.60 |  |  |
| Ni | 9 | 23.42 |  |  |
| P | 2 | 1342.67 | 1455.67 | 1351.86 |
| P | 2 | 1439.26 |  |  |
| P | 2 | 1585.08 |  |  |
| P | 5 | 1388.57 | 1222.44 |  |
| P | 5 | 1130.03 |  |  |
| P | 5 | 1148.71 |  |  |
| P | 9 | 1351.87 | 1377.47 |  |
| P | 9 | 1302.49 |  |  |
| P | 9 | 1478.05 |  |  |
| Pb | 2 | 34.31 | 33.87 | 29.01 |
| Pb | 2 | 31.86 |  |  |
| Pb | 2 | 35.44 |  |  |
| Pb | 5 | 25.96 | 24.13 |  |
| Pb | 5 | 23.00 |  |  |
| Pb | 5 | 23.44 |  |  |
| Pb | 9 | 27.95 | 29.04 |  |
| Pb | 9 | 31.78 |  |  |
| Pb | 9 | 27.41 |  |  |
| Zn | 2 | 82.90 | 86.96 | 81.34 |
| Zn | 2 | 86.59 |  |  |
| Zn | 2 | 91.38 |  |  |
| Zn | 5 | 77.76 | 73.49 |  |
| Zn | 5 | 70.98 |  |  |
| Zn | 5 | 71.72 |  |  |
| Zn | 9 | 81.22 | 83.57 |  |
| Zn | 9 | 83.77 |  |  |
| Zn | 9 | 85.73 |  |  |

|  | 18 week weathering cycle: HNO3 digestion |  |  | TRT2 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
|  |  |  | mg kg-1 |  |
| Al | 3 | 10845.16 | 11742.68 | 10726.25 |
| Al | 3 | 11969.19 |  |  |
| Al | 3 | 12413.70 |  |  |
| Al | 4 | 9781.48 | 10286.71 |  |
| Al | 4 | 9955.39 |  |  |
| Al | 4 | 11123.25 |  |  |
| Al | 7 | 10553.61 | 10149.37 |  |
| Al | 7 | 10131.57 |  |  |
| Al | 7 | 9762.91 |  |  |
| Ca | 3 | 4375.97 | 5033.32 | 4827.00 |
| Ca | 3 | 5371.02 |  |  |
| Ca | 3 | 5352.98 |  |  |
| Ca | 4 | 4361.27 | 4685.96 |  |
| Ca | 4 | 4695.74 |  |  |
| Ca | 4 | 5000.87 |  |  |
| Ca | 7 | 4757.74 | 4761.72 |  |
| Ca | 7 | 5207.17 |  |  |
| Ca | 7 | 4320.25 |  |  |
| Cd | 3 | 0.44 | 0.41 | 0.42 |
| Cd | 3 | 0.40 |  |  |
| Cd | 3 | 0.40 |  |  |
| Cd | 4 | 0.56 | 0.45 |  |
| Cd | 4 | 0.40 |  |  |
| Cd | 4 | 0.40 |  |  |
| Cd | 7 | 0.40 | 0.40 |  |
| Cd | 7 | 0.40 |  |  |
| Cd | 7 | 0.40 |  |  |
| Co | 3 | 11.97 | 11.60 | 11.29 |
| Co | 3 | 10.70 |  |  |
| Co | 3 | 12.13 |  |  |
| Co | 4 | 11.38 | 11.22 |  |
| Co | 4 | 11.12 |  |  |
| Co | 4 | 11.18 |  |  |
| Co | 7 | 10.58 | 11.04 |  |
| Co | 7 | 11.24 |  |  |
| Co | 7 | 11.30 |  |  |
| Cr | 3 | 17.41 | 20.75 | 19.75 |
| Cr | 3 | 22.03 |  |  |
| Cr | 3 | 22.81 |  |  |
| Cr | 4 | 16.17 | 19.66 |  |
| Cr | 4 | 20.31 |  |  |
| Cr | 4 | 22.49 |  |  |
| Cr | 7 | 21.05 | 18.85 |  |
| Cr | 7 | 19.75 |  |  |
| Cr | 7 | 15.76 |  |  |
| Cu | 3 | 27.67 | 26.67 | 26.17 |
| Cu | 3 | 25.44 |  |  |
| Cu | 3 | 26.91 |  |  |
| Cu | 4 | 26.84 | 25.71 |  |
| Cu | 4 | 24.53 |  |  |
| Cu | 4 | 25.76 |  |  |
| Cu | 7 | 25.26 | 26.13 |  |
| Cu | 7 | 25.76 |  |  |
| Cu | 7 | 27.38 |  |  |
| Fe | 3 | 46349.28 | 48783.09 | 48291.40 |
| Fe | 3 | 50000.00 |  |  |
| Fe | 3 | 50000.00 |  |  |
| Fe | 4 | 44076.28 | 48025.43 |  |
| Fe | 4 | 50000.00 |  |  |
| Fe | 4 | 50000.00 |  |  |
| Fe | 7 | 50000.00 | 48065.69 |  |
| Fe | 7 | 50000.00 |  |  |
| Fe | 7 | 44197.06 |  |  |
| K | 3 | 2580.65 | 2530.76 | 2329.19 |
| K | 3 | 2453.49 |  |  |
| K | 3 | 2558.14 |  |  |
| K | 4 | 2329.75 | 2218.44 |  |
| K | 4 | 2011.63 |  |  |
| K | 4 | 2313.95 |  |  |
| K | 7 | 2232.56 | 2238.36 |  |
| K | 7 | 2093.02 |  |  |

|  |  |  |  |  |
|---|---|---|---|---|
| K | 7 | 2389.49 |  |  |
| Mg | 3 | 2246.37 | 2303.93 | 2194.05 |
| Mg | 3 | 2289.35 |  |  |
| Mg | 3 | 2376.07 |  |  |
| Mg | 4 | 2126.11 | 2147.95 |  |
| Mg | 4 | 2095.45 |  |  |
| Mg | 4 | 2222.29 |  |  |
| Mg | 7 | 2140.49 | 2130.26 |  |
| Mg | 7 | 2132.76 |  |  |
| Mg | 7 | 2117.54 |  |  |
| Mn | 3 | 307.83 | 315.49 | 284.68 |
| Mn | 3 | 302.76 |  |  |
| Mn | 3 | 335.88 |  |  |
| Mn | 4 | 267.77 | 270.44 |  |
| Mn | 4 | 270.93 |  |  |
| Mn | 4 | 272.62 |  |  |
| Mn | 7 | 264.03 | 268.11 |  |
| Mn | 7 | 290.37 |  |  |
| Mn | 7 | 249.93 |  |  |
| Na | 3 | 121.16 | 110.34 | 95.59 |
| Na | 3 | 110.55 |  |  |
| Na | 3 | 99.30 |  |  |
| Na | 4 | 77.70 | 85.29 |  |
| Na | 4 | 88.63 |  |  |
| Na | 4 | 89.55 |  |  |
| Na | 7 | 85.99 | 91.14 |  |
| Na | 7 | 89.18 |  |  |
| Na | 7 | 98.26 |  |  |
| Ni | 3 | 25.07 | 29.10 | 26.93 |
| Ni | 3 | 28.35 |  |  |
| Ni | 3 | 33.87 |  |  |
| Ni | 4 | 20.66 | 25.67 |  |
| Ni | 4 | 27.47 |  |  |
| Ni | 4 | 28.88 |  |  |
| Ni | 7 | 26.94 | 26.03 |  |
| Ni | 7 | 28.59 |  |  |
| Ni | 7 | 22.55 |  |  |
| P | 3 | 1731.97 | 1929.98 | 1880.62 |
| P | 3 | 2059.06 |  |  |
| P | 3 | 1998.90 |  |  |
| P | 4 | 1642.24 | 1865.75 |  |
| P | 4 | 1876.67 |  |  |
| P | 4 | 2078.33 |  |  |
| P | 7 | 1877.49 | 1846.15 |  |
| P | 7 | 2044.06 |  |  |
| P | 7 | 1616.90 |  |  |
| Pb | 3 | 32.02 | 34.84 | 32.66 |
| Pb | 3 | 33.92 |  |  |
| Pb | 3 | 38.58 |  |  |
| Pb | 4 | 27.70 | 31.27 |  |
| Pb | 4 | 32.31 |  |  |
| Pb | 4 | 33.80 |  |  |
| Pb | 7 | 31.41 | 31.89 |  |
| Pb | 7 | 37.37 |  |  |
| Pb | 7 | 26.89 |  |  |
| Zn | 3 | 113.20 | 120.70 | 116.04 |
| Zn | 3 | 119.09 |  |  |
| Zn | 3 | 129.80 |  |  |
| Zn | 4 | 106.94 | 113.82 |  |
| Zn | 4 | 114.38 |  |  |
| Zn | 4 | 120.14 |  |  |
| Zn | 7 | 114.08 | 113.60 |  |
| Zn | 7 | 119.65 |  |  |
| Zn | 7 | 107.06 |  |  |

| | 18 week weathering cycle: HNO3 digestion | | | TRT3 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| | | mg kg-1 | | |
| Al | 6 | 12241.30 | 11996.67 | 12174.95 |
| Al | 6 | 12140.99 | | |
| Al | 6 | 11607.72 | | |
| Al | 14 | 12093.03 | 11389.06 | |
| Al | 14 | 11445.78 | | |
| Al | 14 | 10628.37 | | |
| Al | 15 | 12747.14 | 13139.14 | |
| Al | 15 | 13284.84 | | |
| Al | 15 | 13385.43 | | |
| Ca | 6 | 5097.09 | 5063.94 | 5085.49 |
| Ca | 6 | 5065.46 | | |
| Ca | 6 | 5029.26 | | |
| Ca | 14 | 4838.58 | 4803.45 | |
| Ca | 14 | 5385.94 | | |
| Ca | 14 | 4185.84 | | |
| Ca | 15 | 5274.60 | 5389.09 | |
| Ca | 15 | 5559.36 | | |
| Ca | 15 | 5333.32 | | |
| Cd | 6 | 0.40 | 0.40 | 0.41 |
| Cd | 6 | 0.40 | | |
| Cd | 6 | 0.40 | | |
| Cd | 14 | 0.40 | 0.43 | |
| Cd | 14 | 0.40 | | |
| Cd | 14 | 0.49 | | |
| Cd | 15 | 0.40 | 0.40 | |
| Cd | 15 | 0.40 | | |
| Cd | 15 | 0.40 | | |
| Co | 6 | 12.14 | 12.06 | 12.14 |
| Co | 6 | 12.08 | | |
| Co | 6 | 11.96 | | |
| Co | 14 | 12.61 | 12.04 | |
| Co | 14 | 11.78 | | |
| Co | 14 | 11.74 | | |
| Co | 15 | 12.91 | 12.32 | |
| Co | 15 | 11.90 | | |
| Co | 15 | 12.14 | | |
| Cr | 6 | 21.75 | 21.52 | 21.27 |
| Cr | 6 | 21.24 | | |
| Cr | 6 | 21.56 | | |
| Cr | 14 | 21.33 | 19.47 | |
| Cr | 14 | 21.33 | | |
| Cr | 14 | 15.76 | | |
| Cr | 15 | 22.44 | 22.81 | |
| Cr | 15 | 22.77 | | |
| Cr | 15 | 23.23 | | |
| Cu | 6 | 31.44 | 31.06 | 31.35 |
| Cu | 6 | 31.12 | | |
| Cu | 6 | 30.62 | | |
| Cu | 14 | 30.98 | 31.41 | |
| Cu | 14 | 30.94 | | |
| Cu | 14 | 32.31 | | |
| Cu | 15 | 31.16 | 31.58 | |
| Cu | 15 | 31.99 | | |
| Cu | 15 | 31.58 | | |
| Fe | 6 | 50000.00 | 50000.00 | 48848.74 |
| Fe | 6 | 50000.00 | | |
| Fe | 6 | 50000.00 | | |
| Fe | 14 | 49402.50 | 46546.21 | |
| Fe | 14 | 49629.76 | | |
| Fe | 14 | 40606.35 | | |
| Fe | 15 | 50000.00 | 50000.00 | |
| Fe | 15 | 50000.00 | | |
| Fe | 15 | 50000.00 | | |
| K | 6 | 2500.00 | 2437.98 | 2506.27 |
| K | 6 | 2441.86 | | |
| K | 6 | 2372.09 | | |
| K | 14 | 2523.26 | 2499.43 | |
| K | 14 | 2430.23 | | |
| K | 14 | 2544.80 | | |
| K | 15 | 2616.28 | 2581.40 | |
| K | 15 | 2616.28 | | |

| | | | | |
|---|---|---|---|---|
| K | 15 | 2511.63 | | |
| Mg | 6 | 2232.30 | 2183.83 | 2187.48 |
| Mg | 6 | 2179.16 | | |
| Mg | 6 | 2140.04 | | |
| Mg | 14 | 2183.62 | 2131.27 | |
| Mg | 14 | 2136.76 | | |
| Mg | 14 | 2073.42 | | |
| Mg | 15 | 2231.76 | 2247.35 | |
| Mg | 15 | 2262.06 | | |
| Mg | 15 | 2248.23 | | |
| Mn | 6 | 260.42 | 263.69 | 286.18 |
| Mn | 6 | 278.65 | | |
| Mn | 6 | 252.00 | | |
| Mn | 14 | 429.89 | 299.41 | |
| Mn | 14 | 251.34 | | |
| Mn | 14 | 217.01 | | |
| Mn | 15 | 360.44 | 295.45 | |
| Mn | 15 | 264.17 | | |
| Mn | 15 | 261.73 | | |
| Na | 6 | 126.56 | 118.16 | 129.63 |
| Na | 6 | 105.57 | | |
| Na | 6 | 122.34 | | |
| Na | 14 | 125.36 | 132.31 | |
| Na | 14 | 131.92 | | |
| Na | 14 | 139.65 | | |
| Na | 15 | 131.07 | 138.43 | |
| Na | 15 | 141.25 | | |
| Na | 15 | 142.96 | | |
| Ni | 6 | 29.53 | 29.23 | 28.96 |
| Ni | 6 | 30.53 | | |
| Ni | 6 | 27.65 | | |
| Ni | 14 | 33.52 | 28.60 | |
| Ni | 14 | 29.41 | | |
| Ni | 14 | 22.86 | | |
| Ni | 15 | 28.71 | 29.06 | |
| Ni | 15 | 28.35 | | |
| Ni | 15 | 30.11 | | |
| P | 6 | 1947.36 | 1958.04 | 1943.22 |
| P | 6 | 1979.24 | | |
| P | 6 | 1947.51 | | |
| P | 14 | 1904.46 | 1851.21 | |
| P | 14 | 2059.24 | | |
| P | 14 | 1589.92 | | |
| P | 15 | 2055.95 | 2020.43 | |
| P | 15 | 2032.65 | | |
| P | 15 | 1972.68 | | |
| Pb | 6 | 35.71 | 35.11 | 34.99 |
| Pb | 6 | 33.20 | | |
| Pb | 6 | 36.43 | | |
| Pb | 14 | 36.39 | 33.66 | |
| Pb | 14 | 34.35 | | |
| Pb | 14 | 30.24 | | |
| Pb | 15 | 36.11 | 36.21 | |
| Pb | 15 | 36.46 | | |
| Pb | 15 | 36.08 | | |
| Zn | 6 | 116.12 | 115.63 | 115.46 |
| Zn | 6 | 115.58 | | |
| Zn | 6 | 115.19 | | |
| Zn | 14 | 115.92 | 111.99 | |
| Zn | 14 | 116.86 | | |
| Zn | 14 | 103.19 | | |
| Zn | 15 | 120.92 | 118.75 | |
| Zn | 15 | 118.12 | | |
| Zn | 15 | 117.20 | | |

| | 18 week weathering cycle: HNO3 digestion | | | TRT4 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| | | | mg kg-1 | |
| Al | 8 | 12992.55 | 13419.00 | 12841.34 |
| Al | 8 | 12907.38 | | |
| Al | 8 | 14357.07 | | |
| Al | 10 | 12012.41 | 11992.08 | |
| Al | 10 | 13243.39 | | |
| Al | 10 | 10720.43 | | |
| Al | 13 | 13588.71 | 13112.93 | |
| Al | 13 | 13999.29 | | |
| Al | 13 | 11750.79 | | |
| Ca | 8 | 5452.94 | 5363.99 | 5171.51 |
| Ca | 8 | 5253.05 | | |
| Ca | 8 | 5385.99 | | |
| Ca | 10 | 5435.83 | 5428.74 | |
| Ca | 10 | 5849.53 | | |
| Ca | 10 | 5000.85 | | |
| Ca | 13 | 4821.66 | 4721.78 | |
| Ca | 13 | 4657.24 | | |
| Ca | 13 | 4686.46 | | |
| Cd | 8 | 0.40 | 0.45 | 0.64 |
| Cd | 8 | 0.40 | | |
| Cd | 8 | 0.55 | | |
| Cd | 10 | 0.40 | 0.55 | |
| Cd | 10 | 0.72 | | |
| Cd | 10 | 0.54 | | |
| Cd | 13 | 0.40 | 0.91 | |
| Cd | 13 | 0.40 | | |
| Cd | 13 | 1.92 | | |
| Co | 8 | 13.39 | 13.07 | 12.75 |
| Co | 8 | 12.38 | | |
| Co | 8 | 13.45 | | |
| Co | 10 | 12.32 | 12.36 | |
| Co | 10 | 13.45 | | |
| Co | 10 | 11.30 | | |
| Co | 13 | 12.73 | 12.82 | |
| Co | 13 | 12.08 | | |
| Co | 13 | 13.67 | | |
| Cr | 8 | 21.24 | 22.27 | 20.70 |
| Cr | 8 | 22.35 | | |
| Cr | 8 | 23.23 | | |
| Cr | 10 | 19.75 | 19.16 | |
| Cr | 10 | 22.58 | | |
| Cr | 10 | 15.14 | | |
| Cr | 13 | 22.77 | 20.67 | |
| Cr | 13 | 21.89 | | |
| Cr | 13 | 17.35 | | |
| Cu | 8 | 32.90 | 34.03 | 34.48 |
| Cu | 8 | 33.36 | | |
| Cu | 8 | 35.83 | | |
| Cu | 10 | 34.60 | 35.35 | |
| Cu | 10 | 36.15 | | |
| Cu | 10 | 35.31 | | |
| Cu | 13 | 33.50 | 34.07 | |
| Cu | 13 | 32.86 | | |
| Cu | 13 | 35.84 | | |
| Fe | 8 | 49933.00 | 49700.91 | 46903.74 |
| Fe | 8 | 49169.74 | | |
| Fe | 8 | 50000.00 | | |
| Fe | 10 | 44938.03 | 44533.04 | |
| Fe | 10 | 49655.35 | | |
| Fe | 10 | 39005.75 | | |
| Fe | 13 | 50000.00 | 46477.27 | |
| Fe | 13 | 48973.43 | | |
| Fe | 13 | 40458.36 | | |
| K | 8 | 2627.91 | 2693.80 | 2648.55 |
| K | 8 | 2604.65 | | |
| K | 8 | 2848.84 | | |
| K | 10 | 2372.09 | 2494.70 | |
| K | 10 | 2662.79 | | |
| K | 10 | 2449.22 | | |
| K | 13 | 2767.44 | 2757.16 | |
| K | 13 | 2744.19 | | |

|  |  |  |  |  |
|---|---|---|---|---|
| K | 13 | 2759.86 |  |  |
| Mg | 8 | 2138.76 | 2211.68 | 2198.13 |
| Mg | 8 | 2194.63 |  |  |
| Mg | 8 | 2301.64 |  |  |
| Mg | 10 | 2179.98 | 2189.76 |  |
| Mg | 10 | 2324.75 |  |  |
| Mg | 10 | 2064.56 |  |  |
| Mg | 13 | 2249.23 | 2192.95 |  |
| Mg | 13 | 2198.27 |  |  |
| Mg | 13 | 2131.37 |  |  |
| Mn | 8 | 333.44 | 289.53 | 265.52 |
| Mn | 8 | 256.89 |  |  |
| Mn | 8 | 278.26 |  |  |
| Mn | 10 | 255.98 | 251.79 |  |
| Mn | 10 | 284.06 |  |  |
| Mn | 10 | 215.33 |  |  |
| Mn | 13 | 274.54 | 255.25 |  |
| Mn | 13 | 265.08 |  |  |
| Mn | 13 | 226.12 |  |  |
| Na | 8 | 124.85 | 144.95 | 141.66 |
| Na | 8 | 151.62 |  |  |
| Na | 8 | 158.37 |  |  |
| Na | 10 | 158.69 | 143.91 |  |
| Na | 10 | 143.97 |  |  |
| Na | 10 | 129.07 |  |  |
| Na | 13 | 125.46 | 136.11 |  |
| Na | 13 | 152.33 |  |  |
| Na | 13 | 130.54 |  |  |
| Ni | 8 | 28.82 | 29.25 | 28.49 |
| Ni | 8 | 27.41 |  |  |
| Ni | 8 | 31.52 |  |  |
| Ni | 10 | 28.29 | 27.67 |  |
| Ni | 10 | 31.23 |  |  |
| Ni | 10 | 23.49 |  |  |
| Ni | 13 | 32.17 | 28.53 |  |
| Ni | 13 | 29.94 |  |  |
| Ni | 13 | 23.49 |  |  |
| P | 8 | 2131.30 | 2037.77 | 1920.53 |
| P | 8 | 2009.75 |  |  |
| P | 8 | 1972.26 |  |  |
| P | 10 | 1868.27 | 1879.64 |  |
| P | 10 | 2057.94 |  |  |
| P | 10 | 1712.72 |  |  |
| P | 13 | 1950.17 | 1844.19 |  |
| P | 13 | 1864.44 |  |  |
| P | 13 | 1717.96 |  |  |
| Pb | 8 | 30.53 | 34.91 | 34.89 |
| Pb | 8 | 37.37 |  |  |
| Pb | 8 | 36.82 |  |  |
| Pb | 10 | 34.78 | 34.45 |  |
| Pb | 10 | 38.60 |  |  |
| Pb | 10 | 29.96 |  |  |
| Pb | 13 | 34.61 | 35.32 |  |
| Pb | 13 | 36.89 |  |  |
| Pb | 13 | 34.46 |  |  |
| Zn | 8 | 112.11 | 114.95 | 113.43 |
| Zn | 8 | 112.51 |  |  |
| Zn | 8 | 120.22 |  |  |
| Zn | 10 | 112.13 | 113.45 |  |
| Zn | 10 | 122.39 |  |  |
| Zn | 10 | 105.81 |  |  |
| Zn | 13 | 115.68 | 111.90 |  |
| Zn | 13 | 110.72 |  |  |
| Zn | 13 | 109.29 |  |  |

| 18 week weathering cycle: HNO3 digestion | | | | TRT5 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| | | | mg kg-1 | |
| Al | 1 | 15213.88 | 14469.95 | 13734.79 |
| Al | 1 | 14744.57 | | |
| Al | 1 | 13451.40 | | |
| Al | 11 | 14524.25 | 14430.59 | |
| Al | 11 | 14189.91 | | |
| Al | 11 | 14577.61 | | |
| Al | 12 | 12715.08 | 12303.84 | |
| Al | 12 | 12305.82 | | |
| Al | 12 | 11890.61 | | |
| Ca | 1 | 4796.65 | 4921.32 | 5024.45 |
| Ca | 1 | 4963.55 | | |
| Ca | 1 | 5003.76 | | |
| Ca | 11 | 4689.58 | 5026.08 | |
| Ca | 11 | 5058.97 | | |
| Ca | 11 | 5329.70 | | |
| Ca | 12 | 5149.06 | 5125.93 | |
| Ca | 12 | 5193.02 | | |
| Ca | 12 | 5035.72 | | |
| Cd | 1 | 0.40 | 0.40 | 0.45 |
| Cd | 1 | 0.40 | | |
| Cd | 1 | 0.40 | | |
| Cd | 11 | 0.87 | 0.56 | |
| Cd | 11 | 0.40 | | |
| Cd | 11 | 0.40 | | |
| Cd | 12 | 0.40 | 0.40 | |
| Cd | 12 | 0.40 | | |
| Cd | 12 | 0.40 | | |
| Co | 1 | 12.14 | 12.91 | 13.05 |
| Co | 1 | 13.93 | | |
| Co | 1 | 12.67 | | |
| Co | 11 | 12.99 | 13.54 | |
| Co | 11 | 13.45 | | |
| Co | 11 | 14.17 | | |
| Co | 12 | 12.61 | 12.71 | |
| Co | 12 | 12.67 | | |
| Co | 12 | 12.85 | | |
| Cr | 1 | 21.93 | 22.51 | 21.45 |
| Cr | 1 | 24.11 | | |
| Cr | 1 | 21.47 | | |
| Cr | 11 | 18.69 | 21.60 | |
| Cr | 11 | 22.58 | | |
| Cr | 11 | 23.51 | | |
| Cr | 12 | 20.73 | 20.26 | |
| Cr | 12 | 21.19 | | |
| Cr | 12 | 18.87 | | |
| Cu | 1 | 34.92 | 35.48 | 36.40 |
| Cu | 1 | 36.24 | | |
| Cu | 1 | 35.28 | | |
| Cu | 11 | 39.85 | 38.38 | |
| Cu | 11 | 37.34 | | |
| Cu | 11 | 37.94 | | |
| Cu | 12 | 35.92 | 35.34 | |
| Cu | 12 | 35.74 | | |
| Cu | 12 | 34.37 | | |
| Fe | 1 | 45716.66 | 47441.76 | 46547.73 |
| Fe | 1 | 50000.00 | | |
| Fe | 1 | 46608.63 | | |
| Fe | 11 | 40995.15 | 45239.63 | |
| Fe | 11 | 46887.84 | | |
| Fe | 11 | 47835.89 | | |
| Fe | 12 | 47744.21 | 46961.79 | |
| Fe | 12 | 47614.65 | | |
| Fe | 12 | 45526.50 | | |
| K | 1 | 2941.86 | 2899.22 | 2771.40 |
| K | 1 | 3011.63 | | |
| K | 1 | 2744.19 | | |
| K | 11 | 3070.49 | 2988.61 | |
| K | 11 | 2895.35 | | |
| K | 11 | 3000.00 | | |
| K | 12 | 2500.00 | 2426.36 | |
| K | 12 | 2418.60 | | |

| | | | | |
|---|---|---|---|---|
| K | 12 | 2360.47 | | |
| Mg | 1 | 2238.03 | 2250.47 | 2233.05 |
| Mg | 1 | 2328.12 | | |
| Mg | 1 | 2185.26 | | |
| Mg | 11 | 2288.93 | 2322.64 | |
| Mg | 11 | 2315.92 | | |
| Mg | 11 | 2363.06 | | |
| Mg | 12 | 2175.98 | 2126.05 | |
| Mg | 12 | 2133.85 | | |
| Mg | 12 | 2068.33 | | |
| Mn | 1 | 215.77 | 240.20 | 258.09 |
| Mn | 1 | 255.23 | | |
| Mn | 1 | 249.60 | | |
| Mn | 11 | 232.29 | 256.72 | |
| Mn | 11 | 269.54 | | |
| Mn | 11 | 268.32 | | |
| Mn | 12 | 264.39 | 277.34 | |
| Mn | 12 | 260.85 | | |
| Mn | 12 | 306.79 | | |
| Na | 1 | 148.30 | 163.73 | 161.75 |
| Na | 1 | 168.55 | | |
| Na | 1 | 174.33 | | |
| Na | 11 | 154.79 | 171.94 | |
| Na | 11 | 175.72 | | |
| Na | 11 | 185.30 | | |
| Na | 12 | 132.83 | 149.58 | |
| Na | 12 | 161.86 | | |
| Na | 12 | 154.03 | | |
| Ni | 1 | 30.35 | 31.52 | 32.33 |
| Ni | 1 | 32.81 | | |
| Ni | 1 | 31.41 | | |
| Ni | 11 | 43.40 | 35.79 | |
| Ni | 11 | 32.64 | | |
| Ni | 11 | 31.35 | | |
| Ni | 12 | 29.94 | 29.68 | |
| Ni | 12 | 30.88 | | |
| Ni | 12 | 28.24 | | |
| P | 1 | 1875.10 | 1887.96 | 1883.15 |
| P | 1 | 1950.14 | | |
| P | 1 | 1838.65 | | |
| P | 11 | 1670.62 | 1830.35 | |
| P | 11 | 1889.78 | | |
| P | 11 | 1930.64 | | |
| P | 12 | 1980.53 | 1931.13 | |
| P | 12 | 1958.79 | | |
| P | 12 | 1854.06 | | |
| Pb | 1 | 37.15 | 36.57 | 36.09 |
| Pb | 1 | 37.51 | | |
| Pb | 1 | 35.05 | | |
| Pb | 11 | 35.51 | 37.01 | |
| Pb | 11 | 36.14 | | |
| Pb | 11 | 39.38 | | |
| Pb | 12 | 35.00 | 34.69 | |
| Pb | 12 | 35.26 | | |
| Pb | 12 | 33.80 | | |
| Zn | 1 | 109.24 | 115.30 | 114.69 |
| Zn | 1 | 118.15 | | |
| Zn | 1 | 118.50 | | |
| Zn | 11 | 112.58 | 115.91 | |
| Zn | 11 | 116.73 | | |
| Zn | 11 | 118.41 | | |
| Zn | 12 | 115.68 | 112.88 | |
| Zn | 12 | 113.98 | | |
| Zn | 12 | 108.97 | | |

|  | 2 week weathering cycle: totals (aqua regia/HF) |  |  | TRT1 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
|  |  |  | mg kg-1 |  |
| 2 | Al | 95533.25 | 81309.29 | 80952.82 |
| 2 | Al | 67742.11 |  |  |
| 2 | Al | 80652.51 |  |  |
| 5 | Al | 77837.20 | 85327.32 |  |
| 5 | Al | 85106.66 |  |  |
| 5 | Al | 93038.09 |  |  |
| 9 | Al | 75008.16 | 76221.85 |  |
| 9 | Al | 77883.41 |  |  |
| 9 | Al | 75773.97 |  |  |
| 2 | Ba | 430.81 | 415.02 | 449.87 |
| 2 | Ba | 471.26 |  |  |
| 2 | Ba | 343.00 |  |  |
| 5 | Ba | 436.74 | 480.74 |  |
| 5 | Ba | 428.77 |  |  |
| 5 | Ba | 576.72 |  |  |
| 9 | Ba |  | 453.84 |  |
| 9 | Ba | 453.84 |  |  |
| 9 | Ba |  |  |  |
| 2 | Ca | 553.54 | 577.96 | 3005.86 |
| 2 | Ca | 677.90 |  |  |
| 2 | Ca | 502.44 |  |  |
| 5 | Ca | 621.97 | 1584.84 |  |
| 5 | Ca | 726.74 |  |  |
| 5 | Ca | 3405.82 |  |  |
| 9 | Ca | 10226.22 | 6854.79 |  |
| 9 | Ca | 733.16 |  |  |
| 9 | Ca | 9604.98 |  |  |
| 2 | Cd | 2.00 | 2.00 | 2.00 |
| 2 | Cd | 2.00 |  |  |
| 2 | Cd | 2.00 |  |  |
| 5 | Cd | 2.00 | 2.00 |  |
| 5 | Cd | 2.00 |  |  |
| 5 | Cd | 2.00 |  |  |
| 9 | Cd | 2.00 | 2.00 |  |
| 9 | Cd | 2.00 |  |  |
| 9 | Cd | 2.00 |  |  |
| 2 | Co | 8.40 | 9.24 | 11.88 |
| 2 | Co | 10.26 |  |  |
| 2 | Co | 9.06 |  |  |
| 5 | Co | 9.69 | 12.64 |  |
| 5 | Co | 8.63 |  |  |
| 5 | Co | 19.62 |  |  |
| 9 | Co | 12.11 | 13.77 |  |
| 9 | Co | 17.16 |  |  |
| 9 | Co | 12.05 |  |  |
| 2 | Cr | 63.56 | 68.53 | 70.14 |
| 2 | Cr | 86.31 |  |  |
| 2 | Cr | 55.74 |  |  |
| 5 | Cr | 68.34 | 75.52 |  |
| 5 | Cr | 78.80 |  |  |
| 5 | Cr | 79.43 |  |  |
| 9 | Cr | 64.33 | 66.36 |  |
| 9 | Cr | 69.48 |  |  |
| 9 | Cr | 65.28 |  |  |
| 2 | Cu | 11.04 | 7.95 | 18.92 |
| 2 | Cu | 2.00 |  |  |
| 2 | Cu | 10.81 |  |  |
| 5 | Cu | 28.92 | 27.68 |  |
| 5 | Cu | 6.03 |  |  |
| 5 | Cu | 48.08 |  |  |
| 9 | Cu | 19.59 | 21.14 |  |
| 9 | Cu | 26.05 |  |  |
| 9 | Cu | 17.77 |  |  |
| 2 | Fe | 38515.39 | 41841.22 | 42284.93 |
| 2 | Fe | 52555.81 |  |  |
| 2 | Fe | 34452.46 |  |  |
| 5 | Fe | 41727.02 | 44463.99 |  |
| 5 | Fe | 47631.36 |  |  |
| 5 | Fe | 44033.59 |  |  |
| 9 | Fe | 39525.73 | 40549.59 |  |
| 9 | Fe | 42376.42 |  |  |

| | | | | |
|---|---|---|---|---|
| 9 | Fe | 39746.62 | | |
| 2 | K | 4685.49 | 4440.97 | 5825.21 |
| 2 | K | 5107.25 | | |
| 2 | K | 3530.17 | | |
| 5 | K | 6611.04 | 5332.49 | |
| 5 | K | 5311.54 | | |
| 5 | K | 4074.89 | | |
| 9 | K | 7124.52 | 7702.18 | |
| 9 | K | 6803.60 | | |
| 9 | K | 9178.43 | | |
| 2 | Mg | 5194.51 | 5335.91 | 6644.71 |
| 2 | Mg | 6164.24 | | |
| 2 | Mg | 4648.99 | | |
| 5 | Mg | 5408.63 | 5611.08 | |
| 5 | Mg | 5483.81 | | |
| 5 | Mg | 5940.79 | | |
| 9 | Mg | 10858.12 | 8987.14 | |
| 9 | Mg | 5535.31 | | |
| 9 | Mg | 10568.00 | | |
| 2 | Mn | 125.41 | 129.97 | 169.31 |
| 2 | Mn | 152.15 | | |
| 2 | Mn | 112.34 | | |
| 5 | Mn | 138.42 | 142.79 | |
| 5 | Mn | 139.65 | | |
| 5 | Mn | 150.29 | | |
| 9 | Mn | 284.78 | 235.19 | |
| 9 | Mn | 148.26 | | |
| 9 | Mn | 272.54 | | |
| 2 | Mo | 5.00 | 5.06 | 5.02 |
| 2 | Mo | 5.00 | | |
| 2 | Mo | 5.19 | | |
| 5 | Mo | 5.00 | 5.00 | |
| 5 | Mo | 5.00 | | |
| 5 | Mo | 5.00 | | |
| 9 | Mo | 5.00 | 5.00 | |
| 9 | Mo | 5.00 | | |
| 9 | Mo | 5.00 | | |
| 2 | Na | 2302.91 | 5762.96 | 10625.08 |
| 2 | Na | 6285.54 | | |
| 2 | Na | 8700.45 | | |
| 5 | Na | 8944.48 | 7401.85 | |
| 5 | Na | 6973.89 | | |
| 5 | Na | 6287.19 | | |
| 9 | Na | 25685.39 | 18710.42 | |
| 9 | Na | 6339.47 | | |
| 9 | Na | 24106.41 | | |
| 2 | Ni | 10.00 | 15.22 | 15.35 |
| 2 | Ni | 25.66 | | |
| 2 | Ni | 10.00 | | |
| 5 | Ni | 10.00 | 18.86 | |
| 5 | Ni | 10.75 | | |
| 5 | Ni | 35.84 | | |
| 9 | Ni | 10.00 | 11.98 | |
| 9 | Ni | 14.46 | | |
| 9 | Ni | 11.48 | | |
| 2 | P | 708.32 | 773.51 | 839.68 |
| 2 | P | 996.94 | | |
| 2 | P | 615.28 | | |
| 5 | P | 731.76 | 1010.51 | |
| 5 | P | 883.10 | | |
| 5 | P | 1416.67 | | |
| 9 | P | 707.25 | 735.02 | |
| 9 | P | 746.27 | | |
| 9 | P | 751.54 | | |
| 2 | Pb | 120.06 | 124.98 | 137.05 |
| 2 | Pb | 132.37 | | |
| 2 | Pb | 122.50 | | |
| 5 | Pb | 132.53 | 137.62 | |
| 5 | Pb | 121.14 | | |
| 5 | Pb | 159.18 | | |
| 9 | Pb | 155.82 | 148.57 | |
| 9 | Pb | 123.23 | | |
| 9 | Pb | 166.67 | | |
| 2 | S | 3656.28 | 4781.77 | 4613.27 |

| | | | | |
|---|---|---|---|---|
| 2 | S | 6968.24 | | |
| 2 | S | 3720.79 | | |
| 5 | S | 4024.64 | 5082.51 | |
| 5 | S | 6458.66 | | |
| 5 | S | 4764.23 | | |
| 9 | S | 4013.14 | 3975.54 | |
| 9 | S | 3924.14 | | |
| 9 | S | 3989.35 | | |
| 2 | Si | 155560.53 | 184795.43 | 201781.36 |
| 2 | Si | 191440.11 | | |
| 2 | Si | 207385.67 | | |
| 5 | Si | 264862.70 | 205729.07 | |
| 5 | Si | 182932.88 | | |
| 5 | Si | 169391.65 | | |
| 9 | Si | 204806.56 | 214819.56 | |
| 9 | Si | 227274.57 | | |
| 9 | Si | 212377.56 | | |
| 2 | Sr | 89.02 | 93.37 | 122.53 |
| 2 | Sr | 109.65 | | |
| 2 | Sr | 81.44 | | |
| 5 | Sr | 96.32 | 146.23 | |
| 5 | Sr | 96.39 | | |
| 5 | Sr | 245.99 | | |
| 9 | Sr | 141.65 | 128.01 | |
| 9 | Sr | 105.83 | | |
| 9 | Sr | 136.55 | | |
| 2 | Ti | 1837.99 | 2067.96 | 2117.32 |
| 2 | Ti | 2656.74 | | |
| 2 | Ti | 1709.14 | | |
| 5 | Ti | 1927.96 | 2338.61 | |
| 5 | Ti | 2103.14 | | |
| 5 | Ti | 2984.74 | | |
| 9 | Ti | 1892.83 | 1945.40 | |
| 9 | Ti | 2006.63 | | |
| 9 | Ti | 1936.74 | | |
| 2 | Zn | 65.25 | 72.34 | 78.73 |
| 2 | Zn | 83.14 | | |
| 2 | Zn | 68.63 | | |
| 5 | Zn | 75.74 | 85.20 | |
| 5 | Zn | 75.32 | | |
| 5 | Zn | 104.54 | | |
| 9 | Zn | 78.27 | 78.67 | |
| 9 | Zn | 79.53 | | |
| 9 | Zn | 78.20 | | |
| 2 | Zr | 53.98 | 121.77 | 140.26 |
| 2 | Zr | 221.98 | | |
| 2 | Zr | 89.36 | | |
| 5 | Zr | 220.06 | 197.39 | |
| 5 | Zr | 174.73 | | |
| 9 | Zr | 71.37 | 101.61 | |
| 9 | Zr | 163.33 | | |
| 9 | Zr | 70.15 | | |

|  | 2 week weathering cycle: totals (aqua regia/HF) |  |  | TRT2 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
|  |  |  | mg kg-1 |  |
| 3 | Al | 73954.36 | 73796.34 | 75879.55 |
| 3 | Al | 69039.81 |  |  |
| 3 | Al | 78394.85 |  |  |
| 4 | Al | 68744.92 | 75172.42 |  |
| 4 | Al | 82609.57 |  |  |
| 4 | Al | 74162.77 |  |  |
| 7 | Al | 79696.01 | 78669.90 |  |
| 7 | Al | 76755.52 |  |  |
| 7 | Al | 79558.18 |  |  |
| 3 | Ba |  | 407.72 | 407.72 |
| 3 | Ba |  |  |  |
| 3 | Ba |  |  |  |
| 4 | Ba | 392.49 |  |  |
| 4 | Ba |  |  |  |
| 4 | Ba |  |  |  |
| 7 | Ba | 423.73 |  |  |
| 7 | Ba |  |  |  |
| 7 | Ba | 406.94 |  |  |
| 3 | Ca | 11114.57 | 10623.95 | 7827.72 |
| 3 | Ca | 10398.69 |  |  |
| 3 | Ca | 10358.60 |  |  |
| 4 | Ca | 1674.28 | 7713.13 |  |
| 4 | Ca | 10410.14 |  |  |
| 4 | Ca | 11054.97 |  |  |
| 7 | Ca | 1981.44 | 5146.08 |  |
| 7 | Ca | 11574.10 |  |  |
| 7 | Ca | 1882.69 |  |  |
| 3 | Cd | 2.00 | 2.00 | 2.00 |
| 3 | Cd | 2.00 |  |  |
| 3 | Cd | 2.00 |  |  |
| 4 | Cd | 9.62 | 2.00 |  |
| 4 | Cd | 5.53 |  |  |
| 4 | Cd | 2.00 |  |  |
| 7 | Cd | 2.00 | 2.00 |  |
| 7 | Cd | 2.00 |  |  |
| 7 | Cd | 2.00 |  |  |
| 3 | Co | 10.16 | 11.44 | 12.36 |
| 3 | Co | 11.32 |  |  |
| 3 | Co | 12.84 |  |  |
| 4 | Co | 18.94 | 16.62 |  |
| 4 | Co | 17.36 |  |  |
| 4 | Co | 13.57 |  |  |
| 7 | Co | 7.80 | 9.03 |  |
| 7 | Co | 11.72 |  |  |
| 7 | Co | 7.56 |  |  |
| 3 | Cr | 60.98 | 62.64 | 65.13 |
| 3 | Cr | 58.79 |  |  |
| 3 | Cr | 68.15 |  |  |
| 4 | Cr | 58.60 | 63.75 |  |
| 4 | Cr | 70.99 |  |  |
| 4 | Cr | 61.66 |  |  |
| 7 | Cr | 72.55 | 69.02 |  |
| 7 | Cr | 65.09 |  |  |
| 7 | Cr | 69.42 |  |  |
| 3 | Cu | 2.00 | 10.81 | 13.70 |
| 3 | Cu | 13.68 |  |  |
| 3 | Cu | 16.74 |  |  |
| 4 | Cu | 25.09 | 17.39 |  |
| 4 | Cu | 10.84 |  |  |
| 4 | Cu | 16.26 |  |  |
| 7 | Cu | 5.65 | 12.92 |  |
| 7 | Cu | 26.61 |  |  |
| 7 | Cu | 6.50 |  |  |
| 3 | Fe | 38213.07 | 37992.51 | 40047.34 |
| 3 | Fe | 35249.71 |  |  |
| 3 | Fe | 40514.77 |  |  |
| 4 | Fe | 36225.23 | 39579.99 |  |
| 4 | Fe | 44249.33 |  |  |
| 4 | Fe | 38265.40 |  |  |
| 7 | Fe | 44434.17 | 42569.51 |  |
| 7 | Fe | 39965.94 |  |  |

|  |  |  |  |  |
|---|---|---|---|---|
| 7 | Fe | 43308.42 |  |  |
| 3 | K | 6552.86 | 7319.08 | 7445.15 |
| 3 | K | 6803.60 |  |  |
| 3 | K | 8600.77 |  |  |
| 4 | K | 5006.42 | 7044.73 |  |
| 4 | K | 8682.33 |  |  |
| 4 | K | 7445.44 |  |  |
| 7 | K | 7405.52 | 7971.64 |  |
| 7 | K | 9563.54 |  |  |
| 7 | K | 6945.86 |  |  |
| 3 | Mg | 10555.38 | 10383.99 | 8684.24 |
| 3 | Mg | 10027.79 |  |  |
| 3 | Mg | 10568.81 |  |  |
| 4 | Mg | 4874.14 | 8558.20 |  |
| 4 | Mg | 10227.16 |  |  |
| 4 | Mg | 10573.31 |  |  |
| 7 | Mg | 5262.62 | 7110.54 |  |
| 7 | Mg | 10941.89 |  |  |
| 7 | Mg | 5127.10 |  |  |
| 3 | Mn | 243.30 | 232.10 | 214.99 |
| 3 | Mn | 206.46 |  |  |
| 3 | Mn | 246.53 |  |  |
| 4 | Mn | 126.11 | 224.27 |  |
| 4 | Mn | 279.00 |  |  |
| 4 | Mn | 267.69 |  |  |
| 7 | Mn | 137.57 | 188.60 |  |
| 7 | Mn | 291.81 |  |  |
| 7 | Mn | 136.43 |  |  |
| 3 | Mo | 5.00 | 5.00 | 5.00 |
| 3 | Mo | 5.00 |  |  |
| 3 | Mo | 5.00 |  |  |
| 4 | Mo | 5.00 | 5.00 |  |
| 4 | Mo | 5.00 |  |  |
| 4 | Mo | 5.00 |  |  |
| 7 | Mo | 5.00 | 5.00 |  |
| 7 | Mo | 5.00 |  |  |
| 7 | Mo | 5.00 |  |  |
| 3 | Na | 25477.83 | 23864.10 | 18005.30 |
| 3 | Na | 23221.90 |  |  |
| 3 | Na | 22892.59 |  |  |
| 4 | Na | 4823.55 | 18130.26 |  |
| 4 | Na | 25422.71 |  |  |
| 4 | Na | 24144.52 |  |  |
| 7 | Na | 2237.88 | 12021.55 |  |
| 7 | Na | 25431.83 |  |  |
| 7 | Na | 8394.94 |  |  |
| 3 | Ni | 10.00 | 10.00 | 10.00 |
| 3 | Ni | 10.00 |  |  |
| 3 | Ni | 10.00 |  |  |
| 4 | Ni | 10.00 | 10.00 |  |
| 4 | Ni | 10.00 |  |  |
| 4 | Ni | 10.00 |  |  |
| 7 | Ni | 10.00 | 10.00 |  |
| 7 | Ni | 10.00 |  |  |
| 7 | Ni | 17.73 |  |  |
| 3 | P | 848.95 | 826.42 | 864.96 |
| 3 | P | 743.63 |  |  |
| 3 | P | 886.68 |  |  |
| 4 | P | 728.66 | 817.90 |  |
| 4 | P | 960.18 |  |  |
| 4 | P | 764.87 |  |  |
| 7 | P | 966.98 | 950.57 |  |
| 7 | P | 890.75 |  |  |
| 7 | P | 993.99 |  |  |
| 3 | Pb | 117.70 | 121.04 | 124.16 |
| 3 | Pb | 125.05 |  |  |
| 3 | Pb | 120.37 |  |  |
| 4 | Pb | 130.37 | 130.97 |  |
| 4 | Pb | 116.88 |  |  |
| 4 | Pb | 145.65 |  |  |
| 7 | Pb | 115.20 | 120.49 |  |
| 7 | Pb | 136.24 |  |  |
| 7 | Pb | 110.02 |  |  |
| 3 | S | 4921.46 | 4153.85 | 4684.82 |

| | | | | |
|---|---|---|---|---|
| 3 | S | 3574.98 | | |
| 3 | S | 3965.11 | | |
| 4 | S | 3384.54 | 4496.57 | |
| 4 | S | 6185.59 | | |
| 4 | S | 3919.58 | | |
| 7 | S | 6142.39 | 5404.05 | |
| 7 | S | 4134.51 | | |
| 7 | S | 5935.24 | | |
| 3 | Si | 123681.15 | 166238.93 | 174315.33 |
| 3 | Si | 173326.74 | | |
| 3 | Si | 201708.89 | | |
| 4 | Si | 200271.65 | 180430.10 | |
| 4 | Si | 141091.48 | | |
| 4 | Si | 199927.19 | | |
| 7 | Si | 123215.24 | 176276.96 | |
| 7 | Si | 220772.55 | | |
| 7 | Si | 184843.08 | | |
| 3 | Sr | 142.50 | 142.39 | 126.51 |
| 3 | Sr | 141.65 | | |
| 3 | Sr | 143.03 | | |
| 4 | Sr | 97.83 | 119.24 | |
| 4 | Sr | 134.50 | | |
| 4 | Sr | 125.39 | | |
| 7 | Sr | 92.79 | 117.90 | |
| 7 | Sr | 170.86 | | |
| 7 | Sr | 90.06 | | |
| 3 | Ti | 1706.69 | 1740.94 | 1803.96 |
| 3 | Ti | 1630.91 | | |
| 3 | Ti | 1885.22 | | |
| 4 | Ti | 1613.44 | 1783.79 | |
| 4 | Ti | 2024.57 | | |
| 4 | Ti | 1713.35 | | |
| 7 | Ti | 1949.00 | 1887.14 | |
| 7 | Ti | 1835.48 | | |
| 7 | Ti | 1876.95 | | |
| 3 | Zn | 84.28 | 76.78 | 83.50 |
| 3 | Zn | 67.71 | | |
| 3 | Zn | 78.35 | | |
| 4 | Zn | 75.64 | 94.42 | |
| 4 | Zn | 101.43 | | |
| 4 | Zn | 106.19 | | |
| 7 | Zn | 77.84 | 79.30 | |
| 7 | Zn | 83.81 | | |
| 7 | Zn | 76.25 | | |
| 3 | Zr | 73.99 | 61.82 | 108.17 |
| 3 | Zr | 52.31 | | |
| 3 | Zr | 59.17 | | |
| 4 | Zr | 145.33 | 100.66 | |
| 4 | Zr | 99.47 | | |
| 4 | Zr | 57.19 | | |
| 7 | Zr | 78.07 | 162.02 | |
| 7 | Zr | 57.64 | | |
| 7 | Zr | 350.36 | | |

|  | 2 week weathering cycle: totals (aqua regia/HF) |  |  | TRT3 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
|  |  |  | mg kg-1 |  |
| 6 | Al | 95563.19 | 86832.45 | 80578.17 |
| 6 | Al | 78101.71 |  |  |
| 14 | Al | 77728.08 | 76831.51 |  |
| 14 | Al | 71947.94 |  |  |
| 14 | Al | 80818.52 |  |  |
| 15 | Al | 80846.76 | 78070.57 |  |
| 15 | Al | 81682.79 |  |  |
| 15 | Al | 71682.16 |  |  |
| 6 | Ba | 554.73 | 529.26 | 514.99 |
| 6 | Ba | 503.79 |  |  |
| 14 | Ba | 491.82 | 483.87 |  |
| 14 | Ba | 462.96 |  |  |
| 14 | Ba | 496.84 |  |  |
| 15 | Ba | 550.31 | 531.84 |  |
| 15 | Ba | 513.36 |  |  |
| 15 | Ba |  |  |  |
| 6 | Ca | 2687.24 | 2534.77 | 2693.48 |
| 6 | Ca | 2382.30 |  |  |
| 14 | Ca | 2884.03 | 2862.54 |  |
| 14 | Ca | 2754.02 |  |  |
| 14 | Ca | 2949.57 |  |  |
| 15 | Ca | 2770.07 | 2683.15 |  |
| 15 | Ca | 2596.23 |  |  |
| 15 | Ca |  |  |  |
| 6 | Cd | 2.00 | 2.00 | 2.00 |
| 6 | Cd | 2.00 |  |  |
| 14 | Cd | 2.00 | 2.00 |  |
| 14 | Cd | 2.00 |  |  |
| 14 | Cd | 9.38 |  |  |
| 15 | Cd | 2.00 | 2.00 |  |
| 15 | Cd | 2.00 |  |  |
| 15 | Cd | 2.44 |  |  |
| 6 | Co | 15.60 | 15.27 | 16.81 |
| 6 | Co | 14.95 |  |  |
| 14 | Co | 13.86 | 17.26 |  |
| 14 | Co | 14.87 |  |  |
| 14 | Co | 23.05 |  |  |
| 15 | Co | 18.64 | 17.91 |  |
| 15 | Co | 16.02 |  |  |
| 15 | Co | 19.08 |  |  |
| 6 | Cr | 85.37 | 76.76 | 71.92 |
| 6 | Cr | 68.15 |  |  |
| 14 | Cr | 66.76 | 65.45 |  |
| 14 | Cr | 62.04 |  |  |
| 14 | Cr | 67.55 |  |  |
| 15 | Cr | 77.69 | 73.55 |  |
| 15 | Cr | 71.77 |  |  |
| 15 | Cr | 71.20 |  |  |
| 6 | Cu | 35.84 | 40.64 | 41.17 |
| 6 | Cu | 45.43 |  |  |
| 14 | Cu | 28.96 | 37.74 |  |
| 14 | Cu | 40.04 |  |  |
| 14 | Cu | 44.22 |  |  |
| 15 | Cu | 47.72 | 45.15 |  |
| 15 | Cu | 42.82 |  |  |
| 15 | Cu | 44.90 |  |  |
| 6 | Fe | 48099.64 | 43005.42 | 40232.41 |
| 6 | Fe | 37911.21 |  |  |
| 14 | Fe | 38352.18 | 37496.85 |  |
| 14 | Fe | 34871.61 |  |  |
| 14 | Fe | 39266.75 |  |  |
| 15 | Fe | 42379.01 | 40194.96 |  |
| 15 | Fe | 39216.75 |  |  |
| 15 | Fe | 38989.12 |  |  |
| 6 | K | 5311.54 | 5126.89 | 5347.20 |
| 6 | K | 4942.23 |  |  |
| 14 | K | 5286.34 | 5159.48 |  |
| 14 | K | 4685.49 |  |  |
| 14 | K | 5506.61 |  |  |
| 15 | K | 5712.45 | 5755.24 |  |
| 15 | K | 4428.75 |  |  |

| | | | | |
|---|---|---|---|---|
| 15 | K | 7124.52 | | |
| 6 | Mg | 5760.83 | 5544.28 | 5989.36 |
| 6 | Mg | 5327.72 | | |
| 14 | Mg | 5159.28 | 5120.51 | |
| 14 | Mg | 4897.43 | | |
| 14 | Mg | 5304.81 | | |
| 15 | Mg | 5818.49 | 7303.31 | |
| 15 | Mg | 5445.00 | | |
| 15 | Mg | 10646.45 | | |
| 6 | Mn | 143.92 | 134.81 | 150.61 |
| 6 | Mn | 125.69 | | |
| 14 | Mn | 135.14 | 137.05 | |
| 14 | Mn | 128.01 | | |
| 14 | Mn | 148.01 | | |
| 15 | Mn | 143.34 | 179.96 | |
| 15 | Mn | 135.67 | | |
| 15 | Mn | 260.88 | | |
| 6 | Mo | 5.00 | 5.00 | 5.10 |
| 6 | Mo | 5.00 | | |
| 14 | Mo | 5.97 | 5.32 | |
| 14 | Mo | 5.00 | | |
| 14 | Mo | 5.01 | | |
| 15 | Mo | 5.00 | 5.00 | |
| 15 | Mo | 5.00 | | |
| 15 | Mo | 5.00 | | |
| 6 | Na | 4630.34 | 3859.21 | 4687.49 |
| 6 | Na | 3088.09 | | |
| 14 | Na | 2940.74 | 4899.57 | |
| 14 | Na | 5738.91 | | |
| 14 | Na | 6019.06 | | |
| 15 | Na | 2445.80 | 5303.68 | |
| 15 | Na | 8161.57 | | |
| 15 | Na | | | |
| 6 | Ni | 36.98 | 31.57 | 23.81 |
| 6 | Ni | 26.16 | | |
| 14 | Ni | 19.05 | 17.74 | |
| 14 | Ni | 16.07 | | |
| 14 | Ni | 18.11 | | |
| 15 | Ni | 28.00 | 22.11 | |
| 15 | Ni | 17.90 | | |
| 15 | Ni | 20.43 | | |
| 6 | P | 1335.96 | 1166.18 | 1110.16 |
| 6 | P | 996.41 | | |
| 14 | P | 1128.27 | 1103.20 | |
| 14 | P | 1009.43 | | |
| 14 | P | 1171.89 | | |
| 15 | P | 1118.13 | 1061.10 | |
| 15 | P | 1029.20 | | |
| 15 | P | 1035.98 | | |
| 6 | Pb | 151.43 | 139.06 | 133.77 |
| 6 | Pb | 126.69 | | |
| 14 | Pb | 121.89 | 124.96 | |
| 14 | Pb | 129.85 | | |
| 14 | Pb | 123.13 | | |
| 15 | Pb | 137.52 | 137.28 | |
| 15 | Pb | 129.68 | | |
| 15 | Pb | 144.66 | | |
| 6 | S | 5718.65 | 4431.34 | 3856.02 |
| 6 | S | 3144.04 | | |
| 14 | S | 4194.52 | 3729.57 | |
| 14 | S | 3036.04 | | |
| 14 | S | 3958.16 | | |
| 15 | S | 3555.49 | 3407.15 | |
| 15 | S | 3208.47 | | |
| 15 | S | 3457.50 | | |
| 6 | Si | 169514.34 | 157041.56 | 166231.53 |
| 6 | Si | 144568.79 | | |
| 14 | Si | 115013.30 | 142848.27 | |
| 14 | Si | 182837.02 | | |
| 14 | Si | 130694.49 | | |
| 15 | Si | 184526.06 | 198804.77 | |
| 15 | Si | 229504.14 | | |
| 15 | Si | 182384.11 | | |
| 6 | Sr | 200.78 | 192.92 | 194.48 |

| | | | | |
|---|---|---|---|---|
| 6 | Sr | 185.06 | | |
| 14 | Sr | 173.69 | 176.85 | |
| 14 | Sr | 167.01 | | |
| 14 | Sr | 189.86 | | |
| 15 | Sr | 202.14 | 213.67 | |
| 15 | Sr | 192.22 | | |
| 15 | Sr | 246.65 | | |
| 6 | Ti | 2965.76 | 2670.47 | 2481.78 |
| 6 | Ti | 2375.18 | | |
| 14 | Ti | 2325.45 | 2268.85 | |
| 14 | Ti | 2111.92 | | |
| 14 | Ti | 2369.20 | | |
| 15 | Ti | 2602.51 | 2506.03 | |
| 15 | Ti | 2450.27 | | |
| 15 | Ti | 2465.32 | | |
| 6 | Zn | 96.61 | 89.77 | 88.99 |
| 6 | Zn | 82.94 | | |
| 14 | Zn | 84.57 | 86.43 | |
| 14 | Zn | 78.09 | | |
| 14 | Zn | 96.62 | | |
| 15 | Zn | 92.66 | 90.77 | |
| 15 | Zn | 85.13 | | |
| 15 | Zn | 94.53 | | |
| 6 | Zr | 195.36 | 151.51 | 139.15 |
| 6 | Zr | 107.66 | | |
| 14 | Zr | 95.26 | 146.14 | |
| 14 | Zr | 154.94 | | |
| 14 | Zr | 188.23 | | |
| 15 | Zr | 72.59 | 119.81 | |
| 15 | Zr | 213.65 | | |
| 15 | Zr | 73.20 | | |

|  |  | 2 week weathering cycle: totals (aqua regia/HF) |  | TRT4 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
|  |  |  | mg kg-1 |  |
| 8 | Al | 77461.43 | 77369.51 | 85649.18 |
| 8 | Al | 74393.62 |  |  |
| 8 | Al | 80253.48 |  |  |
| 10 | Al | 91235.98 | 93077.16 |  |
| 10 | Al | 94918.35 |  |  |
| 13 | Al | 86664.30 | 86500.88 |  |
| 13 | Al | 96935.41 |  |  |
| 13 | Al | 75902.94 |  |  |
| 8 | Ba | 497.86 | 516.21 | 542.67 |
| 8 | Ba |  |  |  |
| 8 | Ba | 534.57 |  |  |
| 10 | Ba | 570.07 | 557.70 |  |
| 10 | Ba | 545.33 |  |  |
| 13 | Ba |  | 554.10 |  |
| 13 | Ba | 609.20 |  |  |
| 13 | Ba | 499.00 |  |  |
| 8 | Ca | 2977.12 | 3033.72 | 3095.65 |
| 8 | Ca |  |  |  |
| 8 | Ca | 3090.32 |  |  |
| 10 | Ca | 3247.71 | 3174.52 |  |
| 10 | Ca | 3101.32 |  |  |
| 13 | Ca |  | 3078.72 |  |
| 13 | Ca | 3430.30 |  |  |
| 13 | Ca | 2727.14 |  |  |
| 8 | Cd | 2.00 | 2.00 | 2.00 |
| 8 | Cd | 2.00 |  |  |
| 8 | Cd | 2.00 |  |  |
| 10 | Cd | 2.00 | 2.00 |  |
| 10 | Cd | 2.00 |  |  |
| 13 | Cd | 2.00 | 2.00 |  |
| 13 | Cd | 2.00 |  |  |
| 13 | Cd | 2.00 |  |  |
| 8 | Co | 17.91 | 18.09 | 17.73 |
| 8 | Co | 16.87 |  |  |
| 8 | Co | 19.48 |  |  |
| 10 | Co | 18.08 | 17.13 |  |
| 10 | Co | 16.17 |  |  |
| 13 | Co | 17.81 | 17.99 |  |
| 13 | Co | 19.14 |  |  |
| 13 | Co | 17.01 |  |  |
| 8 | Cr | 67.19 | 65.93 | 73.91 |
| 8 | Cr | 60.35 |  |  |
| 8 | Cr | 70.25 |  |  |
| 10 | Cr | 79.59 | 80.91 |  |
| 10 | Cr | 82.24 |  |  |
| 13 | Cr | 74.43 | 74.89 |  |
| 13 | Cr | 84.59 |  |  |
| 13 | Cr | 65.66 |  |  |
| 8 | Cu | 53.72 | 47.74 | 44.04 |
| 8 | Cu | 29.62 |  |  |
| 8 | Cu | 59.90 |  |  |
| 10 | Cu | 42.55 | 40.23 |  |
| 10 | Cu | 37.91 |  |  |
| 13 | Cu | 35.23 | 44.15 |  |
| 13 | Cu | 47.38 |  |  |
| 13 | Cu | 49.83 |  |  |
| 8 | Fe | 35674.84 | 35314.49 | 40255.07 |
| 8 | Fe | 33997.67 |  |  |
| 8 | Fe | 36270.96 |  |  |
| 10 | Fe | 43603.41 | 44456.15 |  |
| 10 | Fe | 45308.90 |  |  |
| 13 | Fe | 41216.72 | 40994.57 |  |
| 13 | Fe | 45985.08 |  |  |
| 13 | Fe | 35781.90 |  |  |
| 8 | K | 6225.93 | 6078.29 | 6655.78 |
| 8 | K | 6938.33 |  |  |
| 8 | K | 5070.60 |  |  |
| 10 | K | 7268.72 | 6596.57 |  |
| 10 | K | 5924.41 |  |  |
| 13 | K | 8529.11 | 7292.50 |  |
| 13 | K | 7764.32 |  |  |

| | | | | |
|---|---|---|---|---|
| 13 | K | 5584.08 | | |
| 8 | Mg | 5077.64 | 7421.55 | 6840.04 |
| 8 | Mg | 11961.04 | | |
| 8 | Mg | 5225.97 | | |
| 10 | Mg | 5881.59 | 5713.25 | |
| 10 | Mg | 5544.91 | | |
| 13 | Mg | 10886.17 | 7385.32 | |
| 13 | Mg | 6226.89 | | |
| 13 | Mg | 5042.91 | | |
| 8 | Mn | 128.15 | 175.90 | 44.04 |
| 8 | Mn | 276.12 | | |
| 8 | Mn | 123.44 | | |
| 10 | Mn | 139.43 | 136.42 | |
| 10 | Mn | 133.41 | | |
| 13 | Mn | 248.48 | 175.01 | |
| 13 | Mn | 154.81 | | |
| 13 | Mn | 121.76 | | |
| 8 | Mo | 5.00 | 5.00 | 5.00 |
| 8 | Mo | 5.01 | | |
| 8 | Mo | 5.46 | | |
| 10 | Mo | 5.00 | 5.00 | |
| 10 | Mo | 5.00 | | |
| 13 | Mo | 5.00 | 5.00 | |
| 13 | Mo | 5.00 | | |
| 13 | Mo | 5.00 | | |
| 8 | Na | 8419.67 | 6527.71 | 7058.63 |
| 8 | Na | | | |
| 8 | Na | 4635.76 | | |
| 10 | Na | 5316.62 | 8495.65 | |
| 10 | Na | 11674.68 | | |
| 13 | Na | | 6152.53 | |
| 13 | Na | 8307.50 | | |
| 13 | Na | 3997.55 | | |
| 8 | Ni | 18.82 | 21.17 | 27.97 |
| 8 | Ni | 17.17 | | |
| 8 | Ni | 27.54 | | |
| 10 | Ni | 33.01 | 32.63 | |
| 10 | Ni | 32.26 | | |
| 13 | Ni | 27.35 | 30.11 | |
| 13 | Ni | 36.60 | | |
| 13 | Ni | 26.39 | | |
| 8 | P | 1087.32 | 1087.12 | 1215.77 |
| 8 | P | 1077.69 | | |
| 8 | P | 1096.37 | | |
| 10 | P | 1307.26 | 1336.70 | |
| 10 | P | 1366.15 | | |
| 13 | P | 1263.95 | 1223.49 | |
| 13 | P | 1359.38 | | |
| 13 | P | 1047.15 | | |
| 8 | Pb | 138.90 | 130.88 | 139.09 |
| 8 | Pb | 109.20 | | |
| 8 | Pb | 144.56 | | |
| 10 | Pb | 160.99 | 144.39 | |
| 10 | Pb | 127.78 | | |
| 13 | Pb | 125.04 | 142.01 | |
| 13 | Pb | 172.59 | | |
| 13 | Pb | 128.41 | | |
| 8 | S | 2888.36 | 3282.71 | 4066.14 |
| 8 | S | 4214.68 | | |
| 8 | S | 2745.10 | | |
| 10 | S | 4494.75 | 4734.87 | |
| 10 | S | 4974.98 | | |
| 13 | S | 4932.51 | 4180.84 | |
| 13 | S | 4823.61 | | |
| 13 | S | 2786.40 | | |
| 8 | Si | 223453.81 | 181324.61 | 177843.81 |
| 8 | Si | 156560.99 | | |
| 8 | Si | 163959.03 | | |
| 10 | Si | 155525.16 | 191368.50 | |
| 10 | Si | 227211.84 | | |
| 13 | Si | 175808.58 | 160838.32 | |
| 13 | Si | 177853.12 | | |
| 13 | Si | 128853.26 | | |
| 8 | Sr | 214.41 | 233.33 | 235.90 |

| | | | | |
|---|---|---|---|---|
| 8 | Sr | 242.23 | | |
| 8 | Sr | 243.34 | | |
| 10 | Sr | 240.04 | 236.39 | |
| 10 | Sr | 232.74 | | |
| 13 | Sr | 250.48 | 237.98 | |
| 13 | Sr | 256.21 | | |
| 13 | Sr | 207.24 | | |
| 8 | Ti | 2453.85 | 2502.12 | 2783.15 |
| 8 | Ti | 2376.97 | | |
| 8 | Ti | 2675.54 | | |
| 10 | Ti | 2980.71 | 3015.60 | |
| 10 | Ti | 3050.49 | | |
| 13 | Ti | 2895.91 | 2831.75 | |
| 13 | Ti | 3173.99 | | |
| 13 | Ti | 2425.36 | | |
| 8 | Zn | 87.63 | 96.97 | 95.48 |
| 8 | Zn | 113.48 | | |
| 8 | Zn | 89.80 | | |
| 10 | Zn | 99.89 | 97.83 | |
| 10 | Zn | 95.76 | | |
| 13 | Zn | 88.38 | 91.63 | |
| 13 | Zn | 104.66 | | |
| 13 | Zn | 81.87 | | |
| 8 | Zr | 256.75 | 195.04 | 209.42 |
| 8 | Zr | 219.75 | | |
| 8 | Zr | 108.63 | | |
| 10 | Zr | 234.84 | 260.12 | |
| 10 | Zr | 285.40 | | |
| 13 | Zr | 115.51 | 173.11 | |
| 13 | Zr | 257.26 | | |
| 13 | Zr | 146.55 | | |

| 2 week weathering cycle: totals (aqua regia/HF) | | | | TRT5 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| | | | mg kg-1 | |
| 1 | Al | 85151.72 | 86541.22 | 86743.94 |
| 1 | Al | 90568.53 | | |
| 1 | Al | 83903.43 | | |
| 11 | Al | 85094.85 | 82817.50 | |
| 11 | Al | 80540.15 | | |
| 12 | Al | 99502.38 | 90873.11 | |
| 12 | Al | 82122.26 | | |
| 12 | Al | 90994.70 | | |
| 1 | Ba | 513.76 | 513.76 | 556.49 |
| 1 | Ba | | | |
| 1 | Ba | | | |
| 11 | Ba | | 564.04 | |
| 11 | Ba | 559.31 | | |
| 11 | Ba | 568.78 | | |
| 12 | Ba | 661.80 | 591.69 | |
| 12 | Ba | 577.68 | | |
| 12 | Ba | 535.59 | | |
| 1 | Ca | 3258.96 | 10179.78 | 7979.11 |
| 1 | Ca | 13957.54 | | |
| 1 | Ca | 13322.85 | | |
| 11 | Ca | 11012.03 | 5778.45 | |
| 11 | Ca | 3223.08 | | |
| 11 | Ca | 3100.23 | | |
| 12 | Ca | 3869.53 | 3346.63 | |
| 12 | Ca | 3215.08 | | |
| 12 | Ca | 2955.27 | | |
| 1 | Cd | 2.00 | 2.00 | 2.00 |
| 1 | Cd | 2.00 | | |
| 1 | Cd | 2.00 | | |
| 11 | Cd | 2.00 | 2.00 | |
| 11 | Cd | 2.00 | | |
| 11 | Cd | 2.00 | | |
| 12 | Cd | 2.00 | 2.00 | |
| 12 | Cd | 2.00 | | |
| 12 | Cd | 2.00 | | |
| 1 | Co | 16.85 | 20.31 | 20.42 |
| 1 | Co | 24.21 | | |
| 1 | Co | 19.89 | | |
| 11 | Co | 22.88 | 20.54 | |
| 11 | Co | 19.23 | | |
| 11 | Co | 19.51 | | |
| 12 | Co | 24.09 | 20.48 | |
| 12 | Co | 20.51 | | |
| 12 | Co | 16.83 | | |
| 1 | Cr | 75.21 | 74.48 | 72.21 |
| 1 | Cr | 75.68 | | |
| 1 | Cr | 72.55 | | |
| 11 | Cr | 68.34 | 69.94 | |
| 11 | Cr | 71.61 | | |
| 11 | Cr | 69.86 | | |
| 12 | Cr | 88.34 | 79.90 | |
| 12 | Cr | 71.77 | | |
| 12 | Cr | 79.59 | | |
| 1 | Cu | 37.51 | 41.20 | 49.20 |
| 1 | Cu | 50.04 | | |
| 1 | Cu | 36.06 | | |
| 11 | Cu | 63.51 | 57.20 | |
| 11 | Cu | 47.20 | | |
| 11 | Cu | 60.91 | | |
| 12 | Cu | 59.05 | 53.67 | |
| 12 | Cu | 60.91 | | |
| 12 | Cu | 41.05 | | |
| 1 | Fe | 41075.43 | 40761.65 | 39233.70 |
| 1 | Fe | 41674.55 | | |
| 1 | Fe | 39534.96 | | |
| 11 | Fe | 36654.26 | 37705.76 | |
| 11 | Fe | 39323.36 | | |
| 11 | Fe | 37139.68 | | |
| 12 | Fe | 46639.28 | 42712.96 | |
| 12 | Fe | 37527.39 | | |
| 12 | Fe | 43972.20 | | |

| | | | | |
|---|---|---|---|---|
| 1 | K | 6230.85 | 8413.11 | 6843.40 |
| 1 | K | 11398.68 | | |
| 1 | K | 7609.81 | | |
| 11 | K | 6611.04 | 5273.69 | |
| 11 | K | 4460.35 | | |
| 11 | K | 4749.68 | | |
| 12 | K | 8920.70 | 8687.44 | |
| 12 | K | 8408.22 | | |
| 12 | K | 8733.40 | | |
| 1 | Mg | 5026.33 | 9153.99 | 7990.27 |
| 1 | Mg | 11734.15 | | |
| 1 | Mg | 10701.50 | | |
| 11 | Mg | 9813.26 | 6826.55 | |
| 11 | Mg | 5387.70 | | |
| 11 | Mg | 5278.69 | | |
| 12 | Mg | 6362.49 | 5733.53 | |
| 12 | Mg | 5404.14 | | |
| 12 | Mg | 5433.96 | | |
| 1 | Mn | 123.46 | 235.56 | 201.54 |
| 1 | Mn | 309.27 | | |
| 1 | Mn | 273.94 | | |
| 11 | Mn | 245.13 | 167.52 | |
| 11 | Mn | 130.00 | | |
| 11 | Mn | 127.45 | | |
| 12 | Mn | 155.15 | 137.48 | |
| 12 | Mn | 127.73 | | |
| 12 | Mn | 129.55 | | |
| 1 | Mo | 5.00 | 5.00 | 5.00 |
| 1 | Mo | 5.00 | | |
| 1 | Mo | 5.00 | | |
| 11 | Mo | 5.00 | 5.00 | |
| 11 | Mo | 5.00 | | |
| 11 | Mo | 5.00 | | |
| 12 | Mo | 5.00 | 5.00 | |
| 12 | Mo | 5.00 | | |
| 12 | Mo | 5.00 | | |
| 1 | Na | 6748.03 | 6748.03 | 4982.11 |
| 1 | Na | | | |
| 1 | Na | | | |
| 11 | Na | | 4109.32 | |
| 11 | Na | 5466.22 | | |
| 11 | Na | 2752.43 | | |
| 12 | Na | 3511.81 | 4088.97 | |
| 12 | Na | 2980.13 | | |
| 12 | Na | 5774.97 | | |
| 1 | Ni | 31.69 | 32.07 | 29.23 |
| 1 | Ni | 34.52 | | |
| 1 | Ni | 30.00 | | |
| 11 | Ni | 19.97 | 26.39 | |
| 11 | Ni | 30.75 | | |
| 11 | Ni | 28.46 | | |
| 12 | Ni | 43.01 | 38.55 | |
| 12 | Ni | 36.03 | | |
| 12 | Ni | 36.60 | | |
| 1 | P | 1308.86 | 1306.97 | 1243.46 |
| 1 | P | 1325.68 | | |
| 1 | P | 1286.39 | | |
| 11 | P | 1136.77 | 1179.95 | |
| 11 | P | 1269.09 | | |
| 11 | P | 1133.99 | | |
| 12 | P | 1497.63 | 1317.21 | |
| 12 | P | 1176.05 | | |
| 12 | P | 1277.94 | | |
| 1 | Pb | 125.76 | 161.90 | 148.23 |
| 1 | Pb | 187.78 | | |
| 1 | Pb | 172.17 | | |
| 11 | Pb | 144.85 | 134.56 | |
| 11 | Pb | 117.25 | | |
| 11 | Pb | 141.59 | | |
| 12 | Pb | 183.19 | 156.04 | |
| 12 | Pb | 156.72 | | |
| 12 | Pb | 128.21 | | |
| 1 | S | 4586.62 | 4600.29 | 3871.18 |
| 1 | S | 4349.48 | | |

| | | | | |
|---|---|---|---|---|
| 1 | S | 4864.78 | | |
| 11 | S | 2963.97 | 3142.07 | |
| 11 | S | 3743.17 | | |
| 11 | S | 2719.08 | | |
| 12 | S | 4531.30 | 3992.92 | |
| 12 | S | 2767.88 | | |
| 12 | S | 4679.59 | | |
| 1 | Si | 143992.66 | 160801.91 | 156994.92 |
| 1 | Si | 176755.74 | | |
| 1 | Si | 161657.33 | | |
| 11 | Si | 174538.16 | 153187.94 | |
| 11 | Si | 136192.31 | | |
| 11 | Si | 148833.34 | | |
| 12 | Si | 152286.25 | 156000.22 | |
| 12 | Si | 157147.95 | | |
| 12 | Si | 158566.47 | | |
| 1 | Sr | 231.57 | 278.89 | 269.51 |
| 1 | Sr | 310.46 | | |
| 1 | Sr | 294.63 | | |
| 11 | Sr | 275.59 | 260.14 | |
| 11 | Sr | 253.50 | | |
| 11 | Sr | 251.34 | | |
| 12 | Sr | 295.65 | 256.39 | |
| 12 | Sr | 251.20 | | |
| 12 | Sr | 222.32 | | |
| 1 | Ti | 2954.69 | 3005.16 | 2934.21 |
| 1 | Ti | 3140.35 | | |
| 1 | Ti | 2920.46 | | |
| 11 | Ti | 2785.75 | 2863.26 | |
| 11 | Ti | 2987.09 | | |
| 11 | Ti | 2816.94 | | |
| 12 | Ti | 3477.07 | 3073.07 | |
| 12 | Ti | 2779.48 | | |
| 12 | Ti | 2962.68 | | |
| 1 | Zn | 92.06 | 97.98 | 98.72 |
| 1 | Zn | 111.28 | | |
| 1 | Zn | 90.59 | | |
| 11 | Zn | 103.86 | 99.46 | |
| 11 | Zn | 97.48 | | |
| 11 | Zn | 97.05 | | |
| 12 | Zn | 113.95 | 100.61 | |
| 12 | Zn | 93.30 | | |
| 12 | Zn | 94.57 | | |
| 1 | Zr | 187.21 | 141.49 | 123.80 |
| 1 | Zr | 131.69 | | |
| 1 | Zr | 105.58 | | |
| 11 | Zr | 92.26 | 106.10 | |
| 11 | Zr | 139.58 | | |
| 11 | Zr | 86.47 | | |
| 12 | Zr | 102.02 | 106.97 | |
| 12 | Zr | 132.58 | | |
| 12 | Zr | 86.31 | | |

| 18 week weathering cycle: totals (aqua regia/HF) | | | | TRT1 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| | | | mg kg-1 | |
| 2 | Al | 75032.94 | 79652.45 | 78749.04 |
| 2 | Al | 80620.16 | | |
| 2 | Al | 83304.26 | | |
| 5 | Al | 78835.30 | 75982.51 | |
| 5 | Al | 71997.93 | | |
| 5 | Al | 77114.30 | | |
| 9 | Al | 78331.93 | 80612.16 | |
| 9 | Al | 83213.55 | | |
| 9 | Al | 80291.01 | | |
| 2 | Ba | 495.35 | 457.34 | 457.34 |
| 2 | Ba | | | |
| 2 | Ba | | | |
| 5 | Ba | 411.19 | | |
| 5 | Ba | | | |
| 5 | Ba | | | |
| 9 | Ba | 465.47 | | |
| 9 | Ba | | | |
| 9 | Ba | | | |
| 2 | Ca | 26391.36 | 27157.36 | 28079.82 |
| 2 | Ca | | | |
| 2 | Ca | 27923.36 | | |
| 5 | Ca | 35514.73 | 30475.74 | |
| 5 | Ca | | | |
| 5 | Ca | 25436.76 | | |
| 9 | Ca | 26489.15 | 26606.35 | |
| 9 | Ca | 26723.54 | | |
| 9 | Ca | | | |
| 2 | Cd | 2.00 | 2.00 | 2.51 |
| 2 | Cd | 2.00 | | |
| 2 | Cd | 2.00 | | |
| 5 | Cd | 2.00 | 3.52 | |
| 5 | Cd | 6.26 | | |
| 5 | Cd | 2.29 | | |
| 9 | Cd | 2.00 | 2.00 | |
| 9 | Cd | 2.00 | | |
| 9 | Cd | 2.00 | | |
| 2 | Co | 15.26 | 14.83 | 15.24 |
| 2 | Co | 10.78 | | |
| 2 | Co | 18.45 | | |
| 5 | Co | 17.99 | 16.81 | |
| 5 | Co | 15.77 | | |
| 5 | Co | 16.66 | | |
| 9 | Co | 15.83 | 14.10 | |
| 9 | Co | 17.03 | | |
| 9 | Co | 9.44 | | |
| 2 | Cr | 63.37 | 69.29 | 68.42 |
| 2 | Cr | 73.87 | | |
| 2 | Cr | 70.63 | | |
| 5 | Cr | 65.47 | 64.71 | |
| 5 | Cr | 64.33 | | |
| 5 | Cr | 64.33 | | |
| 9 | Cr | 67.00 | 71.26 | |
| 9 | Cr | 74.64 | | |
| 9 | Cr | 72.15 | | |
| 2 | Cu | 11.79 | 12.99 | 15.55 |
| 2 | Cu | 11.79 | | |
| 2 | Cu | 15.40 | | |
| 5 | Cu | 17.74 | 21.39 | |
| 5 | Cu | 28.68 | | |
| 5 | Cu | 17.75 | | |
| 9 | Cu | 11.77 | 12.28 | |
| 9 | Cu | 12.52 | | |
| 9 | Cu | 12.55 | | |
| 2 | Fe | 37132.93 | 40998.37 | 40611.98 |
| 2 | Fe | 43921.81 | | |
| 2 | Fe | 41940.36 | | |
| 5 | Fe | 38686.64 | 38610.24 | |
| 5 | Fe | 38331.41 | | |
| 5 | Fe | 38812.67 | | |
| 9 | Fe | 40493.20 | 42227.34 | |
| 9 | Fe | 43293.46 | | |

| | | | | |
|---|---|---|---|---|
| 9 | Fe | 42895.36 | | |
| 2 | K | 11681.64 | 11061.19 | 11082.58 |
| 2 | K | 9370.99 | | |
| 2 | K | 12130.94 | | |
| 5 | K | 12901.16 | 10547.71 | |
| 5 | K | 7638.00 | | |
| 5 | K | 11103.98 | | |
| 9 | K | 13543.00 | 11638.85 | |
| 9 | K | 14441.59 | | |
| 9 | K | 6931.96 | | |
| 2 | Mg | 19812.85 | 20594.15 | 21214.18 |
| 2 | Mg | | | |
| 2 | Mg | 21375.45 | | |
| 5 | Mg | 25127.90 | 22390.08 | |
| 5 | Mg | | | |
| 5 | Mg | 19652.26 | | |
| 9 | Mg | 20403.32 | 20658.30 | |
| 9 | Mg | 20913.29 | | |
| 9 | Mg | | | |
| 2 | Mn | 513.87 | 546.81 | 522.22 |
| 2 | Mn | | | |
| 2 | Mn | 579.75 | | |
| 5 | Mn | 634.30 | 529.31 | |
| 5 | Mn | | | |
| 5 | Mn | 424.32 | | |
| 9 | Mn | 435.57 | 490.54 | |
| 9 | Mn | 545.51 | | |
| 9 | Mn | | | |
| 2 | Mo | 5.00 | 5.00 | 5.00 |
| 2 | Mo | 5.00 | | |
| 2 | Mo | 5.00 | | |
| 5 | Mo | 5.00 | 5.00 | |
| 5 | Mo | 5.00 | | |
| 5 | Mo | 5.00 | | |
| 9 | Mo | 5.00 | 5.00 | |
| 9 | Mo | 5.00 | | |
| 9 | Mo | 5.00 | | |
| 2 | Na | 66212.47 | 68735.60 | 71334.49 |
| 2 | Na | | | |
| 2 | Na | 71258.74 | | |
| 5 | Na | 89042.92 | 76721.63 | |
| 5 | Na | | | |
| 5 | Na | 64400.34 | | |
| 9 | Na | 67799.61 | 68546.23 | |
| 9 | Na | 69292.85 | | |
| 9 | Na | | | |
| 2 | Ni | 10.00 | 12.02 | 11.23 |
| 2 | Ni | 16.07 | | |
| 2 | Ni | 10.00 | | |
| 5 | Ni | 10.00 | 10.00 | |
| 5 | Ni | 10.00 | | |
| 5 | Ni | 10.00 | | |
| 9 | Ni | 11.48 | 11.67 | |
| 9 | Ni | 13.54 | | |
| 9 | Ni | 10.00 | | |
| 2 | P | 748.52 | 766.32 | 750.24 |
| 2 | P | 818.71 | | |
| 2 | P | 731.72 | | |
| 5 | P | 686.45 | 714.04 | |
| 5 | P | 713.69 | | |
| 5 | P | 741.98 | | |
| 9 | P | 806.33 | 770.37 | |
| 9 | P | 751.30 | | |
| 9 | P | 753.48 | | |
| 2 | Pb | 184.40 | 166.00 | 155.07 |
| 2 | Pb | 161.34 | | |
| 2 | Pb | 152.27 | | |
| 5 | Pb | 146.74 | 137.79 | |
| 5 | Pb | 123.09 | | |
| 5 | Pb | 143.55 | | |
| 9 | Pb | 144.32 | 161.42 | |
| 9 | Pb | 217.15 | | |
| 9 | Pb | 122.79 | | |
| 2 | S | 3632.20 | 3707.85 | 3637.16 |

| | | | | |
|---|---|---|---|---|
| 2 | S | 3343.48 | | |
| 2 | S | 4147.88 | | |
| 5 | S | 4161.10 | 3598.46 | |
| 5 | S | 2978.07 | | |
| 5 | S | 3656.21 | | |
| 9 | S | 3689.04 | 3605.18 | |
| 9 | S | 3886.29 | | |
| 9 | S | 3240.23 | | |
| 2 | Si | 301961.49 | 281782.26 | 296405.30 |
| 2 | Si | 205528.55 | | |
| 2 | Si | 337856.75 | | |
| 5 | Si | 350000.00 | 320684.34 | |
| 5 | Si | 324313.90 | | |
| 5 | Si | 287739.11 | | |
| 9 | Si | 302674.07 | 286749.31 | |
| 9 | Si | 305840.33 | | |
| 9 | Si | 251733.54 | | |
| 2 | Sr | 288.13 | 197.09 | 189.10 |
| 2 | Sr | 101.28 | | |
| 2 | Sr | 201.87 | | |
| 5 | Sr | 225.16 | 184.05 | |
| 5 | Sr | 101.97 | | |
| 5 | Sr | 225.02 | | |
| 9 | Sr | 209.45 | 186.16 | |
| 9 | Sr | 242.52 | | |
| 9 | Sr | 106.51 | | |
| 2 | Ti | 2006.27 | 2030.52 | 2052.58 |
| 2 | Ti | 1990.95 | | |
| 2 | Ti | 2094.35 | | |
| 5 | Ti | 2090.68 | 1979.27 | |
| 5 | Ti | 1825.45 | | |
| 5 | Ti | 2021.68 | | |
| 9 | Ti | 2101.08 | 2147.94 | |
| 9 | Ti | 2249.91 | | |
| 9 | Ti | 2092.83 | | |
| 2 | Zn | 86.68 | 82.55 | 83.77 |
| 2 | Zn | 78.41 | | |
| 2 | Zn | | | |
| 5 | Zn | 116.43 | 87.54 | |
| 5 | Zn | 68.83 | | |
| 5 | Zn | 77.36 | | |
| 9 | Zn | 72.21 | 81.23 | |
| 9 | Zn | 102.73 | | |
| 9 | Zn | 68.76 | | |
| 2 | Zr | 68.32 | 101.21 | 146.63 |
| 2 | Zr | 110.87 | | |
| 2 | Zr | 124.44 | | |
| 5 | Zr | 143.20 | 190.57 | |
| 5 | Zr | 352.58 | | |
| 5 | Zr | 75.94 | | |
| 9 | Zr | 91.65 | 148.13 | |
| 9 | Zr | 126.27 | | |
| 9 | Zr | 226.46 | | |

| 18 week weathering cycle: totals (aqua regia/HF) | | | | TRT2 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| . | | | mg kg-1 | |
| 3 | Al | 75870.48 | 76129.08 | 75513.49 |
| 3 | Al | 78882.74 | | |
| 3 | Al | 73634.03 | | |
| 4 | Al | 71002.82 | 73745.37 | |
| 4 | Al | 78428.35 | | |
| 4 | Al | 71804.95 | | |
| 7 | Al | 83511.16 | 76666.01 | |
| 7 | Al | 73025.28 | | |
| 7 | Al | 73461.59 | | |
| 3 | Ba | 464.33 | 434.99 | 427.98 |
| 3 | Ba | 437.42 | | |
| 3 | Ba | 403.21 | | |
| 4 | Ba | | 415.30 | |
| 4 | Ba | | | |
| 4 | Ba | 415.30 | | |
| 7 | Ba | 456.81 | 433.66 | |
| 7 | Ba | | | |
| 7 | Ba | 410.51 | | |
| 3 | Ca | 3269.21 | 3202.42 | 13004.70 |
| 3 | Ca | 3286.00 | | |
| 3 | Ca | 3052.07 | | |
| 4 | Ca | 27567.61 | 23331.80 | |
| 4 | Ca | 39611.68 | | |
| 4 | Ca | 2816.12 | | |
| 7 | Ca | 3396.17 | 12479.88 | |
| 7 | Ca | 30970.29 | | |
| 7 | Ca | 3073.17 | | |
| 3 | Cd | 2.00 | 2.00 | 2.10 |
| 3 | Cd | 2.00 | | |
| 3 | Cd | 2.00 | | |
| 4 | Cd | 2.00 | 2.00 | |
| 4 | Cd | 2.00 | | |
| 4 | Cd | 2.00 | | |
| 7 | Cd | 2.00 | 2.30 | |
| 7 | Cd | 2.00 | | |
| 7 | Cd | 2.90 | | |
| 3 | Co | 10.46 | 10.98 | 13.34 |
| 3 | Co | 11.79 | | |
| 3 | Co | 10.69 | | |
| 4 | Co | 16.19 | 14.59 | |
| 4 | Co | 16.67 | | |
| 4 | Co | 10.92 | | |
| 7 | Co | 11.24 | 14.46 | |
| 7 | Co | 18.05 | | |
| 7 | Co | 14.10 | | |
| 3 | Cr | 68.34 | 69.16 | 67.53 |
| 3 | Cr | 72.54 | | |
| 3 | Cr | 66.62 | | |
| 4 | Cr | 58.98 | 66.17 | |
| 4 | Cr | 75.97 | | |
| 4 | Cr | 63.56 | | |
| 7 | Cr | 73.87 | 67.25 | |
| 7 | Cr | 61.66 | | |
| 7 | Cr | 66.24 | | |
| 3 | Cu | 71.53 | 70.30 | 42.59 |
| 3 | Cu | 71.78 | | |
| 3 | Cu | 67.61 | | |
| 4 | Cu | 30.00 | 36.21 | |
| 4 | Cu | 36.17 | | |
| 4 | Cu | 42.48 | | |
| 7 | Cu | 20.64 | 21.26 | |
| 7 | Cu | 17.03 | | |
| 7 | Cu | 26.12 | | |
| 3 | Fe | 42897.70 | 42679.15 | 41711.66 |
| 3 | Fe | 44230.53 | | |
| 3 | Fe | 40909.24 | | |
| 4 | Fe | 35720.06 | 40532.43 | |
| 4 | Fe | 46569.28 | | |
| 4 | Fe | 39307.97 | | |
| 7 | Fe | 45723.43 | 41923.39 | |
| 7 | Fe | 38180.43 | | |

|  |  |  |  |  |
|---|---|---|---|---|
| 7 | Fe | 41866.31 |  |  |
| 3 | K | 6033.38 | 6225.93 | 8272.71 |
| 3 | K | 5648.27 |  |  |
| 3 | K | 6996.15 |  |  |
| 4 | K | 10783.06 | 9563.54 |  |
| 4 | K | 11938.38 |  |  |
| 4 | K | 5969.19 |  |  |
| 7 | K | 8985.88 | 9028.67 |  |
| 7 | K | 11424.90 |  |  |
| 7 | K | 6675.22 |  |  |
| 3 | Mg | 5376.76 | 5345.97 | 10586.66 |
| 3 | Mg | 5524.27 |  |  |
| 3 | Mg | 5136.89 |  |  |
| 4 | Mg | 19179.47 | 15713.20 |  |
| 4 | Mg | 22931.92 |  |  |
| 4 | Mg | 5028.20 |  |  |
| 7 | Mg | 5659.53 | 10700.80 |  |
| 7 | Mg | 21269.21 |  |  |
| 7 | Mg | 5173.67 |  |  |
| 3 | Mn | 177.85 | 178.74 | 169.56 |
| 3 | Mn | 183.62 |  |  |
| 3 | Mn | 174.76 |  |  |
| 4 | Mn |  | 151.56 |  |
| 4 | Mn |  |  |  |
| 4 | Mn | 151.56 |  |  |
| 7 | Mn | 184.88 | 178.38 |  |
| 7 | Mn |  |  |  |
| 7 | Mn | 171.88 |  |  |
| 3 | Mo | 5.00 | 5.33 | 5.11 |
| 3 | Mo | 5.00 |  |  |
| 3 | Mo | 6.01 |  |  |
| 4 | Mo | 5.00 | 5.00 |  |
| 4 | Mo | 5.00 |  |  |
| 4 | Mo | 5.00 |  |  |
| 7 | Mo | 5.00 | 5.00 |  |
| 7 | Mo | 5.00 |  |  |
| 7 | Mo | 5.00 |  |  |
| 3 | Na | 10851.86 | 11516.68 | 31101.23 |
| 3 | Na | 10935.32 |  |  |
| 3 | Na | 12762.86 |  |  |
| 4 | Na | 63431.47 | 47859.78 |  |
| 4 | Na | 69061.51 |  |  |
| 4 | Na | 11086.36 |  |  |
| 7 | Na | 18225.53 | 33927.24 |  |
| 7 | Na | 72023.95 |  |  |
| 7 | Na | 11532.25 |  |  |
| 3 | Ni | 15.38 | 12.85 | 11.33 |
| 3 | Ni | 12.39 |  |  |
| 3 | Ni | 10.79 |  |  |
| 4 | Ni | 10.00 | 10.11 |  |
| 4 | Ni | 10.00 |  |  |
| 4 | Ni | 10.33 |  |  |
| 7 | Ni | 13.08 | 11.02 |  |
| 7 | Ni | 10.00 |  |  |
| 7 | Ni | 10.00 |  |  |
| 3 | P | 1077.92 | 1045.99 | 1011.53 |
| 3 | P | 1031.06 |  |  |
| 3 | P | 1029.00 |  |  |
| 4 | P | 865.01 | 967.78 |  |
| 4 | P | 1056.58 |  |  |
| 4 | P | 981.77 |  |  |
| 7 | P | 1012.07 | 1020.81 |  |
| 7 | P | 923.45 |  |  |
| 7 | P | 1126.92 |  |  |
| 3 | Pb | 127.47 | 122.25 | 129.30 |
| 3 | Pb | 121.87 |  |  |
| 3 | Pb | 117.41 |  |  |
| 4 | Pb | 136.33 | 135.45 |  |
| 4 | Pb | 150.59 |  |  |
| 4 | Pb | 119.44 |  |  |
| 7 | Pb | 139.47 | 130.19 |  |
| 7 | Pb | 136.36 |  |  |
| 7 | Pb | 114.74 |  |  |
| 3 | S | 2824.73 | 2699.85 | 2936.25 |

| | | | | |
|---|---|---|---|---|
| 3 | S | 2747.50 | | |
| 3 | S | 2527.33 | | |
| 4 | S | 3106.07 | 3142.91 | |
| 4 | S | 3707.49 | | |
| 4 | S | 2615.16 | | |
| 7 | S | 2812.13 | 2966.00 | |
| 7 | S | 3392.59 | | |
| 7 | S | 2693.30 | | |
| 3 | Si | 286971.28 | 275770.40 | 292776.25 |
| 3 | Si | 281517.58 | | |
| 3 | Si | 258822.36 | | |
| 4 | Si | 259163.88 | 287229.53 | |
| 4 | Si | 350000.00 | | |
| 4 | Si | 252524.72 | | |
| 7 | Si | 350000.00 | 315328.82 | |
| 7 | Si | 319549.29 | | |
| 7 | Si | 276437.16 | | |
| 3 | Sr | 92.18 | 96.13 | 144.56 |
| 3 | Sr | 99.76 | | |
| 3 | Sr | 96.46 | | |
| 4 | Sr | 245.82 | 208.20 | |
| 4 | Sr | 290.61 | | |
| 4 | Sr | 88.19 | | |
| 7 | Sr | 102.66 | 129.34 | |
| 7 | Sr | 189.47 | | |
| 7 | Sr | 95.90 | | |
| 3 | Ti | 1569.98 | 1646.38 | 1720.28 |
| 3 | Ti | 1635.75 | | |
| 3 | Ti | 1733.42 | | |
| 4 | Ti | 1704.03 | 1766.72 | |
| 4 | Ti | 2016.58 | | |
| 4 | Ti | 1579.57 | | |
| 7 | Ti | 1842.29 | 1747.73 | |
| 7 | Ti | 1727.87 | | |
| 7 | Ti | 1673.03 | | |
| 3 | Zn | 100.18 | 100.19 | 102.65 |
| 3 | Zn | 105.22 | | |
| 3 | Zn | 95.18 | | |
| 4 | Zn | 99.93 | 104.26 | |
| 4 | Zn | 127.23 | | |
| 4 | Zn | 85.61 | | |
| 7 | Zn | 100.02 | 103.50 | |
| 7 | Zn | 118.17 | | |
| 7 | Zn | 92.30 | | |
| 3 | Zr | 272.52 | 280.45 | 226.53 |
| 3 | Zr | 343.89 | | |
| 3 | Zr | 224.94 | | |
| 4 | Zr | 63.90 | 90.84 | |
| 4 | Zr | 74.27 | | |
| 4 | Zr | 134.35 | | |
| 7 | Zr | 118.19 | 308.30 | |
| 7 | Zr | 692.04 | | |
| 7 | Zr | 114.68 | | |

|  | 18 week weathering cycle: totals (aqua regia/HF) |  |  | TRT3 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
|  |  |  | mg kg-1 |  |
| 6 | Al | 71016.24 | 79852.14 | 77437.97 |
| 6 | Al | 82165.63 |  |  |
| 6 | Al | 86374.55 |  |  |
| 14 | Al | 79774.77 | 76891.26 |  |
| 14 | Al | 72617.13 |  |  |
| 14 | Al | 78281.88 |  |  |
| 15 | Al | 77397.16 | 75570.52 |  |
| 15 | Al | 75593.71 |  |  |
| 15 | Al | 73720.69 |  |  |
| 6 | Ba | 458.63 | 528.64 | 492.91 |
| 6 | Ba | 523.86 |  |  |
| 6 | Ba | 603.45 |  |  |
| 14 | Ba |  | 506.29 |  |
| 14 | Ba | 512.22 |  |  |
| 14 | Ba | 500.36 |  |  |
| 15 | Ba |  | 443.81 |  |
| 15 | Ba | 444.49 |  |  |
| 15 | Ba | 443.12 |  |  |
| 6 | Ca | 3458.46 | 3730.61 | 3496.06 |
| 6 | Ca | 3751.65 |  |  |
| 6 | Ca | 3981.73 |  |  |
| 14 | Ca |  | 3283.29 |  |
| 14 | Ca | 3201.32 |  |  |
| 14 | Ca | 3365.26 |  |  |
| 15 | Ca |  | 3474.29 |  |
| 15 | Ca | 3510.20 |  |  |
| 15 | Ca | 3438.37 |  |  |
| 6 | Cd | 2.00 | 2.00 | 2.00 |
| 6 | Cd | 2.00 |  |  |
| 6 | Cd | 2.00 |  |  |
| 14 | Cd | 2.00 | 2.00 |  |
| 14 | Cd | 2.00 |  |  |
| 14 | Cd | 2.00 |  |  |
| 15 | Cd | 2.00 | 2.00 |  |
| 15 | Cd | 2.00 |  |  |
| 15 | Cd |  |  |  |
| 6 | Co | 15.07 | 16.14 | 17.24 |
| 6 | Co | 15.58 |  |  |
| 6 | Co | 17.78 |  |  |
| 14 | Co | 22.00 | 16.80 |  |
| 14 | Co | 14.05 |  |  |
| 14 | Co | 14.35 |  |  |
| 15 | Co | 19.75 | 18.78 |  |
| 15 | Co | 12.90 |  |  |
| 15 | Co | 23.68 |  |  |
| 6 | Cr | 63.95 | 72.66 | 68.23 |
| 6 | Cr | 75.02 |  |  |
| 6 | Cr | 79.03 |  |  |
| 14 | Cr | 67.38 | 67.06 |  |
| 14 | Cr | 65.09 |  |  |
| 14 | Cr | 68.72 |  |  |
| 15 | Cr | 64.71 | 64.96 |  |
| 15 | Cr | 66.43 |  |  |
| 15 | Cr | 63.76 |  |  |
| 6 | Cu | 43.70 | 55.58 | 46.60 |
| 6 | Cu | 52.97 |  |  |
| 6 | Cu | 70.07 |  |  |
| 14 | Cu | 48.83 | 44.53 |  |
| 14 | Cu | 40.83 |  |  |
| 14 | Cu | 43.92 |  |  |
| 15 | Cu | 37.17 | 39.71 |  |
| 15 | Cu | 37.73 |  |  |
| 15 | Cu | 44.22 |  |  |
| 6 | Fe | 37462.69 | 41733.17 | 39371.40 |
| 6 | Fe | 42838.71 |  |  |
| 6 | Fe | 44898.11 |  |  |
| 14 | Fe | 38362.85 | 38418.55 |  |
| 14 | Fe | 37437.48 |  |  |
| 14 | Fe | 39455.31 |  |  |
| 15 | Fe | 37886.01 | 37962.49 |  |
| 15 | Fe | 38372.21 |  |  |

| | | | | |
|---|---|---|---|---|
| 15 | Fe | 37629.26 | | |
| 6 | K | 5006.42 | 6611.04 | 7366.99 |
| 6 | K | 6803.59 | | |
| 6 | K | 8023.11 | | |
| 14 | K | 12195.12 | 7830.55 | |
| 14 | K | 5327.34 | | |
| 14 | K | 5969.19 | | |
| 15 | K | 11296.53 | 7659.39 | |
| 15 | K | 6354.30 | | |
| 15 | K | 5327.34 | | |
| 6 | Mg | 4868.42 | 5445.68 | 5176.96 |
| 6 | Mg | 5591.70 | | |
| 6 | Mg | 5876.92 | | |
| 14 | Mg | | 5114.62 | |
| 14 | Mg | 5015.94 | | |
| 14 | Mg | 5213.30 | | |
| 15 | Mg | | 4970.58 | |
| 15 | Mg | 5040.86 | | |
| 15 | Mg | 4900.29 | | |
| 6 | Mn | 155.08 | 172.60 | 159.98 |
| 6 | Mn | 177.85 | | |
| 6 | Mn | 184.88 | | |
| 14 | Mn | | 146.78 | |
| 14 | Mn | 144.88 | | |
| 14 | Mn | 148.68 | | |
| 15 | Mn | | 160.56 | |
| 15 | Mn | 156.20 | | |
| 15 | Mn | 164.92 | | |
| 6 | Mo | 5.00 | 5.00 | 5.00 |
| 6 | Mo | 5.00 | | |
| 6 | Mo | 5.00 | | |
| 14 | Mo | 5.00 | 5.00 | |
| 14 | Mo | 5.00 | | |
| 14 | Mo | 5.00 | | |
| 15 | Mo | 5.00 | 5.00 | |
| 15 | Mo | 5.00 | | |
| 15 | Mo | 5.00 | | |
| 6 | Na | 6324.50 | 10019.20 | 11018.00 |
| 6 | Na | 14027.94 | | |
| 6 | Na | 9705.16 | | |
| 14 | Na | | 10741.63 | |
| 14 | Na | 6626.60 | | |
| 14 | Na | 14856.66 | | |
| 15 | Na | | 12293.16 | |
| 15 | Na | 13119.39 | | |
| 15 | Na | 11466.93 | | |
| 6 | Ni | 15.38 | 20.65 | 17.72 |
| 6 | Ni | 21.11 | | |
| 6 | Ni | 25.48 | | |
| 14 | Ni | 20.43 | 16.98 | |
| 14 | Ni | 18.59 | | |
| 14 | Ni | 11.93 | | |
| 15 | Ni | 12.39 | 15.53 | |
| 15 | Ni | 20.88 | | |
| 15 | Ni | 13.31 | | |
| 6 | P | 1156.37 | 1196.71 | 1136.71 |
| 6 | P | 1170.48 | | |
| 6 | P | 1263.29 | | |
| 14 | P | 1038.78 | 1052.14 | |
| 14 | P | 1068.80 | | |
| 14 | P | 1048.83 | | |
| 15 | P | 1134.42 | 1161.27 | |
| 15 | P | 1162.09 | | |
| 15 | P | 1187.30 | | |
| 6 | Pb | 131.37 | 152.37 | 150.91 |
| 6 | Pb | 151.51 | | |
| 6 | Pb | 174.23 | | |
| 14 | Pb | 218.49 | 164.73 | |
| 14 | Pb | 139.30 | | |
| 14 | Pb | 136.40 | | |
| 15 | Pb | 151.81 | 135.63 | |
| 15 | Pb | 131.35 | | |
| 15 | Pb | 123.73 | | |
| 6 | S | 2314.99 | 2483.69 | 2538.52 |

| | | | | |
|---|---|---|---|---|
| 6 | S | 2472.47 | | |
| 6 | S | 2663.62 | | |
| 14 | S | 3008.79 | 2600.55 | |
| 14 | S | 2385.30 | | |
| 14 | S | 2407.56 | | |
| 15 | S | 2902.92 | 2531.31 | |
| 15 | S | 2365.71 | | |
| 15 | S | 2325.29 | | |
| 6 | Si | 164161.16 | 249664.67 | 260038.21 |
| 6 | Si | 312067.44 | | |
| 6 | Si | 272765.41 | | |
| 14 | Si | 291148.99 | 248966.84 | |
| 14 | Si | 179407.30 | | |
| 14 | Si | 276344.24 | | |
| 15 | Si | 301061.98 | 281483.12 | |
| 15 | Si | 278905.06 | | |
| 15 | Si | 264482.33 | | |
| 6 | Sr | 145.37 | 166.50 | 190.78 |
| 6 | Sr | 173.76 | | |
| 6 | Sr | 180.37 | | |
| 14 | Sr | 295.16 | 203.25 | |
| 14 | Sr | 150.47 | | |
| 14 | Sr | 164.11 | | |
| 15 | Sr | 295.71 | 202.60 | |
| 15 | Sr | 151.57 | | |
| 15 | Sr | 160.53 | | |
| 6 | Ti | 1980.38 | 2213.56 | 2130.54 |
| 6 | Ti | 2271.77 | | |
| 6 | Ti | 2388.53 | | |
| 14 | Ti | 2258.69 | 2140.32 | |
| 14 | Ti | 2023.48 | | |
| 14 | Ti | 2138.80 | | |
| 15 | Ti | 2179.03 | 2037.75 | |
| 15 | Ti | 2002.33 | | |
| 15 | Ti | 1931.90 | | |
| 6 | Zn | 91.02 | 108.80 | 102.93 |
| 6 | Zn | 104.04 | | |
| 6 | Zn | 131.34 | | |
| 14 | Zn | 123.60 | 102.32 | |
| 14 | Zn | 88.28 | | |
| 14 | Zn | 95.08 | | |
| 15 | Zn | 101.45 | 97.68 | |
| 15 | Zn | 92.73 | | |
| 15 | Zn | 98.87 | | |
| 6 | Zr | 136.33 | 208.36 | 177.54 |
| 6 | Zr | 152.04 | | |
| 6 | Zr | 336.72 | | |
| 14 | Zr | 128.10 | 170.54 | |
| 14 | Zr | 123.22 | | |
| 14 | Zr | 260.32 | | |
| 15 | Zr | 121.24 | 153.72 | |
| 15 | Zr | 155.24 | | |
| 15 | Zr | 184.68 | | |

| 18 week weathering cycle: totals (aqua regia/HF) | | | | TRT4 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| | | | mg kg-1 | |
| 8 | Al | 84213.23 | 80358.29 | 83210.62 |
| 8 | Al | 78738.00 | | |
| 8 | Al | 78123.66 | | |
| 10 | Al | 86781.17 | 84297.11 | |
| 10 | Al | 89675.90 | | |
| 10 | Al | 76434.26 | | |
| 13 | Al | 81867.03 | 84976.46 | |
| 13 | Al | 86182.00 | | |
| 13 | Al | 86880.36 | | |
| 8 | Ba | 527.73 | 508.92 | 525.97 |
| 8 | Ba | | | |
| 8 | Ba | 490.10 | | |
| 10 | Ba | 564.68 | 529.86 | |
| 10 | Ba | 541.42 | | |
| 10 | Ba | 483.49 | | |
| 13 | Ba | 535.26 | 539.13 | |
| 13 | Ba | | | |
| 13 | Ba | 543.01 | | |
| 8 | Ca | 3879.62 | 3756.14 | 3903.57 |
| 8 | Ca | | | |
| 8 | Ca | 3632.67 | | |
| 10 | Ca | 3997.41 | 4102.88 | |
| 10 | Ca | 4572.60 | | |
| 10 | Ca | 3738.62 | | |
| 13 | Ca | 3658.36 | 3851.69 | |
| 13 | Ca | | | |
| 13 | Ca | 4045.02 | | |
| 8 | Cd | 2.00 | 2.00 | 2.00 |
| 8 | Cd | 2.00 | | |
| 8 | Cd | 2.00 | | |
| 10 | Cd | | 2.00 | |
| 10 | Cd | 2.00 | | |
| 10 | Cd | 2.00 | | |
| 13 | Cd | 2.00 | 2.00 | |
| 13 | Cd | 2.00 | | |
| 13 | Cd | 2.00 | | |
| 8 | Co | 18.92 | 19.64 | 19.53 |
| 8 | Co | 23.19 | | |
| 8 | Co | 16.82 | | |
| 10 | Co | 24.01 | 19.72 | |
| 10 | Co | 18.14 | | |
| 10 | Co | 17.00 | | |
| 13 | Co | 17.12 | 19.23 | |
| 13 | Co | 23.07 | | |
| 13 | Co | 17.49 | | |
| 8 | Cr | 75.59 | 70.43 | 73.09 |
| 8 | Cr | 66.24 | | |
| 8 | Cr | 69.48 | | |
| 10 | Cr | 77.88 | 75.72 | |
| 10 | Cr | 79.03 | | |
| 10 | Cr | 70.25 | | |
| 13 | Cr | 70.82 | 73.11 | |
| 13 | Cr | 72.92 | | |
| 13 | Cr | 75.59 | | |
| 8 | Cu | 54.73 | 51.46 | 51.17 |
| 8 | Cu | 50.35 | | |
| 8 | Cu | 49.32 | | |
| 10 | Cu | 62.23 | 58.61 | |
| 10 | Cu | 60.65 | | |
| 10 | Cu | 52.94 | | |
| 13 | Cu | 42.07 | 43.43 | |
| 13 | Cu | 43.07 | | |
| 13 | Cu | 45.16 | | |
| 8 | Fe | 40678.47 | 38556.44 | 40128.17 |
| 8 | Fe | 36516.53 | | |
| 8 | Fe | 38474.33 | | |
| 10 | Fe | 41449.75 | 40425.89 | |
| 10 | Fe | 41795.88 | | |
| 10 | Fe | 38032.04 | | |
| 13 | Fe | 41500.94 | 41402.19 | |
| 13 | Fe | 40509.05 | | |

| | | | | |
|---|---|---|---|---|
| 13 | Fe | 42196.59 | | |
| 8 | K | 5840.82 | 7937.53 | 7737.84 |
| 8 | K | 11681.64 | | |
| 8 | K | 6290.12 | | |
| 10 | K | 6482.67 | 7231.49 | |
| 10 | K | 8985.88 | | |
| 10 | K | 6225.93 | | |
| 13 | K | 5648.27 | 8044.50 | |
| 13 | K | 10718.87 | | |
| 13 | K | 7766.37 | | |
| 8 | Mg | 5523.46 | 5357.14 | 8721.98 |
| 8 | Mg | | | |
| 8 | Mg | 5190.83 | | |
| 10 | Mg | 5688.54 | 5511.06 | |
| 10 | Mg | 5666.48 | | |
| 10 | Mg | 5178.16 | | |
| 13 | Mg | 5306.88 | 5438.05 | |
| 13 | Mg | | | |
| 13 | Mg | 5569.22 | | |
| 8 | Mn | 166.04 | 157.71 | 159.57 |
| 8 | Mn | | | |
| 8 | Mn | 149.38 | | |
| 10 | Mn | 164.22 | 154.75 | |
| 10 | Mn | 156.90 | | |
| 10 | Mn | 143.13 | | |
| 13 | Mn | 162.88 | 166.25 | |
| 13 | Mn | | | |
| 13 | Mn | 169.63 | | |
| 8 | Mo | 5.00 | 5.00 | 5.00 |
| 8 | Mo | 5.00 | | |
| 8 | Mo | 5.00 | | |
| 10 | Mo | 5.00 | 5.00 | |
| 10 | Mo | 5.00 | | |
| 10 | Mo | 5.00 | | |
| 13 | Mo | 5.00 | 5.00 | |
| 13 | Mo | 5.00 | | |
| 13 | Mo | 5.00 | | |
| 8 | Na | 16801.24 | 13024.59 | 13450.74 |
| 8 | Na | | | |
| 8 | Na | 9247.94 | | |
| 10 | Na | 13301.73 | 12401.34 | |
| 10 | Na | 19640.75 | | |
| 10 | Na | 4261.54 | | |
| 13 | Na | 9922.89 | 14926.29 | |
| 13 | Na | | | |
| 13 | Na | 19929.69 | | |
| 8 | Ni | 17.44 | 17.29 | 23.05 |
| 8 | Ni | 16.29 | | |
| 8 | Ni | 18.13 | | |
| 10 | Ni | 28.46 | 25.24 | |
| 10 | Ni | 25.02 | | |
| 10 | Ni | 22.26 | | |
| 13 | Ni | 22.49 | 26.62 | |
| 13 | Ni | 28.46 | | |
| 13 | Ni | 28.92 | | |
| 8 | P | 1170.35 | 1142.98 | 1184.36 |
| 8 | P | 1072.63 | | |
| 8 | P | 1185.98 | | |
| 10 | P | 1205.33 | 1192.40 | |
| 10 | P | 1213.20 | | |
| 10 | P | 1158.69 | | |
| 13 | P | 1283.78 | 1217.70 | |
| 13 | P | 1172.13 | | |
| 13 | P | 1197.20 | | |
| 8 | Pb | 138.23 | 165.70 | 152.06 |
| 8 | Pb | 228.48 | | |
| 8 | Pb | 130.39 | | |
| 10 | Pb | 158.47 | 144.48 | |
| 10 | Pb | 146.67 | | |
| 10 | Pb | 128.29 | | |
| 13 | Pb | 141.71 | 146.00 | |
| 13 | Pb | 152.19 | | |
| 13 | Pb | 144.10 | | |
| 8 | S | 2342.44 | 2538.57 | 2522.65 |

| | | | | |
|---|---|---|---|---|
| 8 | S | 2861.89 | | |
| 8 | S | 2411.39 | | |
| 10 | S | 2351.98 | 2360.48 | |
| 10 | S | 2444.81 | | |
| 10 | S | 2284.66 | | |
| 13 | S | 2491.06 | 2668.90 | |
| 13 | S | 3155.27 | | |
| 13 | S | 2360.39 | | |
| 8 | Si | 316017.52 | 283556.71 | 286704.59 |
| 8 | Si | 279257.54 | | |
| 8 | Si | 255395.07 | | |
| 10 | Si | 293784.15 | 258973.93 | |
| 10 | Si | 350000.00 | | |
| 10 | Si | 133137.63 | | |
| 13 | Si | 285597.26 | 317583.13 | |
| 13 | Si | 317152.13 | | |
| 13 | Si | 350000.00 | | |
| 8 | Sr | 210.83 | 234.57 | 225.45 |
| 8 | Sr | 303.70 | | |
| 8 | Sr | 189.19 | | |
| 10 | Sr | 219.23 | 212.75 | |
| 10 | Sr | 227.36 | | |
| 10 | Sr | 191.67 | | |
| 13 | Sr | 186.71 | 229.01 | |
| 13 | Sr | 292.95 | | |
| 13 | Sr | 207.38 | | |
| 8 | Ti | 2576.97 | 2463.26 | 2502.53 |
| 8 | Ti | 2419.98 | | |
| 8 | Ti | 2392.83 | | |
| 10 | Ti | 2658.96 | 2621.89 | |
| 10 | Ti | 2778.67 | | |
| 10 | Ti | 2428.05 | | |
| 13 | Ti | 2347.94 | 2422.43 | |
| 13 | Ti | 2500.99 | | |
| 13 | Ti | 2418.37 | | |
| 8 | Zn | 101.10 | 106.47 | 116.44 |
| 8 | Zn | 122.23 | | |
| 8 | Zn | 96.09 | | |
| 10 | Zn | 111.49 | 104.46 | |
| 10 | Zn | 107.06 | | |
| 10 | Zn | 94.82 | | |
| 13 | Zn | 100.75 | 138.38 | |
| 13 | Zn | 202.64 | | |
| 13 | Zn | 111.76 | | |
| 8 | Zr | 259.25 | 261.89 | 244.00 |
| 8 | Zr | 398.02 | | |
| 8 | Zr | 128.40 | | |
| 10 | Zr | 358.22 | 199.42 | |
| 10 | Zr | 173.39 | | |
| 10 | Zr | 66.64 | | |
| 13 | Zr | | 270.69 | |
| 13 | Zr | 107.82 | | |
| 13 | Zr | 433.56 | | |

| 18 week weathering cycle: totals (aqua regia/HF) | | | | TRT5 |
|---|---|---|---|---|
| Element | Container | Concentration | Triplicate average | Replicate average |
| | | | mg kg-1 | |
| 1 | Al | 89062.67 | 90177.83 | 89041.84 |
| 1 | Al | 83124.44 | | |
| 1 | Al | 98346.39 | | |
| 11 | Al | 92557.78 | 91010.48 | |
| 11 | Al | 85198.76 | | |
| 11 | Al | 95274.89 | | |
| 12 | Al | 82964.02 | 85937.21 | |
| 12 | Al | 91170.27 | | |
| 12 | Al | 83677.34 | | |
| 1 | Ba | 621.01 | 577.45 | 575.81 |
| 1 | Ba | 533.89 | | |
| 1 | Ba | | | |
| 11 | Ba | | | |
| 11 | Ba | | | |
| 11 | Ba | | | |
| 12 | Ba | 573.80 | 574.18 | |
| 12 | Ba | 584.29 | | |
| 12 | Ba | 564.45 | | |
| 1 | Ca | 4303.45 | 4306.66 | 4229.28 |
| 1 | Ca | 4309.87 | | |
| 1 | Ca | | | |
| 11 | Ca | | | |
| 11 | Ca | | | |
| 11 | Ca | | | |
| 12 | Ca | 4069.52 | 4151.90 | |
| 12 | Ca | 4320.60 | | |
| 12 | Ca | 4065.57 | | |
| 1 | Cd | 2.00 | 2.00 | 2.00 |
| 1 | Cd | 2.00 | | |
| 1 | Cd | 2.00 | | |
| 11 | Cd | 2.00 | 2.00 | |
| 11 | Cd | 2.00 | | |
| 11 | Cd | 2.00 | | |
| 12 | Cd | 2.00 | 2.00 | |
| 12 | Cd | 2.00 | | |
| 12 | Cd | 2.00 | | |
| 1 | Co | 27.46 | 27.28 | 25.26 |
| 1 | Co | 20.91 | | |
| 1 | Co | 33.49 | | |
| 11 | Co | 29.81 | 28.35 | |
| 11 | Co | 26.17 | | |
| 11 | Co | 29.08 | | |
| 12 | Co | 20.76 | 20.15 | |
| 12 | Co | 21.37 | | |
| 12 | Co | 18.32 | | |
| 1 | Cr | 80.93 | 80.04 | 78.49 |
| 1 | Cr | 75.59 | | |
| 1 | Cr | 83.61 | | |
| 11 | Cr | 77.88 | 76.93 | |
| 11 | Cr | 71.58 | | |
| 11 | Cr | 81.32 | | |
| 12 | Cr | 75.78 | 78.52 | |
| 12 | Cr | 83.23 | | |
| 12 | Cr | 76.54 | | |
| 1 | Cu | 82.19 | 79.59 | 65.19 |
| 1 | Cu | 74.45 | | |
| 1 | Cu | 82.14 | | |
| 11 | Cu | 55.67 | 54.82 | |
| 11 | Cu | 52.09 | | |
| 11 | Cu | 56.70 | | |
| 12 | Cu | 59.10 | 61.15 | |
| 12 | Cu | 66.06 | | |
| 12 | Cu | 58.31 | | |
| 1 | Fe | 41375.43 | 41143.45 | 40997.73 |
| 1 | Fe | 39134.90 | | |
| 1 | Fe | 42920.04 | | |
| 11 | Fe | 40656.65 | 40631.27 | |
| 11 | Fe | 38871.40 | | |
| 11 | Fe | 42365.76 | | |
| 12 | Fe | 40160.05 | 41218.47 | |
| 12 | Fe | 43049.45 | | |

| | | | | |
|---|---|---|---|---|
| 12 | Fe | 40445.90 | | |
| 1 | K | 6418.49 | 5519.90 | 8073.03 |
| 1 | K | 4621.31 | | |
| 1 | K | | | |
| 11 | K | 12130.94 | 12772.78 | |
| 11 | K | 12002.57 | | |
| 11 | K | 14184.85 | | |
| 12 | K | 6097.56 | 5926.40 | |
| 12 | K | 6996.15 | | |
| 12 | K | 4685.49 | | |
| 1 | Mg | 5823.39 | 5603.96 | 5551.11 |
| 1 | Mg | 5384.52 | | |
| 1 | Mg | | | |
| 11 | Mg | | | |
| 11 | Mg | | | |
| 11 | Mg | | | |
| 12 | Mg | 5497.71 | 5498.26 | |
| 12 | Mg | 5876.92 | | |
| 12 | Mg | 5120.14 | | |
| 1 | Mn | 182.56 | 175.25 | 164.40 |
| 1 | Mn | 167.94 | | |
| 1 | Mn | | | |
| 11 | Mn | | | |
| 11 | Mn | | | |
| 11 | Mn | | | |
| 12 | Mn | 148.96 | 153.55 | |
| 12 | Mn | 162.32 | | |
| 12 | Mn | 149.38 | | |
| 1 | Mo | 5.00 | 5.00 | 5.00 |
| 1 | Mo | 5.00 | | |
| 1 | Mo | 5.00 | | |
| 11 | Mo | 5.00 | 5.00 | |
| 11 | Mo | 5.00 | | |
| 11 | Mo | 5.00 | | |
| 12 | Mo | 5.00 | 5.00 | |
| 12 | Mo | 5.00 | | |
| 12 | Mo | 5.00 | | |
| 1 | Na | 7150.05 | 11131.04 | 12535.04 |
| 1 | Na | 15112.04 | | |
| 1 | Na | | | |
| 11 | Na | | | |
| 11 | Na | | | |
| 11 | Na | | | |
| 12 | Na | 6334.94 | 13939.04 | |
| 12 | Na | 18170.64 | | |
| 12 | Na | 17311.53 | | |
| 1 | Ni | 35.57 | 29.68 | 29.37 |
| 1 | Ni | 26.16 | | |
| 1 | Ni | 27.31 | | |
| 11 | Ni | 21.57 | 28.30 | |
| 11 | Ni | 29.15 | | |
| 11 | Ni | 34.20 | | |
| 12 | Ni | 29.84 | 30.14 | |
| 12 | Ni | 39.47 | | |
| 12 | Ni | 21.11 | | |
| 1 | P | 1259.11 | 1289.43 | 1251.88 |
| 1 | P | 1240.49 | | |
| 1 | P | 1368.70 | | |
| 11 | P | 1232.16 | 1213.70 | |
| 11 | P | 1145.35 | | |
| 11 | P | 1263.59 | | |
| 12 | P | 1222.14 | 1252.50 | |
| 12 | P | 1282.44 | | |
| 12 | P | 1252.94 | | |
| 1 | Pb | 170.67 | 183.70 | 179.78 |
| 1 | Pb | 151.06 | | |
| 1 | Pb | 229.38 | | |
| 11 | Pb | 178.41 | 205.62 | |
| 11 | Pb | 158.19 | | |
| 11 | Pb | 280.25 | | |
| 12 | Pb | 162.55 | 150.02 | |
| 12 | Pb | 150.73 | | |
| 12 | Pb | 136.78 | | |
| 1 | S | 2328.90 | 2695.91 | 2699.37 |

|  |  |  |  |  |
|---|---|---|---|---|
| 1 | S | 2183.64 |  |  |
| 1 | S | 3575.19 |  |  |
| 11 | S | 3045.22 | 3048.20 |  |
| 11 | S | 2972.29 |  |  |
| 11 | S | 3127.09 |  |  |
| 12 | S | 2322.00 | 2354.00 |  |
| 12 | S | 2432.73 |  |  |
| 12 | S | 2307.27 |  |  |
| 1 | Si | 237066.67 | 312355.56 | 320704.59 |
| 1 | Si | 350000.00 |  |  |
| 1 | Si | 350000.00 |  |  |
| 11 | Si | 350000.00 | 337679.28 |  |
| 11 | Si | 313037.84 |  |  |
| 11 | Si | 350000.00 |  |  |
| 12 | Si | 236236.79 | 312078.93 |  |
| 12 | Si | 350000.00 |  |  |
| 12 | Si | 350000.00 |  |  |
| 1 | Sr | 252.58 | 333.46 | 323.46 |
| 1 | Sr | 228.88 |  |  |
| 1 | Sr | 518.93 |  |  |
| 11 | Sr | 383.89 | 399.51 |  |
| 11 | Sr | 326.85 |  |  |
| 11 | Sr | 487.79 |  |  |
| 12 | Sr | 230.53 | 237.42 |  |
| 12 | Sr | 254.78 |  |  |
| 12 | Sr | 226.95 |  |  |
| 1 | Ti | 2733.42 | 2745.85 | 2863.90 |
| 1 | Ti | 2515.32 |  |  |
| 1 | Ti | 2988.80 |  |  |
| 11 | Ti | 3064.70 | 2982.44 |  |
| 11 | Ti | 2805.65 |  |  |
| 11 | Ti | 3076.97 |  |  |
| 12 | Ti | 2775.36 | 2863.41 |  |
| 12 | Ti | 2995.97 |  |  |
| 12 | Ti | 2818.91 |  |  |
| 1 | Zn | 120.14 | 123.39 | 131.77 |
| 1 | Zn | 107.98 |  |  |
| 1 | Zn | 142.07 |  |  |
| 11 | Zn | 205.09 | 166.13 |  |
| 11 | Zn | 170.82 |  |  |
| 11 | Zn | 122.48 |  |  |
| 12 | Zn | 102.74 | 105.78 |  |
| 12 | Zn | 112.36 |  |  |
| 12 | Zn | 102.25 |  |  |
| 1 | Zr | 159.67 | 218.53 | 255.06 |
| 1 | Zr | 373.32 |  |  |
| 1 | Zr | 122.61 |  |  |
| 11 | Zr | 136.64 | 198.55 |  |
| 11 | Zr | 103.55 |  |  |
| 11 | Zr | 355.48 |  |  |
| 12 | Zr | 170.80 | 348.10 |  |
| 12 | Zr | 447.89 |  |  |
| 12 | Zr | 425.63 |  |  |

# Appendix E.

# Sequential-Selective Dissolution

| 2 week plot SSD and residual | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | KNO3 | DI | NaOH | EDTA | HNO3 | residual | |
| elem | trt | % total (HF) | % total (HF) | % total (HF) | % total (HF) | % total (HF) | % total (HF) | Sum % |
| Ba | 0:0 | 0.199 | 0.052 | 0.013 | 11.818 | 1.286 | 86.633 | 100.000 |
| Ba | 197:0 | 0.492 | 0.059 | 0.011 | 13.556 | 1.311 | 84.571 | 100.000 |
| Ba | 197:197 | 3.378 | 0.007 | 0.008 | 13.929 | 3.015 | 79.663 | 100.000 |
| Ba | 197:295 | 4.729 | 0.001 | 0.005 | 14.583 | 3.444 | 77.238 | 100.000 |
| Ba | 197:394 | 5.724 | 0.033 | 0.003 | 16.132 | 4.011 | 74.096 | 100.000 |
| Co | 0:0 | 13.662 | 1.981 | 1.207 | 6.592 | 10.644 | 65.914 | 100.000 |
| Co | 197:0 | 11.637 | 1.193 | 1.248 | 7.561 | 9.306 | 69.055 | 100.000 |
| Co | 197:197 | 6.663 | 0.956 | 1.923 | 6.108 | 9.140 | 75.209 | 100.000 |
| Co | 197:295 | 5.641 | 0.963 | 1.789 | 6.799 | 9.666 | 75.142 | 100.000 |
| Co | 197:394 | 4.429 | 0.898 | 2.350 | 6.485 | 9.590 | 76.247 | 100.000 |
| Cr | 0:0 | 0.356 | 0.531 | 0.392 | 3.807 | 4.512 | 90.402 | 100.000 |
| Cr | 197:0 | 0.383 | 0.551 | 0.389 | 1.177 | 4.809 | 92.690 | 100.000 |
| Cr | 197:197 | 0.347 | 0.501 | 0.337 | 0.845 | 4.617 | 93.352 | 100.000 |
| Cr | 197:295 | 0.338 | 0.499 | 0.329 | 1.155 | 4.908 | 92.772 | 100.000 |
| Cr | 197:394 | 0.346 | 0.500 | 0.337 | 1.145 | 5.172 | 92.501 | 100.000 |
| Cu | 0:0 | 68.739 | 0.198 | 11.096 | 14.086 | 5.880 | 0.000 | 100.000 |
| Cu | 197:0 | 18.432 | 0.136 | 36.559 | 37.294 | 7.578 | 0.000 | 100.000 |
| Cu | 197:197 | 12.807 | 0.030 | 24.261 | 25.416 | 8.564 | 28.921 | 100.000 |
| Cu | 197:295 | 7.694 | 0.008 | 22.412 | 24.951 | 9.130 | 35.805 | 100.000 |
| Cu | 197:394 | 5.936 | 0.091 | 20.817 | 23.063 | 10.141 | 39.953 | 100.000 |
| Mn | 0:0 | 49.928 | 0.000 | 0.087 | 6.697 | 9.241 | 34.047 | 100.000 |
| Mn | 197:0 | 37.355 | 0.000 | 0.093 | 7.283 | 7.005 | 48.265 | 100.000 |
| Mn | 197:197 | 47.523 | 0.000 | 0.153 | 9.410 | 9.959 | 32.955 | 100.000 |
| Mn | 197:295 | 36.773 | 0.000 | 0.160 | 8.785 | 8.549 | 45.734 | 100.000 |
| Mn | 197:394 | 27.919 | 0.000 | 0.086 | 7.923 | 7.425 | 56.647 | 100.000 |
| Ni | 0:0 | 21.823 | 3.527 | 3.161 | 17.939 | 20.425 | 33.125 | 100.000 |
| Ni | 197:0 | 33.565 | 4.763 | 4.980 | 31.168 | 25.523 | 0.000 | 100.000 |
| Ni | 197:197 | 11.596 | 2.485 | 3.710 | 17.209 | 14.852 | 50.149 | 100.000 |
| Ni | 197:295 | 8.567 | 2.214 | 2.603 | 16.534 | 14.017 | 56.065 | 100.000 |
| Ni | 197:394 | 7.324 | 2.162 | 3.245 | 16.901 | 14.672 | 55.696 | 100.000 |
| Pb | 0:0 | 2.663 | 1.398 | 0.884 | 20.079 | 2.723 | 72.254 | 100.000 |
| Pb | 197:0 | 1.018 | 1.447 | 1.000 | 20.868 | 2.501 | 73.166 | 100.000 |
| Pb | 197:197 | 0.951 | 1.347 | 1.443 | 18.908 | 3.563 | 73.788 | 100.000 |
| Pb | 197:295 | 0.913 | 1.298 | 1.127 | 18.918 | 3.839 | 73.904 | 100.000 |
| Pb | 197:394 | 0.856 | 1.218 | 1.625 | 19.804 | 4.249 | 72.248 | 100.000 |
| Sr | 0:0 | 0.079 | 0.146 | 0.039 | 25.878 | 0.369 | 73.489 | 100.000 |
| Sr | 197:0 | 1.895 | 0.012 | 0.038 | 21.726 | 0.257 | 76.072 | 100.000 |
| Sr | 197:197 | 4.401 | 0.000 | 0.024 | 20.167 | 4.839 | 70.569 | 100.000 |
| Sr | 197:295 | 4.818 | 0.000 | 0.019 | 19.064 | 5.424 | 70.674 | 100.000 |
| Sr | 197:394 | 5.108 | 0.000 | 0.018 | 18.379 | 6.092 | 70.402 | 100.000 |
| Zn | 0:0 | 17.167 | 0.089 | 0.383 | 10.119 | 14.388 | 57.854 | 100.000 |
| Zn | 197:0 | 16.779 | 0.000 | 0.414 | 12.037 | 14.191 | 56.580 | 100.000 |
| Zn | 197:197 | 14.995 | 0.015 | 0.477 | 14.445 | 14.008 | 56.061 | 100.000 |
| Zn | 197:295 | 12.728 | 0.000 | 0.482 | 15.248 | 12.923 | 58.619 | 100.000 |
| Zn | 197:394 | 11.134 | 0.282 | 0.566 | 16.091 | 13.149 | 58.778 | 100.000 |

2 week weathering cycle: sequential dissolution

Percent of totals

| elem | trt | Container | %KNO3 | %DI | %NaOH | %EDTA | %HNO3 | % residual | Sum % |
|---|---|---|---|---|---|---|---|---|---|
| Ba | 1 | 2 | 0.224 | 0.025 | 0.016 | 12.152 | 1.187 | 86.395 | 100.000 |
| Ba | 1 | 2 | 0.215 | 0.002 | 0.010 | 11.291 | 1.089 | 87.393 | 100.000 |
| Ba | 1 | 2 | 0.272 | 0.004 | 0.014 | 15.061 | 2.053 | 82.596 | 100.000 |
| Ba | 1 | 5 | 0.235 | 0.037 | 0.010 | 12.460 | 1.648 | 85.609 | 100.000 |
| Ba | 1 | 5 | 0.189 | 0.006 | 0.011 | 13.168 | 1.368 | 85.258 | 100.000 |
| Ba | 1 | 5 | 0.135 | 0.004 | 0.008 | 9.651 | 1.017 | 89.184 | 100.000 |
| Ba | 1 | 9 | . | . | . | . | . | . | 0.000 |
| Ba | 1 | 9 | 0.185 | 0.005 | 0.011 | 11.629 | 1.097 | 87.073 | 100.000 |
| Ba | 1 | 9 | . | . | . | . | . | . | 0.000 |
| Ba | 2 | 3 | . | . | . | . | . | . | 0.000 |
| Ba | 2 | 3 | . | . | . | . | . | . | 0.000 |
| Ba | 2 | 3 | . | . | . | . | . | . | 0.000 |
| Ba | 2 | 4 | 0.535 | 0.051 | 0.011 | 13.784 | 1.384 | 84.235 | 100.000 |
| Ba | 2 | 4 | . | . | . | . | . | . | 0.000 |
| Ba | 2 | 4 | . | . | . | . | . | . | 0.000 |
| Ba | 2 | 7 | 0.485 | 0.119 | 0.009 | 13.004 | 1.129 | 85.253 | 100.000 |
| Ba | 2 | 7 | . | . | . | . | . | . | 0.000 |
| Ba | 2 | 7 | 0.501 | 0.063 | 0.010 | 13.913 | 0.933 | 84.580 | 100.000 |
| Ba | 3 | 6 | . | . | . | . | . | . | 0.000 |
| Ba | 3 | 6 | 3.547 | 0.000 | 0.006 | 13.909 | 2.621 | 79.916 | 100.000 |
| Ba | 3 | 6 | 3.662 | 0.004 | 0.008 | 14.553 | 2.650 | 79.123 | 100.000 |
| Ba | 3 | 14 | 2.896 | 0.036 | 0.009 | 11.199 | 3.577 | 82.282 | 100.000 |
| Ba | 3 | 14 | 3.262 | 0.008 | 0.007 | 15.531 | 3.143 | 78.049 | 100.000 |
| Ba | 3 | 14 | 3.074 | 0.021 | 0.019 | 9.794 | 3.566 | 83.526 | 100.000 |
| Ba | 3 | 15 | 3.205 | 0.000 | 0.005 | 14.573 | 2.149 | 80.067 | 100.000 |
| Ba | 3 | 15 | 3.724 | 0.000 | 0.006 | 15.627 | 3.271 | 77.372 | 100.000 |
| Ba | 3 | 15 | . | . | . | . | . | . | 0.000 |
| Ba | 4 | 8 | 4.903 | 0.000 | 0.006 | 15.235 | 4.331 | 75.525 | 100.000 |
| Ba | 4 | 8 | . | . | . | . | . | . | 0.000 |
| Ba | 4 | 8 | 4.325 | 0.004 | 0.005 | 15.811 | 3.812 | 76.044 | 100.000 |
| Ba | 4 | 10 | 4.389 | 0.000 | 0.004 | 11.103 | 3.697 | 80.807 | 100.000 |
| Ba | 4 | 10 | 4.776 | 0.000 | 0.005 | 14.163 | 3.091 | 77.964 | 100.000 |
| Ba | 4 | 10 | . | . | . | . | . | . | 0.000 |
| Ba | 4 | 13 | 4.367 | 0.001 | 0.004 | 14.158 | 2.881 | 78.589 | 100.000 |
| Ba | 4 | 13 | 5.351 | 0.000 | 0.005 | 16.954 | 3.245 | 74.445 | 100.000 |
| Ba | 4 | 13 | 5.582 | 0.000 | 0.005 | 15.049 | 3.442 | 75.922 | 100.000 |
| Ba | 5 | 1 | . | . | . | . | . | . | 0.000 |
| Ba | 5 | 1 | . | . | . | . | . | . | 0.000 |
| Ba | 5 | 1 | . | . | . | . | . | . | 0.000 |
| Ba | 5 | 11 | 5.776 | 0.000 | 0.004 | 16.697 | 5.666 | 71.858 | 100.000 |
| Ba | 5 | 11 | 5.978 | 0.000 | 0.003 | 13.287 | 3.714 | 77.018 | 100.000 |
| Ba | 5 | 11 | 5.117 | 0.000 | 0.003 | 14.199 | 3.173 | 77.509 | 100.000 |
| Ba | 5 | 12 | 5.482 | 0.079 | 0.002 | 16.164 | 3.496 | 74.777 | 100.000 |
| Ba | 5 | 12 | 5.447 | 0.040 | 0.004 | 16.785 | 3.688 | 74.036 | 100.000 |
| Ba | 5 | 12 | 23.559 | 0.000 | 0.017 | 61.944 | 14.480 | 0.000 | 100.000 |
| Co | 1 | 2 | 18.145 | 1.548 | 1.733 | 7.846 | 13.818 | 56.910 | 100.000 |
| Co | 1 | 2 | 15.141 | 1.155 | 1.415 | 6.422 | 11.578 | 64.290 | 100.000 |
| Co | 1 | 2 | 17.467 | 1.308 | 1.607 | 5.958 | 14.567 | 59.093 | 100.000 |
| Co | 1 | 5 | 19.548 | 1.154 | 1.505 | 8.453 | 13.916 | 55.423 | 100.000 |
| Co | 1 | 5 | 20.919 | 1.333 | 1.690 | 11.020 | 16.728 | 48.309 | 100.000 |
| Co | 1 | 5 | 7.841 | 0.653 | 0.743 | 4.573 | 6.817 | 79.373 | 100.000 |
| Co | 1 | 9 | 12.822 | 9.381 | 1.034 | 6.238 | 10.797 | 59.727 | 100.000 |
| Co | 1 | 9 | 9.480 | 0.700 | 0.850 | 4.855 | 7.278 | 76.837 | 100.000 |
| Co | 1 | 9 | 12.771 | 1.171 | 1.212 | 7.787 | 8.575 | 68.485 | 100.000 |
| Co | 2 | 3 | 13.526 | 1.263 | 1.429 | 7.513 | 12.111 | 64.159 | 100.000 |
| Co | 2 | 3 | 13.586 | 1.169 | 1.282 | 7.670 | 10.158 | 66.136 | 100.000 |
| Co | 2 | 3 | 11.628 | 1.268 | 1.127 | 7.486 | 7.074 | 71.417 | 100.000 |
| Co | 2 | 4 | 6.165 | 0.792 | 0.770 | 5.725 | 5.883 | 80.665 | 100.000 |
| Co | 2 | 4 | 6.299 | 0.937 | 0.840 | 4.805 | 8.515 | 78.605 | 100.000 |
| Co | 2 | 4 | 8.496 | 1.206 | 1.664 | 7.265 | 6.747 | 74.621 | 100.000 |
| Co | 2 | 7 | 21.221 | 2.506 | 1.851 | 12.868 | 14.204 | 47.350 | 100.000 |
| Co | 2 | 7 | 15.510 | 1.051 | 1.246 | 8.220 | 11.811 | 62.162 | 100.000 |
| Co | 2 | 7 | 21.909 | 1.449 | 1.925 | 12.557 | 14.100 | 48.060 | 100.000 |
| Co | 3 | 6 | . | . | . | . | . | . | 0.000 |
| Co | 3 | 6 | 7.607 | 1.037 | 0.933 | 7.193 | 11.300 | 71.931 | 100.000 |
| Co | 3 | 6 | 7.449 | 1.097 | 1.678 | 7.297 | 10.545 | 71.934 | 100.000 |
| Co | 3 | 14 | 7.834 | 1.214 | 3.657 | 5.846 | 9.706 | 71.743 | 100.000 |
| Co | 3 | 14 | 8.397 | 1.047 | 2.492 | 7.665 | 9.266 | 71.133 | 100.000 |
| Co | 3 | 14 | 5.479 | 0.677 | 2.311 | 3.063 | 6.222 | 82.248 | 100.000 |
| Co | 3 | 15 | 5.338 | 0.881 | 1.674 | 6.087 | 5.344 | 80.676 | 100.000 |
| Co | 3 | 15 | 6.114 | 1.037 | 1.410 | 6.703 | 10.994 | 73.742 | 100.000 |
| Co | 3 | 15 | 5.138 | 0.870 | 1.786 | 5.871 | 6.609 | 79.728 | 100.000 |
| Co | 4 | 8 | 6.855 | 0.881 | 1.135 | 6.704 | 11.254 | 73.171 | 100.000 |
| Co | 4 | 8 | 7.372 | 0.957 | 2.082 | 7.351 | 11.501 | 70.737 | 100.000 |
| Co | 4 | 8 | 5.471 | 0.878 | 2.198 | 5.846 | 9.295 | 76.313 | 100.000 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Co | | 4 | | 10 | | 3.761 | 1.019 | 1.887 | 4.799 | 9.799 | 78.735 | 100.000 |
| Co | | 4 | | 10 | | 5.118 | 1.121 | 1.256 | 7.824 | 9.906 | 74.776 | 100.000 |
| Co | | 4 | | 10 | | . | . | . | . | . | . | 0.000 |
| Co | | 4 | | 13 | | 5.807 | 0.928 | 2.404 | 7.522 | 9.312 | 74.026 | 100.000 |
| Co | | 4 | | 13 | | 4.939 | 0.907 | 1.182 | 7.135 | 7.439 | 78.399 | 100.000 |
| Co | | 4 | | 13 | | 6.946 | 0.953 | 1.718 | 6.394 | 9.151 | 74.837 | 100.000 |
| Co | | 5 | | 1 | | 6.040 | 0.957 | 3.770 | 6.547 | 11.367 | 71.319 | 100.000 |
| Co | | 5 | | 1 | | 4.813 | 0.897 | 2.181 | 6.036 | 8.543 | 77.530 | 100.000 |
| Co | | 5 | | 1 | | 5.264 | 0.855 | 3.195 | 6.523 | 12.083 | 72.079 | 100.000 |
| Co | | 5 | | 11 | | 3.472 | 0.794 | 1.871 | 5.942 | 12.292 | 75.629 | 100.000 |
| Co | | 5 | | 11 | | 4.124 | 0.926 | 2.524 | 5.379 | 9.179 | 77.868 | 100.000 |
| Co | | 5 | | 11 | | 4.294 | 1.025 | 2.332 | 6.817 | 8.331 | 77.202 | 100.000 |
| Co | | 5 | | 12 | | 3.237 | 0.758 | 1.949 | 5.587 | 7.306 | 81.162 | 100.000 |
| Co | | 5 | | 12 | | 4.243 | 0.892 | 1.524 | 7.592 | 7.919 | 77.829 | 100.000 |
| Co | | 5 | | 12 | | 4.972 | 1.053 | 2.205 | 8.520 | 9.850 | 73.400 | 100.000 |
| Cr | | 1 | | 2 | | 0.393 | 0.565 | 0.381 | 2.634 | 4.501 | 91.526 | 100.000 |
| Cr | | 1 | | 2 | | 0.289 | 0.414 | 0.280 | 2.394 | 3.380 | 93.243 | 100.000 |
| Cr | | 1 | | 2 | | 0.448 | 0.642 | 0.435 | 3.305 | 6.286 | 88.884 | 100.000 |
| Cr | | 1 | | 5 | | 0.365 | 0.706 | 0.352 | 4.622 | 5.504 | 88.450 | 100.000 |
| Cr | | 1 | | 5 | | 0.317 | 0.456 | 0.308 | 4.280 | 4.493 | 90.146 | 100.000 |
| Cr | | 1 | | 5 | | 0.314 | 0.452 | 0.305 | 3.987 | 4.275 | 90.667 | 100.000 |
| Cr | | 1 | | 9 | | 0.388 | 0.560 | 0.830 | 2.817 | 4.691 | 90.714 | 100.000 |
| Cr | | 1 | | 9 | | 0.359 | 0.516 | 0.350 | 4.653 | 5.013 | 89.109 | 100.000 |
| Cr | | 1 | | 9 | | 0.383 | 0.553 | 0.372 | 5.680 | 3.065 | 89.947 | 100.000 |
| Cr | | 2 | | 3 | | 0.410 | 0.586 | 0.396 | 1.084 | 5.421 | 92.103 | 100.000 |
| Cr | | 2 | | 3 | | 0.425 | 0.612 | 0.411 | 1.030 | 5.935 | 91.588 | 100.000 |
| Cr | | 2 | | 3 | | 0.366 | 0.526 | 0.355 | 0.915 | 3.547 | 94.290 | 100.000 |
| Cr | | 2 | | 4 | | 0.426 | 0.612 | 0.414 | 1.642 | 5.225 | 91.680 | 100.000 |
| Cr | | 2 | | 4 | | 0.352 | 0.508 | 0.342 | 1.301 | 5.706 | 91.792 | 100.000 |
| Cr | | 2 | | 4 | | 0.405 | 0.586 | 0.393 | 1.832 | 3.820 | 92.963 | 100.000 |
| Cr | | 2 | | 7 | | 0.344 | 0.495 | 0.472 | 1.036 | 4.068 | 93.585 | 100.000 |
| Cr | | 2 | | 7 | | 0.384 | 0.554 | 0.374 | 1.005 | 5.826 | 91.857 | 100.000 |
| Cr | | 2 | | 7 | | 0.360 | 0.515 | 0.349 | 0.847 | 3.987 | 93.943 | 100.000 |
| Cr | | 3 | | 6 | | . | . | . | . | . | . | 0.000 |
| Cr | | 3 | | 6 | | 0.293 | 0.423 | 0.284 | 0.525 | 4.704 | 93.772 | 100.000 |
| Cr | | 3 | | 6 | | 0.366 | 0.530 | 0.356 | 0.726 | 4.750 | 93.272 | 100.000 |
| Cr | | 3 | | 14 | | 0.374 | 0.542 | 0.364 | 1.163 | 3.777 | 93.781 | 100.000 |
| Cr | | 3 | | 14 | | 0.403 | 0.582 | 0.392 | 1.176 | 5.261 | 92.187 | 100.000 |
| Cr | | 3 | | 14 | | 0.370 | 0.534 | 0.359 | 1.782 | 4.254 | 92.700 | 100.000 |
| Cr | | 3 | | 15 | | 0.321 | 0.463 | 0.312 | 0.744 | 3.611 | 94.549 | 100.000 |
| Cr | | 3 | | 15 | | 0.348 | 0.501 | 0.338 | 0.559 | 5.291 | 92.963 | 100.000 |
| Cr | | 3 | | 15 | | 0.351 | 0.505 | 0.340 | 0.564 | 3.500 | 94.740 | 100.000 |
| Cr | | 4 | | 8 | | 0.372 | 0.537 | 0.363 | 1.212 | 6.105 | 91.411 | 100.000 |
| Cr | | 4 | | 8 | | 0.414 | 0.600 | 0.402 | 0.885 | 6.330 | 91.369 | 100.000 |
| Cr | | 4 | | 8 | | 0.356 | 0.515 | 0.346 | 0.679 | 5.372 | 92.732 | 100.000 |
| Cr | | 4 | | 10 | | 0.314 | 0.452 | 0.305 | 1.267 | 5.744 | 91.918 | 100.000 |
| Cr | | 4 | | 10 | | 0.304 | 0.439 | 0.295 | 1.091 | 3.980 | 93.890 | 100.000 |
| Cr | | 4 | | 10 | | . | . | . | . | . | . | 0.000 |
| Cr | | 4 | | 13 | | 0.336 | 0.492 | 0.326 | 1.618 | 4.535 | 92.693 | 100.000 |
| Cr | | 4 | | 13 | | 0.295 | 0.427 | 0.287 | 1.039 | 3.894 | 94.058 | 100.000 |
| Cr | | 4 | | 13 | | 0.380 | 0.649 | 0.369 | 1.521 | 4.813 | 92.268 | 100.000 |
| Cr | | 5 | | 1 | | 0.332 | 0.477 | 0.323 | 1.069 | 4.742 | 93.057 | 100.000 |
| Cr | | 5 | | 1 | | 0.330 | 0.477 | 0.321 | 1.297 | 4.875 | 92.700 | 100.000 |
| Cr | | 5 | | 1 | | 0.344 | 0.498 | 0.336 | 1.455 | 6.386 | 90.980 | 100.000 |
| Cr | | 5 | | 11 | | 0.365 | 0.528 | 0.355 | 0.780 | 8.299 | 89.672 | 100.000 |
| Cr | | 5 | | 11 | | 0.349 | 0.502 | 0.339 | 1.043 | 4.451 | 93.317 | 100.000 |
| Cr | | 5 | | 11 | | 0.358 | 0.519 | 0.347 | 0.696 | 4.087 | 93.994 | 100.000 |
| Cr | | 5 | | 12 | | 0.283 | 0.409 | 0.275 | 0.889 | 4.085 | 94.060 | 100.000 |
| Cr | | 5 | | 12 | | 0.348 | 0.505 | 0.338 | 1.407 | 4.243 | 93.158 | 100.000 |
| Cr | | 5 | | 12 | | 0.314 | 0.453 | 0.307 | 1.304 | 4.212 | 93.410 | 100.000 |
| Cu | | 1 | | 2 | | 60.04 | 0.00 | 15.58 | 16.64 | 7.74 | 0.00 | 100.000 |
| Cu | | 1 | | 2 | | 59.10 | 0.00 | 14.23 | 17.98 | 8.68 | 0.00 | 100.000 |
| Cu | | 1 | | 2 | | 58.94 | 0.00 | 13.82 | 17.00 | 10.24 | 0.00 | 100.000 |
| Cu | | 1 | | 5 | | 78.34 | 0.00 | 7.36 | 10.11 | 4.19 | 0.00 | 100.000 |
| Cu | | 1 | | 5 | | 75.55 | 0.00 | 8.50 | 11.96 | 3.99 | 0.00 | 100.000 |
| Cu | | 1 | | 5 | | 73.43 | 0.00 | 8.43 | 13.07 | 5.07 | . | 100.000 |
| Cu | | 1 | | 9 | | 64.31 | 1.96 | 14.33 | 12.43 | 6.97 | 0.00 | 100.000 |
| Cu | | 1 | | 9 | | 66.38 | 0.00 | 12.41 | 14.95 | 6.26 | . | 100.000 |
| Cu | | 1 | | 9 | | 60.62 | 0.00 | 13.74 | 20.19 | 5.45 | 0.00 | 100.000 |
| Cu | | 2 | | 3 | | 12.68 | 0.04 | 39.08 | 38.80 | 9.39 | 0.00 | 100.000 |
| Cu | | 2 | | 3 | | 12.68 | 0.18 | 37.45 | 39.75 | 9.94 | 0.00 | 100.000 |
| Cu | | 2 | | 3 | | 12.70 | 0.58 | 39.47 | 38.90 | 8.35 | . | 100.000 |
| Cu | | 2 | | 4 | | 12.33 | 0.19 | 40.30 | 38.01 | 9.17 | . | 100.000 |
| Cu | | 2 | | 4 | | 12.34 | 0.26 | 38.83 | 36.00 | 12.57 | 0.00 | 100.000 |
| Cu | | 2 | | 4 | | 12.96 | 0.24 | 40.30 | 37.66 | 8.83 | . | 100.000 |
| Cu | | 2 | | 7 | | 24.74 | 0.00 | 32.51 | 37.63 | 5.12 | 0.00 | 100.000 |
| Cu | | 2 | | 7 | | 27.68 | 0.00 | 31.42 | 35.24 | 5.65 | 0.00 | 100.000 |
| Cu | | 2 | | 7 | | 23.30 | 0.00 | 36.34 | 35.87 | 4.48 | 0.00 | 100.000 |
| Cu | | 3 | | 6 | | . | . | . | . | . | . | 0.000 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cu |  | 3 |  | 6 |  | 24.31 | 0.00 | 28.41 | 35.27 | 9.32 | 2.69 | 100.000 |
| Cu |  | 3 |  | 6 |  | 21.30 | 0.00 | 24.89 | 26.73 | 7.33 | 19.75 | 100.000 |
| Cu |  | 3 |  | 14 |  | 6.32 | 0.19 | 31.11 | 25.03 | 13.03 | 24.32 | 100.000 |
| Cu |  | 3 |  | 14 |  | 5.65 | 0.06 | 22.08 | 25.03 | 7.64 | 39.54 | 100.000 |
| Cu |  | 3 |  | 14 |  | 4.89 | 0.07 | 20.70 | 17.58 | 8.23 | 48.52 | 100.000 |
| Cu |  | 3 |  | 15 |  | 6.32 | 0.00 | 20.87 | 21.04 | 5.74 | 46.02 | 100.000 |
| Cu |  | 3 |  | 15 |  | 7.93 | 0.00 | 22.58 | 23.50 | 9.12 | 36.87 | 100.000 |
| Cu |  | 3 |  | 15 |  | 6.68 | 0.00 | 22.60 | 21.80 | 6.18 | 42.73 | 100.000 |
| Cu |  | 4 |  | 8 |  | 7.34 | 0.00 | 19.22 | 22.71 | 8.06 | 42.67 | 100.000 |
| Cu |  | 4 |  | 8 |  | 13.02 | 0.00 | 31.80 | 41.92 | 13.26 | 0.00 | 100.000 |
| Cu |  | 4 |  | 8 |  | 7.03 | 0.00 | 17.40 | 22.00 | 7.34 | 46.23 | 100.000 |
| Cu |  | 4 |  | 10 |  | 4.90 | 0.06 | 22.70 | 19.84 | 9.88 | 42.62 | 100.000 |
| Cu |  | 4 |  | 10 |  | 7.05 | 0.02 | 22.80 | 26.78 | 9.58 | 33.77 | 100.000 |
| Cu |  | 4 |  | 10 |  |  |  |  |  |  |  | 0.000 |
| Cu |  | 4 |  | 13 |  | 9.10 | 0.00 | 28.85 | 29.82 | 12.07 | 20.17 | 100.000 |
| Cu |  | 4 |  | 13 |  | 8.00 | 0.00 | 23.43 | 22.52 | 7.37 | 38.68 | 100.000 |
| Cu |  | 4 |  | 13 |  | 7.25 | 0.00 | 17.47 | 19.97 | 7.64 | 47.68 | 100.000 |
| Cu |  | 5 |  | 1 |  | 6.44 | 0.00 | 24.17 | 22.77 | 11.95 | 34.67 | 100.000 |
| Cu |  | 5 |  | 1 |  | 5.16 | 0.20 | 17.54 | 20.72 | 9.45 | 46.93 | 100.000 |
| Cu |  | 5 |  | 1 |  | 6.03 | 0.10 | 24.31 | 27.47 | 16.03 | 26.05 | 100.000 |
| Cu |  | 5 |  | 11 |  | 5.43 | 0.00 | 19.62 | 20.15 | 11.05 | 43.76 | 100.000 |
| Cu |  | 5 |  | 11 |  | 7.71 | 0.00 | 25.39 | 23.27 | 9.79 | 33.85 | 100.000 |
| Cu |  | 5 |  | 11 |  | 5.41 | 0.23 | 17.86 | 20.95 | 7.97 | 47.58 | 100.000 |
| Cu |  | 5 |  | 12 |  | 4.22 | 0.02 | 15.53 | 20.16 | 7.38 | 52.69 | 100.000 |
| Cu |  | 5 |  | 12 |  | 4.22 | 0.18 | 16.26 | 20.15 | 7.30 | 51.89 | 100.000 |
| Cu |  | 5 |  | 12 |  | 8.95 | 0.00 | 27.22 | 30.69 | 11.26 | 21.87 | 100.000 |
| Mn |  | 1 |  | 2 |  | 65.478 | 0.000 | 0.118 | 7.730 | 11.106 | 15.567 | 100.000 |
| Mn |  | 1 |  | 2 |  | 52.259 | 0.000 | 0.065 | 6.723 | 9.338 | 31.615 | 100.000 |
| Mn |  | 1 |  | 2 |  | 72.216 | 0.000 | 0.101 | 8.469 | 14.940 | 4.274 | 100.000 |
| Mn |  | 1 |  | 5 |  | 67.810 | 0.000 | 0.379 | 9.393 | 13.101 | 9.317 | 100.000 |
| Mn |  | 1 |  | 5 |  | 63.128 | 0.000 | 0.040 | 9.395 | 12.842 | 14.594 | 100.000 |
| Mn |  | 1 |  | 5 |  | 56.742 | 0.000 | 0.062 | 8.213 | 11.252 | 23.730 | 100.000 |
| Mn |  | 1 |  | 9 |  | 29.218 | 0.000 | 0.053 | 3.391 | 4.922 | 62.416 | 100.000 |
| Mn |  | 1 |  | 9 |  | 56.590 | 0.000 | 0.004 | 7.797 | 11.397 | 24.211 | 100.000 |
| Mn |  | 1 |  | 9 |  | 30.699 | 0.000 | 0.048 | 4.743 | 4.403 | 60.107 | 100.000 |
| Mn |  | 2 |  | 3 |  | 35.053 | 0.000 | 0.028 | 5.624 | 6.646 | 52.649 | 100.000 |
| Mn |  | 2 |  | 3 |  | 41.967 | 0.000 | 0.060 | 6.788 | 7.147 | 44.038 | 100.000 |
| Mn |  | 2 |  | 3 |  | 35.183 | 0.000 | 0.073 | 5.559 | 5.364 | 53.821 | 100.000 |
| Mn |  | 2 |  | 4 |  | 47.314 | 0.000 | 0.051 | 13.143 | 11.753 | 27.740 | 100.000 |
| Mn |  | 2 |  | 4 |  | 20.465 | 0.000 | 0.022 | 5.076 | 6.908 | 67.529 | 100.000 |
| Mn |  | 2 |  | 4 |  | 22.523 | 0.000 | 0.068 | 6.420 | 4.523 | 66.465 | 100.000 |
| Mn |  | 2 |  | 7 |  | 67.774 | 0.000 | 0.122 | 12.844 | 10.126 | 9.134 | 100.000 |
| Mn |  | 2 |  | 7 |  | 34.636 | 0.000 | 0.270 | 5.816 | 5.953 | 53.324 | 100.000 |
| Mn |  | 2 |  | 7 |  | 67.984 | 0.000 | 0.115 | 12.424 | 10.173 | 9.304 | 100.000 |
| Mn |  | 3 |  | 6 |  |  |  |  |  |  |  | 0.000 |
| Mn |  | 3 |  | 6 |  | 45.568 | 0.000 | 0.144 | 9.548 | 11.450 | 33.290 | 100.000 |
| Mn |  | 3 |  | 6 |  | 50.432 | 0.000 | 0.129 | 10.316 | 10.462 | 28.660 | 100.000 |
| Mn |  | 3 |  | 14 |  | 60.344 | 0.000 | 0.144 | 8.954 | 9.292 | 21.266 | 100.000 |
| Mn |  | 3 |  | 14 |  | 67.116 | 0.000 | 0.136 | 13.631 | 11.472 | 7.645 | 100.000 |
| Mn |  | 3 |  | 14 |  | 58.414 | 0.000 | 0.494 | 7.129 | 9.020 | 24.943 | 100.000 |
| Mn |  | 3 |  | 15 |  | 44.147 | 0.000 | 0.126 | 11.119 | 9.390 | 35.218 | 100.000 |
| Mn |  | 3 |  | 15 |  | 50.193 | 0.000 | 0.158 | 11.345 | 12.158 | 26.146 | 100.000 |
| Mn |  | 3 |  | 15 |  | 24.366 | 0.000 | 0.048 | 5.998 | 4.973 | 64.616 | 100.000 |
| Mn |  | 4 |  | 8 |  | 57.620 | 0.000 | 0.129 | 11.836 | 13.355 | 17.060 | 100.000 |
| Mn |  | 4 |  | 8 |  | 26.364 | 0.000 | 0.050 | 5.936 | 5.561 | 62.088 | 100.000 |
| Mn |  | 4 |  | 8 |  | 58.449 | 0.000 | 0.128 | 14.264 | 12.536 | 14.623 | 100.000 |
| Mn |  | 4 |  | 10 |  | 36.103 | 0.000 | 0.118 | 7.365 | 11.153 | 45.261 | 100.000 |
| Mn |  | 4 |  | 10 |  | 39.239 | 0.000 | 0.185 | 10.726 | 9.950 | 39.899 | 100.000 |
| Mn |  | 4 |  | 10 |  |  |  |  |  |  |  | 0.000 |
| Mn |  | 4 |  | 13 |  | 24.479 | 0.000 | 0.258 | 6.586 | 5.651 | 63.024 | 100.000 |
| Mn |  | 4 |  | 13 |  | 39.116 | 0.000 | 0.098 | 10.255 | 8.707 | 41.824 | 100.000 |
| Mn |  | 4 |  | 13 |  | 52.855 | 0.000 | 0.534 | 10.555 | 10.590 | 25.467 | 100.000 |
| Mn |  | 5 |  | 1 |  | 48.857 | 0.000 | 0.124 | 11.944 | 11.300 | 27.775 | 100.000 |
| Mn |  | 5 |  | 1 |  | 19.845 | 0.000 | 0.098 | 5.758 | 4.973 | 69.326 | 100.000 |
| Mn |  | 5 |  | 1 |  | 21.404 | 0.000 | 0.055 | 6.169 | 6.232 | 66.140 | 100.000 |
| Mn |  | 5 |  | 11 |  | 22.622 | 0.000 | 0.068 | 6.352 | 8.988 | 61.969 | 100.000 |
| Mn |  | 5 |  | 11 |  | 43.844 | 0.000 | 0.138 | 8.927 | 10.403 | 36.689 | 100.000 |
| Mn |  | 5 |  | 11 |  | 44.881 | 0.000 | 0.105 | 12.182 | 9.626 | 33.207 | 100.000 |
| Mn |  | 5 |  | 12 |  | 33.219 | 0.000 | 0.093 | 10.974 | 8.765 | 46.950 | 100.000 |
| Mn |  | 5 |  | 12 |  | 38.875 | 0.000 | 0.121 | 13.625 | 10.183 | 37.195 | 100.000 |
| Mn |  | 5 |  | 12 |  | 42.634 | 0.000 | 0.139 | 13.225 | 10.693 | 33.309 | 100.000 |
| Ni |  | 1 |  | 2 |  | 32.32 | 5.89 | 5.11 | 24.30 | 32.38 | 0.00 | 100.000 |
| Ni |  | 1 |  | 2 |  | 33.22 | 5.61 | 5.09 | 25.90 | 30.18 |  | 100.000 |
| Ni |  | 1 |  | 2 |  | 32.51 | 5.46 | 4.95 | 25.75 | 31.33 | 0.00 | 100.000 |
| Ni |  | 1 |  | 5 |  | 33.59 | 5.14 | 4.63 | 28.84 | 27.78 | 0.00 | 100.000 |
| Ni |  | 1 |  | 5 |  | 33.32 | 4.52 | 4.25 | 26.56 | 31.36 | 0.00 | 100.000 |
| Ni |  | 1 |  | 5 |  | 31.08 | 4.69 | 4.30 | 27.12 | 32.81 | 0.00 | 100.000 |
| Ni |  | 1 |  | 9 |  | 36.13 | 5.64 | 5.02 | 21.98 | 31.23 | 0.00 | 100.000 |
| Ni |  | 1 |  | 9 |  | 30.12 | 4.79 | 4.37 | 28.32 | 32.40 | 0.00 | 100.000 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ni | | 1 | | 9 | | 31.84 | 6.05 | 5.05 | 32.23 | 24.82 | 0.00 | 100.000 |
| Ni | | 2 | | 3 | | 36.51 | 4.34 | 4.45 | 27.55 | 27.15 | 0.00 | 100.000 |
| Ni | | 2 | | 3 | | 33.82 | 4.69 | 4.34 | 27.56 | 29.59 | 0.00 | 100.000 |
| Ni | | 2 | | 3 | | 38.01 | 4.62 | 6.35 | 30.44 | 20.59 | 0.00 | 100.000 |
| Ni | | 2 | | 4 | | 28.09 | 5.62 | 4.81 | 34.44 | 27.03 | 0.00 | 100.000 |
| Ni | | 2 | | 4 | | 25.20 | 6.03 | 6.11 | 34.52 | 28.14 | 0.00 | 100.000 |
| Ni | | 2 | | 4 | | 26.25 | 6.19 | 4.92 | 37.96 | 24.68 | 0.00 | 100.000 |
| Ni | | 2 | | 7 | | 38.71 | 4.16 | 4.28 | 31.22 | 21.63 | 0.00 | 100.000 |
| Ni | | 2 | | 7 | | 35.60 | 3.73 | 3.71 | 26.92 | 30.04 | 0.00 | 100.000 |
| Ni | | 2 | | 7 | | . | . | . | . | . | . | 0.000 |
| Ni | | 3 | | 6 | | . | . | . | . | . | . | 0.000 |
| Ni | | 3 | | 6 | | 7.46 | 1.63 | 1.31 | 10.89 | 11.23 | 67.47 | 100.000 |
| Ni | | 3 | | 6 | | 9.61 | 2.34 | 2.70 | 15.15 | 15.65 | 54.56 | 100.000 |
| Ni | | 3 | | 14 | | 16.16 | 3.09 | 4.75 | 17.98 | 17.30 | 40.71 | 100.000 |
| Ni | | 3 | | 14 | | 18.41 | 3.64 | 6.13 | 28.46 | 20.29 | 23.07 | 100.000 |
| Ni | | 3 | | 14 | | 17.59 | 3.18 | 4.04 | 15.11 | 19.24 | 40.84 | 100.000 |
| Ni | | 3 | | 15 | | 9.42 | 2.10 | 4.84 | 15.93 | 9.02 | 58.69 | 100.000 |
| Ni | | 3 | | 15 | | 14.05 | 3.34 | 4.22 | 25.64 | 18.70 | 34.04 | 100.000 |
| Ni | | 3 | | 15 | | 11.57 | 2.97 | 6.77 | 23.28 | 13.00 | 42.41 | 100.000 |
| Ni | | 4 | | 8 | | 15.31 | 3.15 | 3.04 | 23.82 | 25.57 | 29.11 | 100.000 |
| Ni | | 4 | | 8 | | 15.63 | 3.57 | 2.83 | 26.81 | 27.32 | 23.84 | 100.000 |
| Ni | | 4 | | 8 | | 9.91 | 2.22 | 2.65 | 18.71 | 13.58 | 52.94 | 100.000 |
| Ni | | 4 | | 10 | | 5.26 | 1.96 | 3.59 | 9.97 | 13.84 | 65.39 | 100.000 |
| Ni | | 4 | | 10 | | 6.57 | 1.98 | 1.51 | 16.03 | 11.28 | 62.63 | 100.000 |
| Ni | | 4 | | 10 | | . | . | . | . | . | . | 0.000 |
| Ni | | 4 | | 13 | | 9.70 | 2.18 | 2.66 | 18.29 | 13.33 | 53.84 | 100.000 |
| Ni | | 4 | | 13 | | 6.91 | 1.67 | 2.93 | 13.76 | 8.66 | 66.07 | 100.000 |
| Ni | | 4 | | 13 | | 8.49 | 2.39 | 1.85 | 14.25 | 14.74 | 58.28 | 100.000 |
| Ni | | 5 | | 1 | | 8.51 | 1.83 | 3.25 | 13.23 | 13.67 | 59.51 | 100.000 |
| Ni | | 5 | | 1 | | 6.67 | 1.82 | 3.27 | 15.51 | 13.57 | 59.17 | 100.000 |
| Ni | | 5 | | 1 | | 8.38 | 2.06 | 2.86 | 15.96 | 17.46 | 53.28 | 100.000 |
| Ni | | 5 | | 11 | | 8.40 | 3.30 | 4.22 | 25.52 | 29.11 | 29.47 | 100.000 |
| Ni | | 5 | | 11 | | 7.34 | 2.00 | 3.48 | 12.56 | 12.06 | 62.56 | 100.000 |
| Ni | | 5 | | 11 | | 6.80 | 2.31 | 3.44 | 18.77 | 13.26 | 55.41 | 100.000 |
| Ni | | 5 | | 12 | | 4.29 | 1.51 | 2.19 | 11.84 | 9.93 | 70.24 | 100.000 |
| Ni | | 5 | | 12 | | 4.27 | 1.87 | 2.02 | 14.79 | 9.17 | 67.87 | 100.000 |
| Ni | | 5 | | 12 | | 6.83 | 1.66 | 2.62 | 14.77 | 9.49 | 64.62 | 100.000 |
| Pb | | 1 | | 2 | | 3.480 | 1.345 | 1.010 | 20.839 | 3.037 | 70.290 | 100.000 |
| Pb | | 1 | | 2 | | 3.890 | 1.149 | 0.913 | 21.340 | 2.951 | 69.756 | 100.000 |
| Pb | | 1 | | 2 | | 3.796 | 1.275 | 0.990 | 21.989 | 3.800 | 68.148 | 100.000 |
| Pb | | 1 | | 5 | | 1.685 | 1.314 | 0.917 | 21.328 | 3.096 | 71.661 | 100.000 |
| Pb | | 1 | | 5 | | 4.121 | 1.297 | 1.003 | 24.175 | 3.264 | 66.141 | 100.000 |
| Pb | | 1 | | 5 | | 1.733 | 1.069 | 0.763 | 18.317 | 2.313 | 75.805 | 100.000 |
| Pb | | 1 | | 9 | | 1.838 | 2.658 | 0.755 | 15.234 | 2.520 | 76.995 | 100.000 |
| Pb | | 1 | | 9 | | 2.452 | 1.364 | 0.987 | 22.703 | 2.429 | 70.067 | 100.000 |
| Pb | | 1 | | 9 | | 1.797 | 1.027 | 0.738 | 17.425 | 1.632 | 77.381 | 100.000 |
| Pb | | 2 | | 3 | | 1.062 | 1.518 | 1.028 | 21.613 | 2.515 | 72.264 | 100.000 |
| Pb | | 2 | | 3 | | 1.000 | 1.439 | 0.967 | 20.904 | 2.848 | 72.842 | 100.000 |
| Pb | | 2 | | 3 | | 1.039 | 1.490 | 1.006 | 21.999 | 1.877 | 72.589 | 100.000 |
| Pb | | 2 | | 4 | | 0.959 | 1.377 | 0.932 | 20.418 | 2.622 | 73.692 | 100.000 |
| Pb | | 2 | | 4 | | 1.146 | 1.539 | 1.040 | 20.735 | 3.384 | 72.155 | 100.000 |
| Pb | | 2 | | 4 | | 0.858 | 1.242 | 0.920 | 18.104 | 1.394 | 77.483 | 100.000 |
| Pb | | 2 | | 7 | | 1.117 | 1.557 | 1.071 | 22.746 | 2.805 | 70.703 | 100.000 |
| Pb | | 2 | | 7 | | 0.917 | 1.325 | 0.893 | 18.467 | 2.905 | 75.492 | 100.000 |
| Pb | | 2 | | 7 | | 1.136 | 1.625 | 1.203 | 24.135 | 2.335 | 69.565 | 100.000 |
| Pb | | 3 | | 6 | | . | . | . | . | . | . | 0.000 |
| Pb | | 3 | | 6 | | 0.825 | 1.194 | 0.801 | 17.826 | 3.427 | 75.927 | 100.000 |
| Pb | | 3 | | 6 | | 0.987 | 1.426 | 1.379 | 20.438 | 3.562 | 72.209 | 100.000 |
| Pb | | 3 | | 14 | | 1.026 | 1.485 | 2.228 | 16.673 | 3.471 | 75.117 | 100.000 |
| Pb | | 3 | | 14 | | 0.963 | 1.391 | 1.763 | 20.413 | 3.761 | 71.710 | 100.000 |
| Pb | | 3 | | 14 | | 1.015 | 1.467 | 1.994 | 15.648 | 4.218 | 75.658 | 100.000 |
| Pb | | 3 | | 15 | | 0.909 | 1.308 | 1.458 | 19.925 | 1.286 | 75.114 | 100.000 |
| Pb | | 3 | | 15 | | 0.964 | 1.388 | 1.239 | 20.924 | 4.529 | 70.957 | 100.000 |
| Pb | | 3 | | 15 | | 0.864 | 1.244 | 1.469 | 18.517 | 1.969 | 75.936 | 100.000 |
| Pb | | 4 | | 8 | | 0.900 | 1.301 | 1.178 | 17.928 | 4.387 | 74.306 | 100.000 |
| Pb | | 4 | | 8 | | 1.251 | 1.653 | 1.113 | 24.729 | 5.091 | 66.162 | 100.000 |
| Pb | | 4 | | 8 | | 0.865 | 1.253 | 1.556 | 18.514 | 3.567 | 74.246 | 100.000 |
| Pb | | 4 | | 10 | | 0.776 | 1.118 | 0.899 | 13.437 | 3.572 | 80.198 | 100.000 |
| Pb | | 4 | | 10 | | 0.978 | 1.416 | 0.951 | 19.788 | 4.539 | 72.328 | 100.000 |
| Pb | | 4 | | 10 | | . | . | . | . | . | . | 0.000 |
| Pb | | 4 | | 13 | | 1.000 | 1.442 | 1.799 | 23.432 | 4.616 | 67.712 | 100.000 |
| Pb | | 4 | | 13 | | 0.724 | 1.047 | 0.862 | 16.454 | 2.098 | 78.815 | 100.000 |
| Pb | | 4 | | 13 | | 1.023 | 1.406 | 1.087 | 19.662 | 3.883 | 72.939 | 100.000 |
| Pb | | 5 | | 1 | | 0.994 | 1.429 | 2.131 | 24.526 | 4.979 | 65.942 | 100.000 |
| Pb | | 5 | | 1 | | 0.666 | 0.963 | 1.186 | 18.754 | 2.830 | 75.601 | 100.000 |
| Pb | | 5 | | 1 | | 0.824 | 1.046 | 1.731 | 21.598 | 4.499 | 70.301 | 100.000 |
| Pb | | 5 | | 11 | | 0.863 | 1.247 | 1.220 | 19.402 | 6.673 | 70.595 | 100.000 |
| Pb | | 5 | | 11 | | 1.066 | 1.536 | 2.531 | 19.701 | 5.286 | 69.879 | 100.000 |
| Pb | | 5 | | 11 | | 0.883 | 1.282 | 2.204 | 18.687 | 3.677 | 73.267 | 100.000 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pb | | 5 | | 12 | | 0.682 | 0.986 | 1.150 | 14.885 | 3.474 | 78.822 | 100.000 |
| Pb | | 5 | | 12 | | 0.798 | 1.158 | 0.847 | 17.989 | 2.641 | 76.568 | 100.000 |
| Pb | | 5 | | 12 | | 0.975 | 1.407 | 1.947 | 21.714 | 4.514 | 69.444 | 100.000 |
| Sr | | 1 | | 2 | | 0.092 | 0.078 | 0.054 | 36.750 | 0.235 | 62.789 | 100.000 |
| Sr | | 1 | | 2 | | 0.092 | 0.062 | 0.044 | 27.853 | 0.191 | 71.758 | 100.000 |
| Sr | | 1 | | 2 | | 0.112 | 0.085 | 0.060 | 38.341 | 0.879 | 60.524 | 100.000 |
| Sr | | 1 | | 5 | | 0.095 | 0.072 | 0.050 | 33.328 | 0.812 | 65.643 | 100.000 |
| Sr | | 1 | | 5 | | 0.114 | 0.071 | 0.050 | 33.653 | 0.586 | 65.526 | 100.000 |
| Sr | | 1 | | 5 | | 0.022 | 0.029 | 0.020 | 13.423 | 0.221 | 86.285 | 100.000 |
| Sr | | 1 | | 9 | | 0.116 | 0.744 | 0.031 | 19.562 | 0.585 | 78.963 | 100.000 |
| Sr | | 1 | | 9 | | 0.086 | 0.065 | 0.046 | 31.057 | 0.000 | 68.746 | 100.000 |
| Sr | | 1 | | 9 | | 0.060 | 0.052 | 0.036 | 24.003 | 0.161 | 75.689 | 100.000 |
| Sr | | 2 | | 3 | | 1.585 | 0.000 | 0.034 | 19.451 | 0.257 | 78.673 | 100.000 |
| Sr | | 2 | | 3 | | 1.633 | 0.000 | 0.034 | 19.636 | 0.171 | 78.526 | 100.000 |
| Sr | | 2 | | 3 | | 1.662 | 0.047 | 0.032 | 18.751 | 0.153 | 79.356 | 100.000 |
| Sr | | 2 | | 4 | | 2.448 | 0.000 | 0.050 | 28.135 | 0.317 | 69.050 | 100.000 |
| Sr | | 2 | | 4 | | 1.672 | 0.000 | 0.036 | 19.900 | 0.746 | 77.646 | 100.000 |
| Sr | | 2 | | 4 | | 1.903 | 0.000 | 0.039 | 22.562 | 0.131 | 75.365 | 100.000 |
| Sr | | 2 | | 7 | | 2.670 | 0.070 | 0.049 | 30.148 | 0.000 | 67.062 | 100.000 |
| Sr | | 2 | | 7 | | 1.594 | 0.000 | 0.028 | 15.734 | 0.365 | 82.278 | 100.000 |
| Sr | | 2 | | 7 | | 2.659 | 0.000 | 0.054 | 30.633 | 0.000 | 66.654 | 100.000 |
| Sr | | 3 | | 6 | | . | . | . | . | . | . | 0.000 |
| Sr | | 3 | | 6 | | 4.585 | 0.000 | 0.023 | 20.508 | 4.718 | 70.166 | 100.000 |
| Sr | | 3 | | 6 | | 4.688 | 0.000 | 0.024 | 20.713 | 4.460 | 70.114 | 100.000 |
| Sr | | 3 | | 14 | | 4.442 | 0.000 | 0.027 | 19.184 | 5.678 | 70.668 | 100.000 |
| Sr | | 3 | | 14 | | 4.910 | 0.000 | 0.028 | 23.857 | 5.157 | 66.047 | 100.000 |
| Sr | | 3 | | 14 | | 4.247 | 0.000 | 0.025 | 18.179 | 4.830 | 72.719 | 100.000 |
| Sr | | 3 | | 15 | | 4.156 | 0.000 | 0.023 | 20.420 | 3.796 | 71.604 | 100.000 |
| Sr | | 3 | | 15 | | 4.770 | 0.000 | 0.024 | 21.790 | 5.417 | 67.999 | 100.000 |
| Sr | | 3 | | 15 | | 3.436 | 0.000 | 0.019 | 16.707 | 3.116 | 76.722 | 100.000 |
| Sr | | 4 | | 8 | | 5.121 | 0.000 | 0.022 | 20.823 | 6.919 | 67.115 | 100.000 |
| Sr | | 4 | | 8 | | 4.431 | 0.000 | 0.019 | 19.303 | 5.432 | 70.816 | 100.000 |
| Sr | | 4 | | 8 | | 4.298 | 0.000 | 0.019 | 18.872 | 5.810 | 71.001 | 100.000 |
| Sr | | 4 | | 10 | | 4.578 | 0.000 | 0.019 | 17.277 | 5.585 | 72.541 | 100.000 |
| Sr | | 4 | | 10 | | 4.977 | 0.000 | 0.020 | 18.044 | 5.075 | 71.884 | 100.000 |
| Sr | | 4 | | 10 | | . | . | . | . | . | . | 0.000 |
| Sr | | 4 | | 13 | | 4.599 | 0.000 | 0.018 | 18.794 | 4.974 | 71.615 | 100.000 |
| Sr | | 4 | | 13 | | 4.535 | 0.000 | 0.018 | 18.158 | 4.526 | 72.763 | 100.000 |
| Sr | | 4 | | 13 | | 6.052 | 0.000 | 0.022 | 22.525 | 5.530 | 65.870 | 100.000 |
| Sr | | 5 | | 1 | | 5.847 | 0.000 | 0.017 | 19.628 | 6.257 | 68.251 | 100.000 |
| Sr | | 5 | | 1 | | 4.529 | 0.000 | 0.028 | 16.596 | 4.808 | 74.039 | 100.000 |
| Sr | | 5 | | 1 | | 4.487 | 0.000 | 0.015 | 17.259 | 6.471 | 71.768 | 100.000 |
| Sr | | 5 | | 11 | | 5.188 | 0.000 | 0.016 | 18.279 | 8.503 | 68.014 | 100.000 |
| Sr | | 5 | | 11 | | 5.832 | 0.000 | 0.017 | 18.086 | 5.741 | 70.325 | 100.000 |
| Sr | | 5 | | 11 | | 5.813 | 0.000 | 0.016 | 20.339 | 6.122 | 67.710 | 100.000 |
| Sr | | 5 | | 12 | | 4.410 | 0.000 | 0.015 | 17.368 | 5.140 | 73.068 | 100.000 |
| Sr | | 5 | | 12 | | 4.880 | 0.000 | 0.017 | 19.592 | 5.896 | 69.615 | 100.000 |
| Sr | | 5 | | 12 | | 6.345 | 0.000 | 0.020 | 22.528 | 7.158 | 63.948 | 100.000 |
| Zn | | 1 | | 2 | | 17.984 | 0.000 | 0.434 | 10.513 | 15.502 | 55.567 | 100.000 |
| Zn | | 1 | | 2 | | 13.588 | 0.000 | 0.231 | 9.166 | 12.478 | 64.538 | 100.000 |
| Zn | | 1 | | 2 | | 16.700 | 0.000 | 0.797 | 10.342 | 17.910 | 54.251 | 100.000 |
| Zn | | 1 | | 5 | | 23.209 | 0.000 | 0.650 | 11.255 | 17.620 | 47.266 | 100.000 |
| Zn | | 1 | | 5 | | 21.323 | 0.000 | 0.255 | 11.610 | 16.770 | 50.041 | 100.000 |
| Zn | | 1 | | 5 | | 13.821 | 0.000 | 0.185 | 7.892 | 11.560 | 66.542 | 100.000 |
| Zn | | 1 | | 9 | | 16.557 | 0.806 | 0.468 | 8.882 | 13.205 | 60.083 | 100.000 |
| Zn | | 1 | | 9 | | 16.404 | 0.000 | 0.243 | 10.623 | 14.846 | 57.884 | 100.000 |
| Zn | | 1 | | 9 | | 16.710 | 0.000 | 0.326 | 11.772 | 11.473 | 59.718 | 100.000 |
| Zn | | 2 | | 3 | | 15.383 | 0.000 | 0.224 | 11.490 | 14.987 | 57.916 | 100.000 |
| Zn | | 2 | | 3 | | 19.428 | 0.000 | 0.330 | 14.660 | 17.285 | 48.298 | 100.000 |
| Zn | | 2 | | 3 | | 17.101 | 0.000 | 0.831 | 12.644 | 13.040 | 56.384 | 100.000 |
| Zn | | 2 | | 4 | | 14.687 | 0.000 | 0.256 | 13.445 | 15.448 | 56.164 | 100.000 |
| Zn | | 2 | | 4 | | 10.619 | 0.000 | 0.192 | 8.908 | 14.917 | 65.363 | 100.000 |
| Zn | | 2 | | 4 | | 10.775 | 0.000 | 0.235 | 9.637 | 9.082 | 70.270 | 100.000 |
| Zn | | 2 | | 7 | | 21.983 | 0.000 | 0.546 | 13.820 | 14.359 | 49.293 | 100.000 |
| Zn | | 2 | | 7 | | 22.642 | 0.000 | 0.761 | 12.502 | 15.699 | 48.397 | 100.000 |
| Zn | | 2 | | 7 | | 22.511 | 0.000 | 0.456 | 13.460 | 14.817 | 48.755 | 100.000 |
| Zn | | 3 | | 6 | | . | . | . | . | . | . | 0.000 |
| Zn | | 3 | | 6 | | 15.489 | 0.000 | 0.299 | 13.518 | 13.431 | 57.262 | 100.000 |
| Zn | | 3 | | 6 | | 18.214 | 0.000 | 0.555 | 14.851 | 13.041 | 53.340 | 100.000 |
| Zn | | 3 | | 14 | | 14.455 | 0.139 | 0.407 | 13.036 | 12.776 | 59.187 | 100.000 |
| Zn | | 3 | | 14 | | 16.544 | 0.000 | 0.552 | 18.596 | 15.951 | 48.356 | 100.000 |
| Zn | | 3 | | 14 | | 13.613 | 0.000 | 0.755 | 10.379 | 11.835 | 63.418 | 100.000 |
| Zn | | 3 | | 15 | | 12.048 | 0.000 | 0.557 | 15.217 | 11.804 | 60.373 | 100.000 |
| Zn | | 3 | | 15 | | 14.199 | 0.000 | 0.358 | 16.146 | 16.210 | 53.086 | 100.000 |
| Zn | | 3 | | 15 | | 11.797 | 0.000 | 0.461 | 14.889 | 11.270 | 61.582 | 100.000 |
| Zn | | 4 | | 8 | | 16.250 | 0.000 | 0.388 | 16.501 | 16.241 | 50.619 | 100.000 |
| Zn | | 4 | | 8 | | 12.412 | 0.000 | 0.295 | 13.187 | 11.587 | 62.519 | 100.000 |
| Zn | | 4 | | 8 | | 15.889 | 0.000 | 0.441 | 17.227 | 15.320 | 51.123 | 100.000 |
| Zn | | 4 | | 10 | | 9.696 | 0.000 | 0.377 | 11.505 | 13.256 | 65.166 | 100.000 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zn | | 4 | | 10 | | 11.073 | 0.000 | 0.438 | 15.204 | 11.580 | 61.705 | 100.000 |
| Zn | | 4 | | 10 | | . | . | . | . | . | . | 0.000 |
| Zn | | 4 | | 13 | | 13.144 | 0.000 | 0.929 | 17.937 | 13.948 | 54.042 | 100.000 |
| Zn | | 4 | | 13 | | 11.159 | 0.000 | 0.369 | 14.663 | 10.800 | 63.009 | 100.000 |
| Zn | | 4 | | 13 | | 15.010 | 0.000 | 0.806 | 16.092 | 13.186 | 54.905 | 100.000 |
| Zn | | 5 | | 1 | | 12.779 | 0.000 | 0.544 | 15.457 | 12.949 | 58.270 | 100.000 |
| Zn | | 5 | | 1 | | 10.870 | 0.000 | 0.713 | 14.769 | 11.558 | 62.091 | 100.000 |
| Zn | | 5 | | 1 | | 12.499 | 0.000 | 0.500 | 17.612 | 16.367 | 53.022 | 100.000 |
| Zn | | 5 | | 11 | | 10.043 | 0.000 | 0.676 | 15.781 | 18.646 | 54.854 | 100.000 |
| Zn | | 5 | | 11 | | 11.242 | 0.000 | 0.721 | 13.439 | 12.045 | 62.553 | 100.000 |
| Zn | | 5 | | 11 | | 11.015 | 2.512 | 0.397 | 16.927 | 11.165 | 57.984 | 100.000 |
| Zn | | 5 | | 12 | | 9.037 | 0.000 | 0.371 | 14.620 | 10.270 | 65.702 | 100.000 |
| Zn | | 5 | | 12 | | 10.577 | 0.074 | 0.614 | 18.293 | 12.295 | 58.147 | 100.000 |
| Zn | | 5 | | 12 | | 12.151 | 0.000 | 0.530 | 17.658 | 12.793 | 56.867 | 100.000 |

2 week weathering cycle: sequential dissolution

|  |  |  | KNO3 | DI | NaOH | EDTA | HNO3 |  | total |  | residual |
|---|---|---|---|---|---|---|---|---|---|---|---|
| elem | trt | container | ug/g | ug/g | ug/g | ug/g | ug/g | sum ssd | ug/g | residual | % of total |
| Ba | 1 | 2 | 0.965 | 0.108 | 0.069 | 52.353 | 5.114 | 58.609 | 430.805 | 372.196 | 86.395 |
| Ba | 1 | 2 | 1.012 | 0.010 | 0.048 | 53.210 | 5.134 | 59.414 | 471.260 | 411.846 | 87.393 |
| Ba | 1 | 2 | 0.934 | 0.012 | 0.049 | 51.660 | 7.041 | 59.696 | 343.000 | 283.304 | 82.596 |
| Ba | 1 | 5 | 1.028 | 0.161 | 0.046 | 54.419 | 7.198 | 62.851 | 436.735 | 373.884 | 85.609 |
| Ba | 1 | 5 | 0.810 | 0.023 | 0.049 | 56.459 | 5.868 | 63.211 | 428.770 | 365.559 | 85.258 |
| Ba | 1 | 5 | 0.778 | 0.026 | 0.049 | 55.661 | 5.866 | 62.380 | 576.715 | 514.335 | 89.184 |
| Ba | 1 | 9 | 0.856 | 1.693 | 0.099 | 46.993 | 5.862 | 55.503 | . | . | . |
| Ba | 1 | 9 | 0.841 | 0.021 | 0.049 | 52.778 | 4.980 | 58.668 | 453.840 | 395.172 | 87.073 |
| Ba | 1 | 9 | 0.825 | 0.030 | 0.061 | 54.965 | 4.998 | 60.879 | . | . | . |
| Ba | 2 | 3 | 1.697 | 0.230 | 0.042 | 55.410 | 5.616 | 62.995 | . | . | . |
| Ba | 2 | 3 | 1.822 | 0.144 | 0.044 | 57.815 | 5.515 | 65.340 | . | . | . |
| Ba | 2 | 3 | 1.853 | 0.435 | 0.039 | 57.598 | 4.281 | 64.205 | . | . | . |
| Ba | 2 | 4 | 2.102 | 0.199 | 0.044 | 54.100 | 5.431 | 61.875 | 392.490 | 330.615 | 84.235 |
| Ba | 2 | 4 | 2.024 | 0.139 | 0.045 | 49.552 | 8.307 | 60.067 | . | . | . |
| Ba | 2 | 4 | 2.102 | 0.150 | 0.057 | 55.456 | 4.765 | 62.530 | . | . | . |
| Ba | 2 | 7 | 2.055 | 0.505 | 0.038 | 55.103 | 4.785 | 62.486 | 423.730 | 361.244 | 85.253 |
| Ba | 2 | 7 | 2.366 | 0.106 | 0.046 | 55.787 | 5.625 | 63.929 | . | . | . |
| Ba | 2 | 7 | 2.039 | 0.255 | 0.042 | 56.618 | 3.797 | 62.751 | 406.935 | 344.184 | 84.580 |
| Ba | 3 | 6 | 19.305 | 0.000 | 0.025 | 80.005 | 21.432 | 120.768 | . | . | . |
| Ba | 3 | 6 | 19.679 | 0.000 | 0.033 | 77.156 | 14.542 | 111.409 | 554.730 | 443.321 | 79.916 |
| Ba | 3 | 6 | 18.449 | 0.018 | 0.042 | 73.315 | 13.352 | 105.175 | 503.785 | 398.610 | 79.123 |
| Ba | 3 | 14 | 14.245 | 0.178 | 0.045 | 55.079 | 17.591 | 87.138 | 491.815 | 404.677 | 82.282 |
| Ba | 3 | 14 | 15.102 | 0.036 | 0.034 | 71.903 | 14.552 | 101.626 | 462.960 | 361.334 | 78.049 |
| Ba | 3 | 14 | 15.273 | 0.103 | 0.096 | 48.660 | 17.719 | 81.850 | 496.840 | 414.990 | 83.526 |
| Ba | 3 | 15 | 17.639 | 0.000 | 0.029 | 80.199 | 11.828 | 109.695 | 550.310 | 440.615 | 80.067 |
| Ba | 3 | 15 | 19.118 | 0.000 | 0.029 | 80.222 | 16.793 | 116.163 | 513.360 | 397.197 | 77.372 |
| Ba | 3 | 15 | 17.764 | 0.010 | 0.028 | 79.048 | 11.939 | 108.789 | . | . | . |
| Ba | 4 | 8 | 24.412 | 0.000 | 0.030 | 75.846 | 21.563 | 121.851 | 497.855 | 376.004 | 75.525 |
| Ba | 4 | 8 | 23.602 | 0.000 | 0.028 | 82.240 | 19.176 | 125.045 | . | . | . |
| Ba | 4 | 8 | 23.119 | 0.020 | 0.028 | 84.519 | 20.376 | 128.062 | 534.570 | 406.508 | 76.044 |
| Ba | 4 | 10 | 25.019 | 0.000 | 0.022 | 63.297 | 21.077 | 109.414 | 570.070 | 460.656 | 80.807 |
| Ba | 4 | 10 | 26.046 | 0.000 | 0.029 | 77.237 | 16.858 | 120.169 | 545.325 | 425.156 | 77.964 |
| Ba | 4 | 10 | 26.793 | 0.000 | 0.027 | 80.929 | 17.746 | 125.495 | . | . | . |
| Ba | 4 | 13 | 26.607 | 0.007 | 0.022 | 86.252 | 17.550 | 130.437 | 609.200 | 478.763 | 78.589 |
| Ba | 4 | 13 | 26.700 | 0.000 | 0.026 | 84.599 | 16.193 | 127.518 | 498.995 | 371.477 | 74.445 |
| Ba | 4 | 13 | 28.677 | 0.000 | 0.025 | 77.316 | 17.684 | 123.703 | 513.755 | 390.052 | 75.922 |
| Ba | 5 | 1 | 29.580 | 0.395 | 0.012 | 82.946 | 19.658 | 132.591 | . | . | . |
| Ba | 5 | 1 | 30.966 | 0.540 | 0.011 | 94.481 | 20.231 | 146.228 | . | . | . |
| Ba | 5 | 1 | 30.514 | 0.064 | 0.025 | 93.318 | 25.977 | 149.898 | . | . | . |
| Ba | 5 | 11 | 32.305 | 0.000 | 0.020 | 93.386 | 31.691 | 157.402 | 559.305 | 401.903 | 71.858 |
| Ba | 5 | 11 | 34.002 | 0.000 | 0.016 | 75.572 | 21.125 | 130.714 | 568.780 | 438.066 | 77.018 |
| Ba | 5 | 11 | 33.862 | 0.000 | 0.017 | 93.967 | 20.996 | 148.843 | 661.795 | 512.952 | 77.509 |
| Ba | 5 | 12 | 31.666 | 0.459 | 0.010 | 93.375 | 20.195 | 145.705 | 577.675 | 431.970 | 74.777 |
| Ba | 5 | 12 | 29.175 | 0.213 | 0.020 | 89.899 | 19.752 | 139.060 | 535.585 | 396.525 | 74.036 |
| Ba | 5 | 12 | 34.624 | 0.000 | 0.025 | 91.039 | 21.281 | 146.969 | 146.969 | 0.000 | 0.000 |
| Co | 1 | 2 | 1.523 | 0.130 | 0.146 | 0.659 | 1.160 | 3.617 | 8.395 | 4.778 | 56.910 |
| Co | 1 | 2 | 1.553 | 0.118 | 0.145 | 0.659 | 1.187 | 3.662 | 10.255 | 6.593 | 64.290 |
| Co | 1 | 2 | 1.583 | 0.119 | 0.146 | 0.540 | 1.320 | 3.706 | 9.060 | 5.354 | 59.093 |
| Co | 1 | 5 | 1.893 | 0.112 | 0.146 | 0.819 | 1.348 | 4.317 | 9.685 | 5.368 | 55.423 |
| Co | 1 | 5 | 1.804 | 0.115 | 0.146 | 0.951 | 1.443 | 4.458 | 8.625 | 4.167 | 48.309 |
| Co | 1 | 5 | 1.538 | 0.128 | 0.146 | 0.897 | 1.337 | 4.046 | 19.615 | 15.569 | 79.373 |
| Co | 1 | 9 | 1.553 | 1.136 | 0.125 | 0.755 | 1.308 | 4.877 | 12.110 | 7.233 | 59.727 |
| Co | 1 | 9 | 1.627 | 0.120 | 0.146 | 0.833 | 1.249 | 3.975 | 17.160 | 13.185 | 76.837 |
| Co | 1 | 9 | 1.538 | 0.141 | 0.146 | 0.938 | 1.033 | 3.796 | 12.045 | 8.249 | 68.485 |
| Co | 2 | 3 | 1.374 | 0.128 | 0.145 | 0.763 | 1.230 | 3.641 | 10.160 | 6.519 | 64.159 |
| Co | 2 | 3 | 1.537 | 0.132 | 0.145 | 0.868 | 1.149 | 3.832 | 11.315 | 7.483 | 66.136 |
| Co | 2 | 3 | 1.493 | 0.163 | 0.145 | 0.961 | 0.908 | 3.669 | 12.835 | 9.166 | 71.417 |
| Co | 2 | 4 | 1.167 | 0.150 | 0.146 | 1.084 | 1.114 | 3.661 | 18.935 | 15.274 | 80.665 |
| Co | 2 | 4 | 1.094 | 0.163 | 0.146 | 0.834 | 1.478 | 3.714 | 17.360 | 13.646 | 78.605 |
| Co | 2 | 4 | 1.153 | 0.164 | 0.226 | 0.986 | 0.915 | 3.443 | 13.565 | 10.122 | 74.621 |
| Co | 2 | 7 | 1.655 | 0.195 | 0.144 | 1.004 | 1.108 | 4.107 | 7.800 | 3.693 | 47.350 |
| Co | 2 | 7 | 1.818 | 0.123 | 0.146 | 0.963 | 1.384 | 4.435 | 11.720 | 7.285 | 62.162 |
| Co | 2 | 7 | 1.655 | 0.109 | 0.145 | 0.949 | 1.065 | 3.924 | 7.555 | 3.631 | 48.060 |
| Co | 3 | 6 | 1.231 | 0.145 | 0.226 | 1.047 | 2.317 | 4.966 | . | . | . |
| Co | 3 | 6 | 1.186 | 0.162 | 0.145 | 1.122 | 1.762 | 4.377 | 15.595 | 11.218 | 71.931 |
| Co | 3 | 6 | 1.113 | 0.164 | 0.251 | 1.090 | 1.576 | 4.194 | 14.945 | 10.751 | 71.934 |
| Co | 3 | 14 | 1.086 | 0.168 | 0.507 | 0.810 | 1.345 | 3.916 | 13.860 | 9.944 | 71.743 |
| Co | 3 | 14 | 1.248 | 0.156 | 0.370 | 1.139 | 1.377 | 4.291 | 14.865 | 10.574 | 71.133 |
| Co | 3 | 14 | 1.263 | 0.156 | 0.533 | 0.706 | 1.434 | 4.091 | 23.045 | 18.954 | 82.248 |
| Co | 3 | 15 | 0.995 | 0.164 | 0.312 | 1.135 | 0.996 | 3.602 | 18.640 | 15.038 | 80.676 |
| Co | 3 | 15 | 0.980 | 0.166 | 0.226 | 1.074 | 1.761 | 4.207 | 16.020 | 11.813 | 73.742 |
| Co | 3 | 15 | 0.980 | 0.166 | 0.341 | 1.120 | 1.261 | 3.868 | 19.080 | 15.212 | 79.728 |
| Co | 4 | 8 | 1.228 | 0.158 | 0.203 | 1.201 | 2.016 | 4.805 | 17.910 | 13.105 | 73.171 |
| Co | 4 | 8 | 1.243 | 0.161 | 0.351 | 1.240 | 1.940 | 4.935 | 16.865 | 11.930 | 70.737 |
| Co | 4 | 8 | 1.066 | 0.171 | 0.428 | 1.139 | 1.811 | 4.614 | 19.480 | 14.866 | 76.313 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Co | 4 | 10 | 0.680 | 0.184 | 0.341 | 0.868 | 1.772 | 3.845 | 18.080 | 14.235 | 78.735 |
| Co | 4 | 10 | 0.828 | 0.181 | 0.203 | 1.265 | 1.602 | 4.079 | 16.170 | 12.091 | 74.776 |
| Co | 4 | 10 | 0.798 | 0.179 | 0.381 | 1.346 | 1.648 | 4.353 | . | . | . |
| Co | 4 | 13 | 1.034 | 0.165 | 0.428 | 1.340 | 1.658 | 4.626 | 17.810 | 13.184 | 74.026 |
| Co | 4 | 13 | 0.945 | 0.174 | 0.226 | 1.366 | 1.424 | 4.135 | 19.140 | 15.005 | 78.399 |
| Co | 4 | 13 | 1.181 | 0.162 | 0.292 | 1.087 | 1.556 | 4.279 | 17.005 | 12.726 | 74.837 |
| Co | 5 | 1 | 1.018 | 0.161 | 0.635 | 1.103 | 1.915 | 4.831 | 16.845 | 12.014 | 71.319 |
| Co | 5 | 1 | 1.165 | 0.217 | 0.528 | 1.461 | 2.068 | 5.439 | 24.205 | 18.766 | 77.530 |
| Co | 5 | 1 | 1.047 | 0.170 | 0.635 | 1.297 | 2.403 | 5.552 | 19.885 | 14.333 | 72.079 |
| Co | 5 | 11 | 0.794 | 0.182 | 0.428 | 1.359 | 2.812 | 5.575 | 22.875 | 17.300 | 75.629 |
| Co | 5 | 11 | 0.793 | 0.178 | 0.485 | 1.034 | 1.765 | 4.256 | 19.230 | 14.974 | 77.868 |
| Co | 5 | 11 | 0.838 | 0.200 | 0.455 | 1.330 | 1.625 | 4.447 | 19.505 | 15.058 | 77.202 |
| Co | 5 | 12 | 0.780 | 0.183 | 0.469 | 1.346 | 1.760 | 4.537 | 24.085 | 19.548 | 81.162 |
| Co | 5 | 12 | 0.870 | 0.183 | 0.313 | 1.557 | 1.624 | 4.547 | 20.510 | 15.963 | 77.829 |
| Co | 5 | 12 | 0.837 | 0.177 | 0.371 | 1.434 | 1.658 | 4.477 | 16.830 | 12.353 | 73.400 |
| Cr | 1 | 2 | 0.250 | 0.359 | 0.242 | 1.674 | 2.861 | 5.386 | 63.560 | 58.174 | 91.526 |
| Cr | 1 | 2 | 0.250 | 0.357 | 0.242 | 2.066 | 2.917 | 5.832 | 86.305 | 80.473 | 93.243 |
| Cr | 1 | 2 | 0.250 | 0.358 | 0.242 | 1.842 | 3.504 | 6.196 | 55.735 | 49.539 | 88.884 |
| Cr | 1 | 5 | 0.250 | 0.483 | 0.240 | 3.158 | 3.761 | 7.893 | 68.335 | 60.442 | 88.450 |
| Cr | 1 | 5 | 0.250 | 0.359 | 0.243 | 3.373 | 3.540 | 7.765 | 78.800 | 71.035 | 90.146 |
| Cr | 1 | 5 | 0.250 | 0.359 | 0.243 | 3.167 | 3.395 | 7.413 | 79.425 | 72.012 | 90.667 |
| Cr | 1 | 9 | 0.250 | 0.360 | 0.534 | 1.812 | 3.017 | 5.973 | 64.325 | 58.352 | 90.714 |
| Cr | 1 | 9 | 0.250 | 0.359 | 0.243 | 3.233 | 3.483 | 7.567 | 69.480 | 61.913 | 89.109 |
| Cr | 1 | 9 | 0.250 | 0.361 | 0.243 | 3.708 | 2.001 | 6.562 | 65.280 | 58.718 | 89.947 |
| Cr | 2 | 3 | 0.250 | 0.357 | 0.242 | 0.661 | 3.306 | 4.815 | 60.975 | 56.160 | 92.103 |
| Cr | 2 | 3 | 0.250 | 0.360 | 0.242 | 0.605 | 3.489 | 4.946 | 58.790 | 53.844 | 91.588 |
| Cr | 2 | 3 | 0.250 | 0.358 | 0.242 | 0.624 | 2.417 | 3.891 | 68.145 | 64.254 | 94.290 |
| Cr | 2 | 4 | 0.250 | 0.359 | 0.243 | 0.962 | 3.062 | 4.875 | 58.600 | 53.725 | 91.680 |
| Cr | 2 | 4 | 0.250 | 0.360 | 0.243 | 0.924 | 4.050 | 5.827 | 70.985 | 65.158 | 91.792 |
| Cr | 2 | 4 | 0.250 | 0.361 | 0.243 | 1.130 | 2.355 | 4.339 | 61.655 | 57.316 | 92.963 |
| Cr | 2 | 7 | 0.250 | 0.359 | 0.342 | 0.751 | 2.951 | 4.653 | 72.545 | 67.892 | 93.585 |
| Cr | 2 | 7 | 0.250 | 0.361 | 0.243 | 0.654 | 3.792 | 5.300 | 65.090 | 59.790 | 91.857 |
| Cr | 2 | 7 | 0.250 | 0.357 | 0.242 | 0.588 | 2.768 | 4.205 | 69.420 | 65.215 | 93.943 |
| Cr | 3 | 6 | 0.250 | 0.358 | 0.242 | 0.438 | 4.880 | 6.168 | . | . | . |
| Cr | 3 | 6 | 0.250 | 0.361 | 0.242 | 0.448 | 4.016 | 5.317 | 85.370 | 80.053 | 93.772 |
| Cr | 3 | 6 | 0.250 | 0.361 | 0.242 | 0.495 | 3.237 | 4.585 | 68.145 | 63.560 | 93.272 |
| Cr | 3 | 14 | 0.250 | 0.362 | 0.243 | 0.776 | 2.521 | 4.152 | 66.760 | 62.608 | 93.781 |
| Cr | 3 | 14 | 0.250 | 0.361 | 0.243 | 0.730 | 3.263 | 4.847 | 62.035 | 57.188 | 92.187 |
| Cr | 3 | 14 | 0.250 | 0.361 | 0.243 | 1.204 | 2.873 | 4.931 | 67.545 | 62.614 | 92.700 |
| Cr | 3 | 15 | 0.250 | 0.359 | 0.242 | 0.578 | 2.805 | 4.235 | 77.685 | 73.450 | 94.549 |
| Cr | 3 | 15 | 0.250 | 0.360 | 0.243 | 0.401 | 3.797 | 5.050 | 71.770 | 66.720 | 92.963 |
| Cr | 3 | 15 | 0.250 | 0.360 | 0.242 | 0.402 | 2.491 | 3.745 | 71.195 | 67.450 | 94.740 |
| Cr | 4 | 8 | 0.250 | 0.361 | 0.244 | 0.814 | 4.102 | 5.771 | 67.190 | 61.419 | 91.411 |
| Cr | 4 | 8 | 0.250 | 0.362 | 0.243 | 0.534 | 3.820 | 5.209 | 60.350 | 55.141 | 91.369 |
| Cr | 4 | 8 | 0.250 | 0.362 | 0.243 | 0.477 | 3.773 | 5.105 | 70.245 | 65.140 | 92.732 |
| Cr | 4 | 10 | 0.250 | 0.360 | 0.243 | 1.008 | 4.572 | 6.432 | 79.585 | 73.153 | 91.918 |
| Cr | 4 | 10 | 0.250 | 0.361 | 0.243 | 0.897 | 3.273 | 5.024 | 82.240 | 77.216 | 93.890 |
| Cr | 4 | 10 | 0.250 | 0.360 | 0.243 | 0.870 | 3.276 | 4.999 | . | . | . |
| Cr | 4 | 13 | 0.250 | 0.366 | 0.243 | 1.205 | 3.375 | 5.438 | 74.425 | 68.987 | 92.693 |
| Cr | 4 | 13 | 0.250 | 0.361 | 0.243 | 0.879 | 3.294 | 5.026 | 84.585 | 79.559 | 94.058 |
| Cr | 4 | 13 | 0.250 | 0.426 | 0.242 | 0.999 | 3.160 | 5.077 | 65.660 | 60.583 | 92.268 |
| Cr | 5 | 1 | 0.250 | 0.359 | 0.243 | 0.804 | 3.566 | 5.222 | 75.205 | 69.983 | 93.057 |
| Cr | 5 | 1 | 0.250 | 0.361 | 0.243 | 0.981 | 3.689 | 5.524 | 75.675 | 70.151 | 92.700 |
| Cr | 5 | 1 | 0.250 | 0.361 | 0.244 | 1.056 | 4.633 | 6.544 | 72.545 | 66.001 | 90.980 |
| Cr | 5 | 11 | 0.250 | 0.361 | 0.243 | 0.533 | 5.671 | 7.057 | 68.335 | 61.278 | 89.672 |
| Cr | 5 | 11 | 0.250 | 0.360 | 0.243 | 0.747 | 3.187 | 4.786 | 71.610 | 66.824 | 93.317 |
| Cr | 5 | 11 | 0.250 | 0.363 | 0.242 | 0.486 | 2.855 | 4.196 | 69.860 | 65.664 | 93.994 |
| Cr | 5 | 12 | 0.250 | 0.361 | 0.243 | 0.785 | 3.609 | 5.248 | 88.340 | 83.092 | 94.060 |
| Cr | 5 | 12 | 0.250 | 0.363 | 0.243 | 1.010 | 3.045 | 4.910 | 71.770 | 66.860 | 93.158 |
| Cr | 5 | 12 | 0.250 | 0.360 | 0.244 | 1.038 | 3.352 | 5.244 | 79.585 | 74.341 | 93.410 |
| Cu | 1 | 2 | 10.784 | 0.000 | 2.799 | 2.989 | 1.390 | 17.962 | 11.040 | 0.000 | 0.000 |
| Cu | 1 | 2 | 9.805 | 0.000 | 2.361 | 2.982 | 1.440 | 16.588 | 2.000 | 0.000 | 0.000 |
| Cu | 1 | 2 | 9.894 | 0.000 | 2.319 | 2.853 | 1.719 | 16.785 | 10.810 | 0.000 | 0.000 |
| Cu | 1 | 5 | 35.620 | 0.000 | 3.348 | 4.595 | 1.904 | 45.467 | 28.920 | 0.000 | 0.000 |
| Cu | 1 | 5 | 29.948 | 0.000 | 3.370 | 4.741 | 1.582 | 39.641 | 6.030 | 0.000 | 0.000 |
| Cu | 1 | 5 | 22.967 | 0.000 | 2.637 | 4.088 | 1.587 | 31.278 | . | . | . |
| Cu | 1 | 9 | 15.667 | 0.478 | 3.492 | 3.029 | 1.697 | 24.363 | 19.590 | 0.000 | 0.000 |
| Cu | 1 | 9 | 15.247 | 0.000 | 2.851 | 3.433 | 1.437 | 22.969 | . | . | . |
| Cu | 1 | 9 | 15.705 | 0.000 | 3.560 | 5.231 | 1.412 | 25.907 | 17.765 | 0.000 | 0.000 |
| Cu | 2 | 3 | 2.035 | 0.007 | 6.269 | 6.224 | 1.506 | 16.041 | 2.000 | 0.000 | 0.000 |
| Cu | 2 | 3 | 2.022 | 0.028 | 5.972 | 6.339 | 1.586 | 15.946 | 13.675 | 0.000 | 0.000 |
| Cu | 2 | 3 | 2.124 | 0.097 | 6.598 | 6.503 | 1.396 | 16.717 | . | . | . |
| Cu | 2 | 4 | 1.882 | 0.029 | 6.150 | 5.801 | 1.399 | 15.261 | . | . | . |
| Cu | 2 | 4 | 1.920 | 0.040 | 6.040 | 5.601 | 1.955 | 15.556 | 10.835 | 0.000 | 0.000 |
| Cu | 2 | 4 | 2.086 | 0.039 | 6.486 | 6.061 | 1.421 | 16.092 | . | . | . |
| Cu | 2 | 7 | 6.486 | 0.000 | 8.522 | 9.865 | 1.342 | 26.215 | 5.645 | 0.000 | 0.000 |
| Cu | 2 | 7 | 7.757 | 0.000 | 8.804 | 9.875 | 1.584 | 28.021 | 26.605 | 0.000 | 0.000 |
| Cu | 2 | 7 | 6.269 | 0.000 | 9.777 | 9.651 | 1.206 | 26.903 | 6.495 | 0.000 | 0.000 |
| Cu | 3 | 6 | 13.404 | 0.000 | 11.631 | 14.465 | 5.169 | 44.669 | . | . | . |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cu | | 3 | | 6 | | 8.711 | 0.000 | 10.182 | 12.641 | 3.341 | 34.875 | 35.840 | 0.965 | 2.693 |
| Cu | | 3 | | 6 | | 9.678 | 0.000 | 11.308 | 12.141 | 3.331 | 36.458 | 45.430 | 8.972 | 19.749 |
| Cu | | 3 | | 14 | | 1.831 | 0.054 | 9.011 | 7.248 | 3.774 | 21.918 | 28.960 | 7.042 | 24.316 |
| Cu | | 3 | | 14 | | 2.264 | 0.024 | 8.841 | 10.019 | 3.057 | 24.205 | 40.035 | 15.830 | 39.540 |
| Cu | | 3 | | 14 | | 2.162 | 0.032 | 9.155 | 7.773 | 3.641 | 22.763 | 44.220 | 21.457 | 48.523 |
| Cu | | 3 | | 15 | | 3.014 | 0.000 | 9.961 | 10.041 | 2.741 | 25.757 | 47.720 | 21.963 | 46.024 |
| Cu | | 3 | | 15 | | 3.395 | 0.000 | 9.667 | 10.061 | 3.907 | 27.030 | 42.820 | 15.790 | 36.875 |
| Cu | | 3 | | 15 | | 3.001 | 0.000 | 10.145 | 9.789 | 2.775 | 25.710 | 44.895 | 19.185 | 42.733 |
| Cu | | 4 | | 8 | | 3.942 | 0.000 | 10.326 | 12.198 | 4.330 | 30.796 | 53.715 | 22.919 | 42.667 |
| Cu | | 4 | | 8 | | 4.082 | 0.000 | 9.971 | 13.145 | 4.157 | 31.354 | 29.615 | 0.000 | 0.000 |
| Cu | | 4 | | 8 | | 4.209 | 0.000 | 10.421 | 13.179 | 4.397 | 32.206 | 59.895 | 27.689 | 46.229 |
| Cu | | 4 | | 10 | | 2.086 | 0.025 | 9.658 | 8.442 | 4.203 | 24.414 | 42.550 | 18.136 | 42.623 |
| Cu | | 4 | | 10 | | 2.671 | 0.009 | 8.644 | 10.151 | 3.632 | 25.105 | 37.905 | 12.800 | 33.768 |
| Cu | | 4 | | 10 | | 2.899 | 0.000 | 9.844 | 10.656 | 3.912 | 27.311 | . | . | . |
| Cu | | 4 | | 13 | | 3.205 | 0.000 | 10.164 | 10.504 | 4.251 | 28.123 | 35.230 | 7.107 | 20.172 |
| Cu | | 4 | | 13 | | 3.790 | 0.000 | 11.100 | 10.668 | 3.494 | 29.052 | 47.380 | 18.328 | 38.684 |
| Cu | | 4 | | 13 | | 3.612 | 0.000 | 8.703 | 9.949 | 3.809 | 26.073 | 49.830 | 23.757 | 47.676 |
| Cu | | 5 | | 1 | | 2.416 | 0.000 | 9.065 | 8.540 | 4.481 | 24.503 | 37.505 | 13.002 | 34.668 |
| Cu | | 5 | | 1 | | 2.582 | 0.098 | 8.778 | 10.368 | 4.730 | 26.555 | 50.040 | 23.485 | 46.932 |
| Cu | | 5 | | 1 | | 2.175 | 0.036 | 8.767 | 9.905 | 5.781 | 26.662 | 36.055 | 9.393 | 26.051 |
| Cu | | 5 | | 11 | | 3.446 | 0.000 | 12.459 | 12.793 | 7.016 | 35.715 | 63.505 | 27.790 | 43.761 |
| Cu | | 5 | | 11 | | 3.637 | 0.000 | 11.982 | 10.981 | 4.619 | 31.219 | 47.195 | 15.976 | 33.851 |
| Cu | | 5 | | 11 | | 3.294 | 0.143 | 10.881 | 12.760 | 4.852 | 31.929 | 60.905 | 28.976 | 47.576 |
| Cu | | 5 | | 12 | | 2.492 | 0.015 | 9.168 | 11.906 | 4.355 | 27.936 | 59.045 | 31.109 | 52.688 |
| Cu | | 5 | | 12 | | 2.569 | 0.112 | 9.905 | 12.275 | 4.446 | 29.306 | 60.910 | 31.604 | 51.886 |
| Cu | | 5 | | 12 | | 3.675 | 0.000 | 11.174 | 12.597 | 4.624 | 32.070 | 41.045 | 8.975 | 21.866 |
| Mn | | 1 | | 2 | | 82.116 | 0.000 | 0.148 | 9.694 | 13.928 | 105.887 | 125.410 | 19.523 | 15.567 |
| Mn | | 1 | | 2 | | 79.513 | 0.000 | 0.098 | 10.229 | 14.208 | 104.048 | 152.150 | 48.102 | 31.615 |
| Mn | | 1 | | 2 | | 81.124 | 0.000 | 0.113 | 9.514 | 16.783 | 107.533 | 112.335 | 4.802 | 4.274 |
| Mn | | 1 | | 5 | | 93.860 | 0.000 | 0.525 | 13.001 | 18.134 | 125.519 | 138.415 | 12.896 | 9.317 |
| Mn | | 1 | | 5 | | 88.159 | 0.000 | 0.056 | 13.121 | 17.934 | 119.269 | 139.650 | 20.381 | 14.594 |
| Mn | | 1 | | 5 | | 85.278 | 0.000 | 0.094 | 12.343 | 16.910 | 114.626 | 150.290 | 35.664 | 23.730 |
| Mn | | 1 | | 9 | | 83.206 | 0.000 | 0.151 | 9.657 | 14.016 | 107.030 | 284.775 | 177.745 | 62.416 |
| Mn | | 1 | | 9 | | 83.898 | 0.000 | 0.006 | 11.560 | 16.897 | 112.361 | 148.255 | 35.894 | 24.211 |
| Mn | | 1 | | 9 | | 83.667 | 0.000 | 0.132 | 12.926 | 11.999 | 108.725 | 272.540 | 163.815 | 60.107 |
| Mn | | 2 | | 3 | | 85.283 | 0.000 | 0.069 | 13.684 | 16.170 | 115.206 | 243.300 | 128.094 | 52.649 |
| Mn | | 2 | | 3 | | 86.645 | 0.000 | 0.124 | 14.015 | 14.756 | 115.539 | 206.460 | 90.921 | 44.038 |
| Mn | | 2 | | 3 | | 86.737 | 0.000 | 0.180 | 13.704 | 13.223 | 113.844 | 246.530 | 132.686 | 53.821 |
| Mn | | 2 | | 4 | | 59.668 | 0.000 | 0.064 | 16.574 | 14.822 | 91.127 | 126.110 | 34.983 | 27.740 |
| Mn | | 2 | | 4 | | 57.097 | 0.000 | 0.062 | 14.161 | 19.273 | 90.592 | 278.995 | 188.403 | 67.529 |
| Mn | | 2 | | 4 | | 60.291 | 0.000 | 0.183 | 17.187 | 12.108 | 89.769 | 267.690 | 177.921 | 66.465 |
| Mn | | 2 | | 7 | | 93.236 | 0.000 | 0.168 | 17.670 | 13.930 | 125.004 | 137.570 | 12.566 | 9.134 |
| Mn | | 2 | | 7 | | 101.070 | 0.000 | 0.789 | 16.973 | 17.372 | 136.203 | 291.805 | 155.602 | 53.324 |
| Mn | | 2 | | 7 | | 92.747 | 0.000 | 0.157 | 16.950 | 13.879 | 123.733 | 136.425 | 12.692 | 9.304 |
| Mn | | 3 | | 6 | | 66.329 | 0.000 | 0.080 | 13.769 | 21.840 | 102.018 | . | . | . |
| Mn | | 3 | | 6 | | 65.581 | 0.000 | 0.207 | 13.742 | 16.478 | 96.008 | 143.920 | 47.912 | 33.290 |
| Mn | | 3 | | 6 | | 63.389 | 0.000 | 0.162 | 12.967 | 13.150 | 89.667 | 125.690 | 36.023 | 28.660 |
| Mn | | 3 | | 14 | | 81.548 | 0.000 | 0.194 | 12.101 | 12.558 | 106.401 | 135.140 | 28.739 | 21.266 |
| Mn | | 3 | | 14 | | 85.915 | 0.000 | 0.175 | 17.449 | 14.685 | 118.223 | 128.010 | 9.787 | 7.645 |
| Mn | | 3 | | 14 | | 86.455 | 0.000 | 0.732 | 10.551 | 13.350 | 111.088 | 148.005 | 36.917 | 24.943 |
| Mn | | 3 | | 15 | | 63.278 | 0.000 | 0.181 | 15.938 | 13.459 | 92.855 | 143.335 | 50.480 | 35.218 |
| Mn | | 3 | | 15 | | 68.097 | 0.000 | 0.214 | 15.391 | 16.495 | 100.198 | 135.670 | 35.472 | 26.146 |
| Mn | | 3 | | 15 | | 63.564 | 0.000 | 0.124 | 15.648 | 12.973 | 92.309 | 260.875 | 168.566 | 64.616 |
| Mn | | 4 | | 8 | | 73.840 | 0.000 | 0.166 | 15.168 | 17.114 | 106.288 | 128.150 | 21.862 | 17.060 |
| Mn | | 4 | | 8 | | 72.796 | 0.000 | 0.139 | 16.391 | 15.355 | 104.681 | 276.115 | 171.434 | 62.088 |
| Mn | | 4 | | 8 | | 72.150 | 0.000 | 0.158 | 17.608 | 15.474 | 105.390 | 123.440 | 18.050 | 14.623 |
| Mn | | 4 | | 10 | | 50.339 | 0.000 | 0.164 | 10.269 | 15.551 | 76.323 | 139.430 | 63.107 | 45.261 |
| Mn | | 4 | | 10 | | 52.347 | 0.000 | 0.247 | 14.310 | 13.274 | 80.178 | 133.405 | 53.227 | 39.899 |
| Mn | | 4 | | 10 | | 53.145 | 0.000 | 0.118 | 15.024 | 13.084 | 81.372 | . | . | . |
| Mn | | 4 | | 13 | | 60.827 | 0.000 | 0.642 | 16.366 | 14.043 | 91.877 | 248.480 | 156.603 | 63.024 |
| Mn | | 4 | | 13 | | 60.554 | 0.000 | 0.151 | 15.875 | 13.479 | 90.059 | 154.805 | 64.746 | 41.824 |
| Mn | | 4 | | 13 | | 64.353 | 0.000 | 0.650 | 12.851 | 12.894 | 90.748 | 121.755 | 31.007 | 25.467 |
| Mn | | 5 | | 1 | | 60.319 | 0.000 | 0.153 | 14.747 | 13.951 | 89.169 | 123.460 | 34.291 | 27.775 |
| Mn | | 5 | | 1 | | 61.376 | 0.000 | 0.303 | 17.806 | 15.380 | 94.865 | 309.270 | 214.405 | 69.326 |
| Mn | | 5 | | 1 | | 58.634 | 0.000 | 0.151 | 16.899 | 17.072 | 92.756 | 273.940 | 181.184 | 66.140 |
| Mn | | 5 | | 11 | | 55.453 | 0.000 | 0.168 | 15.571 | 22.033 | 93.225 | 245.125 | 151.900 | 61.969 |
| Mn | | 5 | | 11 | | 56.995 | 0.000 | 0.179 | 11.604 | 13.523 | 82.301 | 129.995 | 47.694 | 36.689 |
| Mn | | 5 | | 11 | | 57.198 | 0.000 | 0.133 | 15.525 | 12.268 | 85.124 | 127.445 | 42.321 | 33.207 |
| Mn | | 5 | | 12 | | 51.539 | 0.000 | 0.144 | 17.026 | 13.599 | 82.308 | 155.150 | 72.842 | 46.950 |
| Mn | | 5 | | 12 | | 49.656 | 0.000 | 0.155 | 17.403 | 13.007 | 80.221 | 127.730 | 47.509 | 37.195 |
| Mn | | 5 | | 12 | | 55.232 | 0.000 | 0.181 | 17.133 | 13.853 | 86.398 | 129.550 | 43.152 | 33.309 |
| Ni | | 1 | | 2 | | 3.064 | 0.558 | 0.485 | 2.303 | 3.069 | 9.479 | 9.995 | 0.516 | **0.000** |
| Ni | | 1 | | 2 | | 3.155 | 0.533 | 0.483 | 2.460 | 2.867 | 9.498 | . | 16.157 | . |
| Ni | | 1 | | 2 | | 3.186 | 0.535 | 0.485 | 2.523 | 3.070 | 9.799 | 9.995 | 0.196 | **0.000** |
| Ni | | 1 | | 5 | | 3.521 | 0.539 | 0.486 | 3.023 | 2.912 | 10.481 | 9.995 | 0.000 | 0.000 |
| Ni | | 1 | | 5 | | 3.811 | 0.517 | 0.486 | 3.037 | 3.586 | 11.437 | 10.750 | 0.000 | 0.000 |
| Ni | | 1 | | 5 | | 3.506 | 0.529 | 0.485 | 3.060 | 3.701 | 11.280 | . | 24.560 | **0.000** |
| Ni | | 1 | | 9 | | 3.491 | 0.545 | 0.485 | 2.124 | 3.017 | 9.661 | 9.995 | 0.334 | **0.000** |
| Ni | | 1 | | 9 | | 3.353 | 0.534 | 0.486 | 3.153 | 3.607 | 11.133 | . | 3.322 | **0.000** |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ni | | 1 | | 9 | | 3.064 | 0.582 | 0.486 | 3.101 | 2.389 | 9.622 | . | 1.853 | **0.000** |
| Ni | | 2 | | 3 | | 3.963 | 0.471 | 0.484 | 2.991 | 2.948 | 10.856 | 9.995 | 0.000 | 0.000 |
| Ni | | 2 | | 3 | | 3.765 | 0.523 | 0.483 | 3.069 | 3.294 | 11.134 | 9.995 | 0.000 | 0.000 |
| Ni | | 2 | | 3 | | 4.009 | 0.487 | 0.669 | 3.210 | 2.171 | 10.547 | 9.995 | 0.000 | 0.000 |
| Ni | | 2 | | 4 | | 2.835 | 0.567 | 0.486 | 3.476 | 2.728 | 10.092 | 9.995 | 0.000 | 0.000 |
| Ni | | 2 | | 4 | | 2.530 | 0.605 | 0.614 | 3.465 | 2.825 | 10.040 | 10.000 | 0.000 | 0.000 |
| Ni | | 2 | | 4 | | 2.591 | 0.612 | 0.485 | 3.748 | 2.437 | 9.873 | 9.995 | 0.122 | **0.000** |
| Ni | | 2 | | 7 | | 4.390 | 0.471 | 0.486 | 3.541 | 2.453 | 11.341 | 10.000 | 0.000 | 0.000 |
| Ni | | 2 | | 7 | | 4.664 | 0.488 | 0.487 | 3.527 | 3.936 | 13.102 | 9.995 | 0.000 | 0.000 |
| Ni | | 2 | | 7 | | 4.222 | 0.455 | 0.698 | 3.588 | 2.277 | 11.240 | . | . | . |
| Ni | | 3 | | 6 | | 2.835 | 0.565 | 0.641 | 4.338 | 5.006 | 13.385 | . | . | . |
| Ni | | 3 | | 6 | | 2.759 | 0.602 | 0.485 | 4.028 | 4.154 | 12.028 | 36.975 | 24.947 | 67.471 |
| Ni | | 3 | | 6 | | 2.515 | 0.612 | 0.706 | 3.962 | 4.094 | 11.888 | 26.160 | 14.272 | 54.557 |
| Ni | | 3 | | 14 | | 3.079 | 0.589 | 0.906 | 3.426 | 3.296 | 11.295 | 19.050 | 7.755 | 40.706 |
| Ni | | 3 | | 14 | | 2.957 | 0.585 | 0.985 | 4.573 | 3.259 | 12.359 | 16.065 | 3.706 | 23.066 |
| Ni | | 3 | | 14 | | 3.186 | 0.576 | 0.732 | 2.736 | 3.484 | 10.713 | 18.110 | 7.397 | 40.843 |
| Ni | | 3 | | 15 | | 2.637 | 0.589 | 1.355 | 4.459 | 2.526 | 11.566 | 27.995 | 16.429 | 58.685 |
| Ni | | 3 | | 15 | | 2.515 | 0.598 | 0.756 | 4.590 | 3.347 | 11.807 | 17.900 | 6.093 | 34.037 |
| Ni | | 3 | | 15 | | 2.363 | 0.607 | 1.383 | 4.756 | 2.654 | 11.763 | 20.425 | 8.662 | 42.410 |
| Ni | | 4 | | 8 | | 2.881 | 0.592 | 0.572 | 4.482 | 4.811 | 13.339 | 18.815 | 5.476 | 29.107 |
| Ni | | 4 | | 8 | | 2.683 | 0.612 | 0.486 | 4.602 | 4.690 | 13.073 | 17.165 | 4.092 | 23.842 |
| Ni | | 4 | | 8 | | 2.728 | 0.611 | 0.728 | 5.153 | 3.740 | 12.961 | 27.540 | 14.579 | 52.939 |
| Ni | | 4 | | 10 | | 1.738 | 0.645 | 1.184 | 3.290 | 4.568 | 11.426 | 33.010 | 21.584 | 65.387 |
| Ni | | 4 | | 10 | | 2.119 | 0.638 | 0.486 | 5.172 | 3.639 | 12.053 | 32.255 | 20.202 | 62.633 |
| Ni | | 4 | | 10 | | 1.997 | 0.636 | 0.810 | 5.129 | 3.135 | 11.706 | . | . | . |
| Ni | | 4 | | 13 | | 2.652 | 0.597 | 0.728 | 5.003 | 3.645 | 12.625 | 27.350 | 14.725 | 53.839 |
| Ni | | 4 | | 13 | | 2.530 | 0.612 | 1.071 | 5.034 | 3.169 | 12.417 | 36.595 | 24.178 | 66.070 |
| Ni | | 4 | | 13 | | 2.241 | 0.630 | 0.487 | 3.760 | 3.891 | 11.009 | 26.390 | 15.381 | 58.284 |
| Ni | | 5 | | 1 | | 2.698 | 0.581 | 1.030 | 4.193 | 4.330 | 12.832 | 31.690 | 18.858 | 59.507 |
| Ni | | 5 | | 1 | | 2.302 | 0.627 | 1.129 | 5.354 | 4.683 | 14.095 | 34.520 | 20.425 | 59.170 |
| Ni | | 5 | | 1 | | 2.515 | 0.617 | 0.858 | 4.788 | 5.237 | 14.015 | 29.995 | 15.980 | 53.276 |
| Ni | | 5 | | 11 | | 1.677 | 0.658 | 0.842 | 5.094 | 5.811 | 14.082 | 19.965 | 5.883 | 29.466 |
| Ni | | 5 | | 11 | | 2.256 | 0.616 | 1.070 | 3.862 | 3.708 | 11.511 | 30.750 | 19.239 | 62.565 |
| Ni | | 5 | | 11 | | 1.936 | 0.658 | 0.979 | 5.342 | 3.774 | 12.688 | 28.455 | 15.767 | 55.409 |
| Ni | | 5 | | 12 | | 1.844 | 0.650 | 0.942 | 5.093 | 4.272 | 12.801 | 43.010 | 30.209 | 70.238 |
| Ni | | 5 | | 12 | | 1.540 | 0.675 | 0.728 | 5.328 | 3.305 | 11.576 | 36.030 | 24.454 | 67.870 |
| Ni | | 5 | | 12 | | 2.500 | 0.607 | 0.959 | 5.407 | 3.474 | 12.946 | 36.595 | 23.649 | 64.623 |
| Pb | | 1 | | 2 | | 4.178 | 1.614 | 1.213 | 25.020 | 3.646 | 35.670 | 120.060 | 84.390 | 70.290 |
| Pb | | 1 | | 2 | | 5.150 | 1.522 | 1.209 | 28.247 | 3.906 | 40.034 | 132.370 | 92.336 | 69.756 |
| Pb | | 1 | | 2 | | 4.651 | 1.562 | 1.213 | 26.936 | 4.655 | 39.017 | 122.495 | 83.478 | 68.148 |
| Pb | | 1 | | 5 | | 2.233 | 1.741 | 1.215 | 28.265 | 4.103 | 37.558 | 132.530 | 94.972 | 71.661 |
| Pb | | 1 | | 5 | | 4.992 | 1.571 | 1.215 | 29.286 | 3.954 | 41.017 | 121.140 | 80.123 | 66.141 |
| Pb | | 1 | | 5 | | 2.759 | 1.701 | 1.214 | 29.157 | 3.682 | 38.513 | 159.180 | 120.667 | 75.805 |
| Pb | | 1 | | 9 | | 2.864 | 4.141 | 1.177 | 23.738 | 3.927 | 35.847 | 155.820 | 119.973 | 76.995 |
| Pb | | 1 | | 9 | | 3.022 | 1.680 | 1.216 | 27.975 | 2.993 | 36.886 | 123.225 | 86.339 | 70.067 |
| Pb | | 1 | | 9 | | 2.995 | 1.711 | 1.230 | 29.042 | 2.720 | 37.699 | 166.665 | 128.966 | 77.381 |
| Pb | | 2 | | 3 | | 1.250 | 1.787 | 1.210 | 25.438 | 2.960 | 32.644 | 117.695 | 85.051 | 72.264 |
| Pb | | 2 | | 3 | | 1.250 | 1.800 | 1.209 | 26.140 | 3.561 | 33.961 | 125.050 | 91.089 | 72.842 |
| Pb | | 2 | | 3 | | 1.250 | 1.793 | 1.211 | 26.479 | 2.259 | 32.993 | 120.365 | 87.372 | 72.589 |
| Pb | | 2 | | 4 | | 1.250 | 1.795 | 1.215 | 26.618 | 3.418 | 34.296 | 130.365 | 96.069 | 73.692 |
| Pb | | 2 | | 4 | | 1.340 | 1.799 | 1.215 | 24.236 | 3.956 | 32.545 | 116.880 | 84.335 | 72.155 |
| Pb | | 2 | | 4 | | 1.250 | 1.808 | 1.339 | 26.368 | 2.030 | 32.796 | 145.650 | 112.854 | 77.483 |
| Pb | | 2 | | 7 | | 1.287 | 1.793 | 1.234 | 26.204 | 3.232 | 33.750 | 115.200 | 81.450 | 70.703 |
| Pb | | 2 | | 7 | | 1.250 | 1.805 | 1.217 | 25.159 | 3.958 | 33.389 | 136.240 | 102.851 | 75.492 |
| Pb | | 2 | | 7 | | 1.250 | 1.788 | 1.324 | 26.552 | 2.569 | 33.483 | 110.015 | 76.532 | 69.565 |
| Pb | | 3 | | 6 | | 1.445 | 1.781 | 1.211 | 27.329 | 8.399 | 40.166 | . | . | . |
| Pb | | 3 | | 6 | | 1.250 | 1.808 | 1.212 | 26.994 | 5.189 | 36.454 | 151.430 | 114.976 | 75.927 |
| Pb | | 3 | | 6 | | 1.250 | 1.806 | 1.747 | 25.893 | 4.512 | 35.208 | 126.690 | 91.482 | 72.209 |
| Pb | | 3 | | 14 | | 1.250 | 1.810 | 2.716 | 20.323 | 4.231 | 30.330 | 121.890 | 91.560 | 75.117 |
| Pb | | 3 | | 14 | | 1.250 | 1.806 | 2.290 | 26.506 | 4.883 | 36.735 | 129.850 | 93.115 | 71.710 |
| Pb | | 3 | | 14 | | 1.250 | 1.807 | 2.455 | 19.267 | 5.194 | 29.973 | 123.130 | 93.157 | 75.658 |
| Pb | | 3 | | 15 | | 1.250 | 1.799 | 2.005 | 27.399 | 1.768 | 34.221 | 137.515 | 103.294 | 75.114 |
| Pb | | 3 | | 15 | | 1.250 | 1.800 | 1.606 | 27.134 | 5.873 | 37.663 | 129.680 | 92.017 | 70.957 |
| Pb | | 3 | | 15 | | 1.250 | 1.800 | 2.125 | 26.786 | 2.848 | 34.809 | 144.655 | 109.846 | 75.936 |
| Pb | | 4 | | 8 | | 1.250 | 1.807 | 1.636 | 24.902 | 6.094 | 35.687 | 138.895 | 103.208 | 74.306 |
| Pb | | 4 | | 8 | | 1.366 | 1.805 | 1.215 | 27.004 | 5.560 | 36.951 | 109.200 | 72.249 | 66.162 |
| Pb | | 4 | | 8 | | 1.250 | 1.812 | 2.249 | 26.762 | 5.156 | 37.229 | 144.555 | 107.326 | 74.246 |
| Pb | | 4 | | 10 | | 1.250 | 1.800 | 1.447 | 21.632 | 5.751 | 31.879 | 160.990 | 129.111 | 80.198 |
| Pb | | 4 | | 10 | | 1.250 | 1.809 | 1.215 | 25.285 | 5.800 | 35.360 | 127.780 | 92.420 | 72.328 |
| Pb | | 4 | | 10 | | 1.250 | 1.804 | 1.218 | 28.295 | 5.325 | 37.892 | . | . | . |
| Pb | | 4 | | 13 | | 1.250 | 1.803 | 2.249 | 29.299 | 5.772 | 40.373 | 125.040 | 84.667 | 67.712 |
| Pb | | 4 | | 13 | | 1.250 | 1.807 | 1.489 | 28.397 | 3.620 | 36.563 | 172.590 | 136.027 | 78.815 |
| Pb | | 4 | | 13 | | 1.314 | 1.805 | 1.396 | 25.247 | 4.986 | 34.748 | 128.405 | 93.657 | 72.939 |
| Pb | | 5 | | 1 | | 1.250 | 1.797 | 2.680 | 30.843 | 6.261 | 42.830 | 125.755 | 82.925 | 65.942 |
| Pb | | 5 | | 1 | | 1.250 | 1.808 | 2.228 | 35.215 | 5.315 | 45.816 | 187.775 | 141.959 | 75.601 |
| Pb | | 5 | | 1 | | 1.419 | 1.800 | 2.980 | 37.185 | 7.747 | 51.131 | 172.165 | 121.034 | 70.301 |
| Pb | | 5 | | 11 | | 1.250 | 1.807 | 1.767 | 28.103 | 9.666 | 42.594 | 144.850 | 102.256 | 70.595 |
| Pb | | 5 | | 11 | | 1.250 | 1.801 | 2.968 | 23.100 | 6.198 | 35.317 | 117.250 | 81.933 | 69.879 |
| Pb | | 5 | | 11 | | 1.250 | 1.816 | 3.121 | 26.459 | 5.206 | 37.852 | 141.590 | 103.738 | 73.267 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pb | | 5 | | 12 | | 1.250 | 1.807 | 2.107 | 27.268 | 6.364 | 38.796 | 183.190 | 144.394 | 78.822 |
| Pb | | 5 | | 12 | | 1.250 | 1.815 | 1.328 | 28.193 | 4.138 | 36.723 | 156.720 | 119.997 | 76.568 |
| Pb | | 5 | | 12 | | 1.250 | 1.804 | 2.496 | 27.839 | 5.787 | 39.175 | 128.205 | 89.030 | 69.444 |
| Sr | | 1 | | 2 | | 0.082 | 0.070 | 0.049 | 32.713 | 0.209 | 33.123 | 89.015 | 55.892 | 62.789 |
| Sr | | 1 | | 2 | | 0.101 | 0.068 | 0.048 | 30.540 | 0.209 | 30.966 | 109.645 | 78.679 | 71.758 |
| Sr | | 1 | | 2 | | 0.091 | 0.069 | 0.049 | 31.223 | 0.716 | 32.147 | 81.435 | 49.288 | 60.524 |
| Sr | | 1 | | 5 | | 0.091 | 0.070 | 0.049 | 32.100 | 0.782 | 33.091 | 96.315 | 63.224 | 65.643 |
| Sr | | 1 | | 5 | | 0.110 | 0.068 | 0.049 | 32.438 | 0.564 | 33.229 | 96.390 | 63.161 | 65.526 |
| Sr | | 1 | | 5 | | 0.055 | 0.072 | 0.049 | 33.018 | 0.544 | 33.737 | 245.985 | 212.248 | 86.285 |
| Sr | | 1 | | 9 | | 0.165 | 1.053 | 0.043 | 27.709 | 0.828 | 29.799 | 141.650 | 111.851 | 78.963 |
| Sr | | 1 | | 9 | | 0.091 | 0.069 | 0.049 | 32.866 | 0.000 | 33.075 | 105.825 | 72.750 | 68.746 |
| Sr | | 1 | | 9 | | 0.082 | 0.071 | 0.049 | 32.776 | 0.219 | 33.197 | 136.550 | 103.353 | 75.689 |
| Sr | | 2 | | 3 | | 2.258 | 0.000 | 0.048 | 27.717 | 0.367 | 30.390 | 142.500 | 112.110 | 78.673 |
| Sr | | 2 | | 3 | | 2.313 | 0.000 | 0.048 | 27.814 | 0.243 | 30.418 | 141.650 | 111.232 | 78.526 |
| Sr | | 2 | | 3 | | 2.377 | 0.067 | 0.045 | 26.820 | 0.219 | 29.527 | 143.030 | 113.503 | 79.356 |
| Sr | | 2 | | 4 | | 2.395 | 0.000 | 0.049 | 27.525 | 0.310 | 30.278 | 97.830 | 67.552 | 69.050 |
| Sr | | 2 | | 4 | | 2.249 | 0.000 | 0.049 | 26.765 | 1.003 | 30.066 | 134.500 | 104.434 | 77.646 |
| Sr | | 2 | | 4 | | 2.386 | 0.000 | 0.049 | 28.291 | 0.164 | 30.889 | 125.390 | 94.501 | 75.365 |
| Sr | | 2 | | 7 | | 2.478 | 0.065 | 0.046 | 27.973 | 0.000 | 30.562 | 92.785 | 62.223 | 67.062 |
| Sr | | 2 | | 7 | | 2.724 | 0.000 | 0.049 | 26.883 | 0.624 | 30.280 | 170.860 | 140.580 | 82.278 |
| Sr | | 2 | | 7 | | 2.395 | 0.000 | 0.048 | 27.586 | 0.000 | 30.030 | 90.055 | 60.025 | 66.654 |
| Sr | | 3 | | 6 | | 9.133 | 0.000 | 0.045 | 41.429 | 13.556 | 64.164 | . | . | . |
| Sr | | 3 | | 6 | | 9.206 | 0.000 | 0.047 | 41.174 | 9.472 | 59.900 | 200.775 | 140.875 | 70.166 |
| Sr | | 3 | | 6 | | 8.676 | 0.000 | 0.045 | 38.331 | 8.254 | 55.306 | 185.055 | 129.749 | 70.114 |
| Sr | | 3 | | 14 | | 7.716 | 0.000 | 0.047 | 33.322 | 9.862 | 50.946 | 173.690 | 122.744 | 70.668 |
| Sr | | 3 | | 14 | | 8.200 | 0.000 | 0.047 | 39.843 | 8.613 | 56.703 | 167.005 | 110.302 | 66.047 |
| Sr | | 3 | | 14 | | 8.063 | 0.000 | 0.047 | 34.515 | 9.171 | 51.796 | 189.860 | 138.064 | 72.719 |
| Sr | | 3 | | 15 | | 8.402 | 0.000 | 0.046 | 41.278 | 7.674 | 57.399 | 202.140 | 144.741 | 71.604 |
| Sr | | 3 | | 15 | | 9.170 | 0.000 | 0.046 | 41.885 | 10.412 | 61.512 | 192.220 | 130.708 | 67.999 |
| Sr | | 3 | | 15 | | 8.475 | 0.000 | 0.046 | 41.209 | 7.687 | 57.416 | 246.650 | 189.234 | 76.722 |
| Sr | | 4 | | 8 | | 10.980 | 0.000 | 0.047 | 44.646 | 14.835 | 70.508 | 214.405 | 143.897 | 67.115 |
| Sr | | 4 | | 8 | | 10.733 | 0.000 | 0.046 | 46.757 | 13.157 | 70.693 | 242.230 | 171.537 | 70.816 |
| Sr | | 4 | | 8 | | 10.459 | 0.000 | 0.046 | 45.922 | 14.139 | 70.566 | 243.340 | 172.774 | 71.001 |
| Sr | | 4 | | 10 | | 10.989 | 0.000 | 0.045 | 41.471 | 13.407 | 65.911 | 240.040 | 174.129 | 72.541 |
| Sr | | 4 | | 10 | | 11.583 | 0.000 | 0.047 | 41.996 | 11.813 | 65.438 | 232.740 | 167.302 | 71.884 |
| Sr | | 4 | | 10 | | 11.866 | 0.000 | 0.046 | 43.680 | 12.289 | 67.881 | . | . | . |
| Sr | | 4 | | 13 | | 11.519 | 0.000 | 0.045 | 47.075 | 12.459 | 71.098 | 250.480 | 179.382 | 71.615 |
| Sr | | 4 | | 13 | | 11.620 | 0.000 | 0.046 | 46.523 | 11.595 | 69.783 | 256.210 | 186.427 | 72.763 |
| Sr | | 4 | | 13 | | 12.543 | 0.000 | 0.046 | 46.682 | 11.460 | 70.730 | 207.240 | 136.510 | 65.870 |
| Sr | | 5 | | 1 | | 13.539 | 0.000 | 0.040 | 45.453 | 14.490 | 73.522 | 231.570 | 158.048 | 68.251 |
| Sr | | 5 | | 1 | | 14.061 | 0.000 | 0.086 | 51.523 | 14.927 | 80.597 | 310.455 | 229.858 | 74.039 |
| Sr | | 5 | | 1 | | 13.219 | 0.000 | 0.044 | 50.850 | 19.066 | 83.179 | 294.630 | 211.451 | 71.768 |
| Sr | | 5 | | 11 | | 14.298 | 0.000 | 0.044 | 50.374 | 23.432 | 88.148 | 275.585 | 187.437 | 68.014 |
| Sr | | 5 | | 11 | | 14.783 | 0.000 | 0.043 | 45.846 | 14.552 | 75.225 | 253.495 | 178.270 | 70.325 |
| Sr | | 5 | | 11 | | 14.609 | 0.000 | 0.041 | 51.119 | 15.388 | 81.157 | 251.335 | 170.178 | 67.710 |
| Sr | | 5 | | 12 | | 13.037 | 0.000 | 0.044 | 51.347 | 15.197 | 79.624 | 295.645 | 216.021 | 73.068 |
| Sr | | 5 | | 12 | | 12.260 | 0.000 | 0.042 | 49.214 | 14.810 | 76.326 | 251.195 | 174.869 | 69.615 |
| Sr | | 5 | | 12 | | 14.106 | 0.000 | 0.045 | 50.084 | 15.914 | 80.149 | 222.315 | 142.166 | 63.948 |
| Zn | | 1 | | 2 | | 11.734 | 0.000 | 0.283 | 6.859 | 10.114 | 28.990 | 65.245 | 36.255 | 55.567 |
| Zn | | 1 | | 2 | | 11.297 | 0.000 | 0.192 | 7.621 | 10.374 | 29.484 | 83.140 | 53.656 | 64.538 |
| Zn | | 1 | | 2 | | 11.462 | 0.000 | 0.547 | 7.098 | 12.291 | 31.398 | 68.630 | 37.232 | 54.251 |
| Zn | | 1 | | 5 | | 17.577 | 0.000 | 0.492 | 8.524 | 13.344 | 39.938 | 75.735 | 35.797 | 47.266 |
| Zn | | 1 | | 5 | | 16.061 | 0.000 | 0.192 | 8.745 | 12.631 | 37.629 | 75.320 | 37.691 | 50.041 |
| Zn | | 1 | | 5 | | 14.448 | 0.000 | 0.193 | 8.250 | 12.085 | 34.977 | 104.540 | 69.563 | 66.542 |
| Zn | | 1 | | 9 | | 12.959 | 0.630 | 0.366 | 6.952 | 10.335 | 31.243 | 78.270 | 47.027 | 60.083 |
| Zn | | 1 | | 9 | | 13.045 | 0.000 | 0.193 | 8.448 | 11.806 | 33.493 | 79.525 | 46.032 | 57.884 |
| Zn | | 1 | | 9 | | 13.067 | 0.000 | 0.255 | 9.206 | 8.972 | 31.500 | 78.200 | 46.700 | 59.718 |
| Zn | | 2 | | 3 | | 12.965 | 0.000 | 0.189 | 9.684 | 12.631 | 35.469 | 84.280 | 48.811 | 57.916 |
| Zn | | 2 | | 3 | | 13.154 | 0.000 | 0.223 | 9.926 | 11.703 | 35.005 | 67.705 | 32.700 | 48.298 |
| Zn | | 2 | | 3 | | 13.398 | 0.000 | 0.651 | 9.907 | 10.217 | 34.173 | 78.350 | 44.177 | 56.384 |
| Zn | | 2 | | 4 | | 11.109 | 0.000 | 0.194 | 10.169 | 11.684 | 33.156 | 75.635 | 42.479 | 56.164 |
| Zn | | 2 | | 4 | | 10.770 | 0.000 | 0.195 | 9.035 | 15.130 | 35.130 | 101.425 | 66.295 | 65.363 |
| Zn | | 2 | | 4 | | 11.442 | 0.000 | 0.249 | 10.234 | 9.645 | 31.570 | 106.190 | 74.620 | 70.270 |
| Zn | | 2 | | 7 | | 17.112 | 0.000 | 0.425 | 10.757 | 11.177 | 39.470 | 77.840 | 38.370 | 49.293 |
| Zn | | 2 | | 7 | | 18.976 | 0.000 | 0.638 | 10.478 | 13.157 | 43.248 | 83.810 | 40.562 | 48.397 |
| Zn | | 2 | | 7 | | 17.165 | 0.000 | 0.348 | 10.264 | 11.298 | 39.074 | 76.250 | 37.176 | 48.755 |
| Zn | | 3 | | 6 | | 17.327 | 0.000 | 0.309 | 12.817 | 18.309 | 48.762 | . | . | . |
| Zn | | 3 | | 6 | | 14.963 | 0.000 | 0.289 | 13.059 | 12.975 | 41.287 | 96.605 | 55.318 | 57.262 |
| Zn | | 3 | | 6 | | 15.106 | 0.000 | 0.460 | 12.317 | 10.815 | 38.698 | 82.935 | 44.237 | 53.340 |
| Zn | | 3 | | 14 | | 12.225 | 0.117 | 0.344 | 11.025 | 10.804 | 34.515 | 84.570 | 50.055 | 59.187 |
| Zn | | 3 | | 14 | | 12.919 | 0.000 | 0.431 | 14.522 | 12.456 | 40.328 | 78.090 | 37.762 | 48.356 |
| Zn | | 3 | | 14 | | 13.152 | 0.000 | 0.730 | 10.027 | 11.435 | 35.344 | 96.615 | 61.271 | 63.418 |
| Zn | | 3 | | 15 | | 11.164 | 0.000 | 0.517 | 14.100 | 10.938 | 36.718 | 92.660 | 55.942 | 60.373 |
| Zn | | 3 | | 15 | | 12.088 | 0.000 | 0.305 | 13.745 | 13.800 | 39.938 | 85.130 | 45.192 | 53.086 |
| Zn | | 3 | | 15 | | 11.152 | 0.000 | 0.436 | 14.074 | 10.653 | 36.314 | 94.525 | 58.211 | 61.582 |
| Zn | | 4 | | 8 | | 14.240 | 0.000 | 0.340 | 14.460 | 14.232 | 43.272 | 87.630 | 44.358 | 50.619 |
| Zn | | 4 | | 8 | | 14.085 | 0.000 | 0.334 | 14.964 | 13.149 | 42.532 | 113.475 | 70.943 | 62.519 |
| Zn | | 4 | | 8 | | 14.269 | 0.000 | 0.396 | 15.470 | 13.757 | 43.892 | 89.800 | 45.908 | 51.123 |
| Zn | | 4 | | 10 | | 9.685 | 0.000 | 0.377 | 11.492 | 13.242 | 34.796 | 99.890 | 65.094 | 65.166 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Zn | | 4 | | 10 | | 10.604 | 0.000 | 0.420 | 14.559 | 11.089 | 36.672 | 95.760 | 59.088 | 61.705 |
| Zn | | 4 | | 10 | | 10.901 | 0.000 | 0.407 | 15.706 | 11.151 | 38.165 | . | . | . |
| Zn | | 4 | | 13 | | 11.616 | 0.000 | 0.821 | 15.852 | 12.327 | 40.616 | 88.375 | 47.759 | 54.042 |
| Zn | | 4 | | 13 | | 11.679 | 0.000 | 0.387 | 15.345 | 11.302 | 38.713 | 104.655 | 65.942 | 63.009 |
| Zn | | 4 | | 13 | | 12.289 | 0.000 | 0.660 | 13.175 | 10.795 | 36.919 | 81.870 | 44.951 | 54.905 |
| Zn | | 5 | | 1 | | 11.764 | 0.000 | 0.501 | 14.230 | 11.921 | 38.416 | 92.060 | 53.644 | 58.270 |
| Zn | | 5 | | 1 | | 12.095 | 0.000 | 0.793 | 16.434 | 12.861 | 42.183 | 111.275 | 69.092 | 62.091 |
| Zn | | 5 | | 1 | | 11.323 | 0.000 | 0.453 | 15.955 | 14.827 | 42.557 | 90.590 | 48.033 | 53.022 |
| Zn | | 5 | | 11 | | 10.431 | 0.000 | 0.702 | 16.390 | 19.366 | 46.888 | 103.860 | 56.972 | 54.854 |
| Zn | | 5 | | 11 | | 10.959 | 0.000 | 0.702 | 13.100 | 11.741 | 36.502 | 97.475 | 60.973 | 62.553 |
| Zn | | 5 | | 11 | | 10.689 | 2.438 | 0.385 | 16.427 | 10.835 | 40.775 | 97.045 | 56.270 | 57.984 |
| Zn | | 5 | | 12 | | 10.298 | 0.000 | 0.423 | 16.659 | 11.703 | 39.083 | 113.950 | 74.867 | 65.702 |
| Zn | | 5 | | 12 | | 9.868 | 0.069 | 0.573 | 17.068 | 11.471 | 39.049 | 93.300 | 54.251 | 58.147 |
| Zn | | 5 | | 12 | | 11.492 | 0.000 | 0.502 | 16.699 | 12.099 | 40.791 | 94.570 | 53.779 | 56.867 |

| 18 week weathering cycle: sequential selective dissolution | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | KNO3 | Di water | NaOH | EDTA | HNO3 | Residual | |
| elem | trt | % total | % total | % total | % total | % total | % total | Sum% |
| Ba | 0:0 | 0.255 | 0.038 | 0.014 | 13.822 | 1.065 | 84.807 | 100.000 |
| Ba | 197:0 | 0.385 | 0.272 | 0.000 | 15.907 | 1.138 | 82.297 | 100.000 |
| Ba | 197:197 | 0.827 | 0.172 | 0.002 | 18.296 | 2.164 | 78.540 | 100.000 |
| Ba | 197:295 | 0.943 | 0.275 | 0.005 | 17.461 | 2.447 | 78.869 | 100.000 |
| Ba | 197:394 | 1.136 | 0.184 | 0.003 | 17.550 | 2.802 | 78.325 | 100.000 |
| Co | 0:0 | 2.768 | 1.301 | 0.955 | 8.858 | 11.099 | 75.018 | 100.000 |
| Co | 197:0 | 1.124 | 1.613 | 1.752 | 17.398 | 14.321 | 63.793 | 100.000 |
| Co | 197:197 | 0.870 | 1.248 | 1.643 | 13.731 | 12.785 | 69.723 | 100.000 |
| Co | 197:295 | 0.768 | 1.110 | 1.398 | 12.036 | 11.273 | 73.415 | 100.000 |
| Co | 197:394 | 0.594 | 0.855 | 1.388 | 10.991 | 8.694 | 77.478 | 100.000 |
| Cr | 0:0 | 0.365 | 0.524 | 0.354 | 6.338 | 5.170 | 87.249 | 100.000 |
| Cr | 197:0 | 0.370 | 1.182 | 0.312 | 1.080 | 6.201 | 90.855 | 100.000 |
| Cr | 197:197 | 0.366 | 1.109 | 0.311 | 1.408 | 6.467 | 90.338 | 100.000 |
| Cr | 197:295 | 0.439 | 1.152 | 0.288 | 1.213 | 5.772 | 91.137 | 100.000 |
| Cr | 197:394 | 0.318 | 0.964 | 0.270 | 1.136 | 5.334 | 91.977 | 100.000 |
| Cu | 0:0 | 21.041 | 0.000 | 13.570 | 21.434 | 10.864 | 33.092 | 100.000 |
| Cu | 197:0 | 0.235 | 0.444 | 13.039 | 25.544 | 5.547 | 55.192 | 100.000 |
| Cu | 197:197 | 0.215 | 0.550 | 13.449 | 26.836 | 6.994 | 51.956 | 100.000 |
| Cu | 197:295 | 0.195 | 0.514 | 12.601 | 24.827 | 7.151 | 54.711 | 100.000 |
| Cu | 197:394 | 0.153 | 0.403 | 10.658 | 20.689 | 6.092 | 62.004 | 100.000 |
| Mn | 0:0 | 4.732 | 0.000 | 0.038 | 6.351 | 4.192 | 84.687 | 100.000 |
| Mn | 197:0 | 0.403 | 0.230 | 0.061 | 56.125 | 9.427 | 33.754 | 100.000 |
| Mn | 197:197 | 0.583 | 0.300 | 0.055 | 69.366 | 11.798 | 17.898 | 100.000 |
| Mn | 197:295 | 0.768 | 0.257 | 0.038 | 65.047 | 11.459 | 22.431 | 100.000 |
| Mn | 197:394 | 0.459 | 0.187 | 0.068 | 50.373 | 8.691 | 40.221 | 100.000 |
| Ni | 0:0 | 6.554 | 6.271 | 4.321 | 28.977 | 35.792 | 18.085 | 100.000 |
| Ni | 197:0 | 3.496 | 5.015 | 7.904 | 53.792 | 29.793 | 0.000 | 100.000 |
| Ni | 197:197 | 2.820 | 4.089 | 6.382 | 45.177 | 26.461 | 15.070 | 100.000 |
| Ni | 197:295 | 2.168 | 3.133 | 4.834 | 36.408 | 19.748 | 33.710 | 100.000 |
| Ni | 197:394 | 1.701 | 2.456 | 3.901 | 30.645 | 16.100 | 45.197 | 100.000 |
| Pb | 0:0 | 2.029 | 1.080 | 0.782 | 19.101 | 3.078 | 73.929 | 100.000 |
| Pb | 197:0 | 0.978 | 1.386 | 1.177 | 21.888 | 3.656 | 70.914 | 100.000 |
| Pb | 197:197 | 0.828 | 1.188 | 1.141 | 18.641 | 3.728 | 74.474 | 100.000 |
| Pb | 197:295 | 0.822 | 1.188 | 1.026 | 18.535 | 3.805 | 74.624 | 100.000 |
| Pb | 197:394 | 0.695 | 1.001 | 1.035 | 16.336 | 3.221 | 77.711 | 100.000 |
| Sr | 0:0 | 0.081 | 0.034 | 0.026 | 16.232 | 0.376 | 83.251 | 100.000 |
| Sr | 197:0 | 0.952 | 0.004 | 0.032 | 17.011 | 0.500 | 81.500 | 100.000 |
| Sr | 197:197 | 2.868 | 0.004 | 0.022 | 19.141 | 3.076 | 74.889 | 100.000 |
| Sr | 197:295 | 3.119 | 0.000 | 0.026 | 16.576 | 3.642 | 76.638 | 100.000 |
| Sr | 197:394 | 2.690 | 0.000 | 0.012 | 13.061 | 3.184 | 81.053 | 100.000 |
| Zn | 0:0 | 5.721 | 0.027 | 0.409 | 10.493 | 17.600 | 65.751 | 100.000 |
| Zn | 197:0 | 0.195 | 0.690 | 0.363 | 28.507 | 17.815 | 52.431 | 100.000 |
| Zn | 197:197 | 0.194 | 0.674 | 0.574 | 31.600 | 18.083 | 48.875 | 100.000 |
| Zn | 197:295 | 0.270 | 0.593 | 0.652 | 27.824 | 14.890 | 55.771 | 100.000 |
| Zn | 197:394 | 0.155 | 0.492 | 0.628 | 26.770 | 12.715 | 59.239 | 100.000 |

18 week weathering cycle: sequential selective dissolution

Percent of Totals

| elem | trt | sample name | %KNO3 | %DI | %NaOH | %EDTA | %HNO3 | % Residual | Sum % |
|---|---|---|---|---|---|---|---|---|---|
| Ba | 1 | 2 | 0.335 | 0.000 | 0.010 | 13.499 | 0.538 | 85.618 | 100.000 |
| Ba | 1 | 2 | | | | | | . | 0.000 |
| Ba | 1 | 2 | | | | | | . | 0.000 |
| Ba | 1 | 5 | 0.297 | 0.003 | 0.027 | 14.148 | 1.091 | 84.434 | 100.000 |
| Ba | 1 | 5 | | | | | | . | 0.000 |
| Ba | 1 | 5 | | | | | | . | 0.000 |
| Ba | 1 | 9 | 0.189 | 0.023 | 0.010 | 13.033 | 1.087 | 85.659 | 100.000 |
| Ba | 1 | 9 | | | | | | . | 0.000 |
| Ba | 1 | 9 | | | | | | . | 0.000 |
| Ba | 2 | 3 | 0.340 | 0.209 | 0.000 | 13.561 | 1.045 | 84.845 | 100.000 |
| Ba | 2 | 3 | 0.342 | 0.201 | 0.001 | 16.105 | 0.520 | 82.831 | 100.000 |
| Ba | 2 | 3 | 0.363 | 0.260 | 0.000 | 16.121 | 1.593 | 81.663 | 100.000 |
| Ba | 2 | 4 | | | | | | . | 0.000 |
| Ba | 2 | 4 | | | | | | . | 0.000 |
| Ba | 2 | 4 | 0.490 | 0.234 | 0.001 | 17.341 | 0.672 | 81.262 | 100.000 |
| Ba | 2 | 7 | 0.367 | 0.258 | 0.000 | 14.508 | 1.261 | 83.606 | 100.000 |
| Ba | 2 | 7 | | | | | | . | 0.000 |
| Ba | 2 | 7 | 0.412 | 0.313 | 0.000 | 17.590 | 1.099 | 80.585 | 100.000 |
| Ba | 3 | 6 | 0.876 | 0.215 | 0.000 | 20.817 | 2.640 | 75.452 | 100.000 |
| Ba | 3 | 6 | 0.761 | 0.103 | 0.002 | 16.207 | 1.704 | 81.222 | 100.000 |
| Ba | 3 | 6 | 0.725 | 0.064 | 0.001 | 17.025 | 1.392 | 80.792 | 100.000 |
| Ba | 3 | 14 | | | | | | . | 0.000 |
| Ba | 3 | 14 | 0.737 | 0.227 | 0.004 | 16.018 | 1.777 | 81.237 | 100.000 |
| Ba | 3 | 14 | 0.751 | 0.137 | 0.006 | 17.551 | 2.385 | 79.169 | 100.000 |
| Ba | 3 | 15 | | | | | | . | 0.000 |
| Ba | 3 | 15 | 0.951 | 0.170 | 0.000 | 20.759 | 2.570 | 75.550 | 100.000 |
| Ba | 3 | 15 | 0.918 | 0.195 | 0.000 | 18.646 | 2.368 | 77.873 | 100.000 |
| Ba | 4 | 8 | 0.881 | 0.252 | 0.000 | 17.743 | 2.640 | 78.484 | 100.000 |
| Ba | 4 | 8 | | | | | | . | 0.000 |
| Ba | 4 | 8 | 1.016 | 0.234 | 0.000 | 18.924 | 2.500 | 77.326 | 100.000 |
| Ba | 4 | 10 | 0.821 | 0.162 | 0.007 | 15.864 | 2.880 | 80.265 | 100.000 |
| Ba | 4 | 10 | 0.976 | 0.660 | 0.000 | 16.709 | 2.242 | 79.413 | 100.000 |
| Ba | 4 | 10 | 0.992 | 0.186 | 0.000 | 18.417 | 2.492 | 77.913 | 100.000 |
| Ba | 4 | 13 | 0.924 | 0.184 | 0.000 | 17.140 | 2.364 | 79.388 | 100.000 |
| Ba | 4 | 13 | | | | | | . | 0.000 |
| Ba | 4 | 13 | 0.947 | 0.144 | 0.000 | 17.048 | 2.217 | 79.644 | 100.000 |
| Ba | 5 | 1 | 1.092 | 0.134 | 0.000 | 16.176 | 2.492 | 80.106 | 100.000 |
| Ba | 5 | 1 | 1.276 | 0.217 | 0.000 | 17.869 | 3.058 | 77.579 | 100.000 |
| Ba | 5 | 1 | | | | | | . | 0.000 |
| Ba | 5 | 11 | | | | | | . | 0.000 |
| Ba | 5 | 11 | | | | | | . | 0.000 |
| Ba | 5 | 11 | | | | | | . | 0.000 |
| Ba | 5 | 12 | 1.103 | 0.190 | 0.022 | 18.457 | 4.902 | 75.327 | 100.000 |
| Ba | 5 | 12 | 1.005 | 0.170 | 0.000 | 16.852 | 2.474 | 79.500 | 100.000 |
| Ba | 5 | 12 | 1.049 | 0.082 | 0.001 | 18.634 | 2.913 | 77.320 | 100.000 |
| Co | 1 | 2 | 3.427 | 1.235 | 0.950 | 8.833 | 10.639 | 74.916 | 100.000 |
| Co | 1 | 2 | 3.422 | 1.853 | 1.354 | 13.243 | 15.913 | 64.215 | 100.000 |
| Co | 1 | 2 | 1.499 | 1.114 | 0.792 | 7.236 | 9.477 | 79.883 | 100.000 |
| Co | 1 | 5 | 2.221 | 1.137 | 0.808 | 6.250 | 9.541 | 80.042 | 100.000 |
| Co | 1 | 5 | 2.633 | 1.301 | 0.920 | 8.056 | 10.845 | 76.245 | 100.000 |
| Co | 1 | 5 | 3.324 | 1.187 | 0.877 | 7.628 | 9.968 | 77.016 | 100.000 |
| Co | 1 | 9 | 2.721 | 1.216 | 0.919 | 8.956 | 10.704 | 75.484 | 100.000 |
| Co | 1 | 9 | 2.167 | 1.160 | 0.858 | 9.255 | 10.119 | 76.441 | 100.000 |
| Co | 1 | 9 | 4.891 | 2.057 | 1.541 | 14.667 | 17.339 | 59.504 | 100.000 |
| Co | 2 | 3 | 1.434 | 2.050 | 2.292 | 25.604 | 17.686 | 50.935 | 100.000 |
| Co | 2 | 3 | 1.273 | 1.834 | 1.260 | 26.344 | 15.049 | 54.240 | 100.000 |
| Co | 2 | 3 | 1.404 | 2.032 | 2.860 | 20.954 | 18.076 | 54.674 | 100.000 |
| Co | 2 | 4 | 0.926 | 1.330 | 1.623 | 14.160 | 12.215 | 69.746 | 100.000 |
| Co | 2 | 4 | 0.900 | 1.294 | 2.398 | 16.572 | 11.709 | 67.127 | 100.000 |
| Co | 2 | 4 | 1.374 | 1.975 | 1.291 | 15.976 | 14.804 | 64.581 | 100.000 |
| Co | 2 | 7 | 1.335 | 1.907 | 2.929 | 21.522 | 16.979 | 55.328 | 100.000 |
| Co | 2 | 7 | 0.831 | 1.189 | 0.766 | 9.503 | 11.862 | 75.849 | 100.000 |
| Co | 2 | 7 | 1.064 | 1.516 | 0.986 | 13.754 | 14.534 | 68.146 | 100.000 |
| Co | 3 | 6 | 0.996 | 1.420 | 3.406 | 12.806 | 15.416 | 65.956 | 100.000 |
| Co | 3 | 6 | 0.963 | 1.372 | 1.980 | 15.789 | 14.389 | 65.507 | 100.000 |
| Co | 3 | 6 | 0.844 | 1.200 | 1.720 | 15.887 | 11.332 | 69.017 | 100.000 |
| Co | 3 | 14 | 0.682 | 0.984 | 1.194 | 8.530 | 10.255 | 78.354 | 100.000 |
| Co | 3 | 14 | 1.068 | 1.543 | 2.048 | 17.438 | 14.698 | 63.206 | 100.000 |
| Co | 3 | 14 | 1.045 | 1.509 | 2.004 | 16.824 | 14.852 | 63.766 | 100.000 |
| Co | 3 | 15 | 0.759 | 1.094 | 0.702 | 13.065 | 11.121 | 73.259 | 100.000 |
| Co | 3 | 15 | 1.163 | 1.663 | 1.075 | 13.817 | 18.359 | 63.924 | 100.000 |
| Co | 3 | 15 | 0.633 | 0.905 | 1.297 | 12.612 | 9.462 | 75.091 | 100.000 |
| Co | 4 | 8 | 0.793 | 1.147 | 0.749 | 9.771 | 12.397 | 75.143 | 100.000 |
| Co | 4 | 8 | 0.647 | 0.936 | 2.217 | 10.401 | 10.349 | 75.450 | 100.000 |
| Co | 4 | 8 | 0.892 | 1.291 | 0.819 | 13.511 | 13.136 | 70.352 | 100.000 |

|  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|
| Co | 4 | 10 | 0.625 | 0.905 | 1.347 | 7.077 | 10.734 | 79.312 | 100.000 |
| Co | 4 | 10 | 0.827 | 1.193 | 0.759 | 14.155 | 12.195 | 70.871 | 100.000 |
| Co | 4 | 10 | 0.882 | 1.276 | 0.826 | 12.219 | 12.681 | 72.116 | 100.000 |
| Co | 4 | 13 | 0.876 | 1.264 | 1.669 | 14.780 | 12.807 | 68.604 | 100.000 |
| Co | 4 | 13 | 0.650 | 0.939 | 1.930 | 11.671 | 7.456 | 77.354 | 100.000 |
| Co | 4 | 13 | 0.858 | 1.236 | 1.894 | 17.460 | 11.438 | 67.114 | 100.000 |
| Co | 5 | 1 | 0.546 | 0.789 | 1.944 | 13.072 | 7.355 | 76.294 | 100.000 |
| Co | 5 | 1 | 0.718 | 1.035 | 2.136 | 11.437 | 8.902 | 75.773 | 100.000 |
| Co | 5 | 1 | 0.448 | 0.646 | 1.323 | 7.810 | 6.080 | 83.694 | 100.000 |
| Co | 5 | 11 | 0.503 | 0.723 | 0.525 | 11.270 | 7.717 | 79.261 | 100.000 |
| Co | 5 | 11 | 0.573 | 0.821 | 0.765 | 7.703 | 8.964 | 81.174 | 100.000 |
| Co | 5 | 11 | 0.516 | 0.740 | 1.610 | 8.735 | 7.434 | 80.964 | 100.000 |
| Co | 5 | 12 | 0.723 | 1.042 | 1.660 | 12.714 | 12.695 | 71.166 | 100.000 |
| Co | 5 | 12 | 0.702 | 1.015 | 1.116 | 12.349 | 10.444 | 74.373 | 100.000 |
| Co | 5 | 12 | 0.819 | 1.180 | 1.770 | 17.461 | 11.874 | 66.896 | 100.000 |
| Cr | 1 | 2 | 0.394 | 0.564 | 0.381 | 8.997 | 4.951 | 84.714 | 100.000 |
| Cr | 1 | 2 | 0.338 | 0.484 | 0.329 | 7.511 | 4.737 | 86.602 | 100.000 |
| Cr | 1 | 2 | 0.354 | 0.505 | 0.344 | 4.843 | 5.088 | 88.866 | 100.000 |
| Cr | 1 | 5 | 0.381 | 0.553 | 0.370 | 5.894 | 5.392 | 87.410 | 100.000 |
| Cr | 1 | 5 | 0.388 | 0.564 | 0.376 | 5.243 | 5.524 | 87.906 | 100.000 |
| Cr | 1 | 5 | 0.388 | 0.563 | 0.378 | 8.105 | 5.491 | 85.075 | 100.000 |
| Cr | 1 | 9 | 0.373 | 0.531 | 0.361 | 6.790 | 5.227 | 86.718 | 100.000 |
| Cr | 1 | 9 | 0.335 | 0.477 | 0.326 | 4.848 | 5.248 | 88.766 | 100.000 |
| Cr | 1 | 9 | 0.346 | 0.496 | 0.335 | 5.187 | 4.953 | 88.683 | 100.000 |
| Cr | 2 | 3 | 0.365 | 1.078 | 0.315 | 0.382 | 6.655 | 91.204 | 100.000 |
| Cr | 2 | 3 | 0.344 | 1.043 | 0.294 | 1.070 | 5.406 | 91.842 | 100.000 |
| Cr | 2 | 3 | 0.375 | 1.191 | 0.306 | 1.379 | 6.283 | 90.467 | 100.000 |
| Cr | 2 | 4 | 0.423 | 1.221 | 0.367 | 1.402 | 6.433 | 90.154 | 100.000 |
| Cr | 2 | 4 | 0.329 | 1.018 | 0.284 | 0.342 | 6.201 | 91.826 | 100.000 |
| Cr | 2 | 4 | 0.393 | 1.272 | 0.341 | 1.699 | 5.929 | 90.365 | 100.000 |
| Cr | 2 | 7 | 0.338 | 0.949 | 0.286 | 0.316 | 6.116 | 91.995 | 100.000 |
| Cr | 2 | 7 | 0.405 | 1.707 | 0.315 | 1.848 | 6.417 | 89.308 | 100.000 |
| Cr | 2 | 7 | 0.377 | 1.269 | 0.314 | 1.615 | 6.471 | 89.954 | 100.000 |
| Cr | 3 | 6 | 0.391 | 1.178 | 0.334 | 1.466 | 7.204 | 89.427 | 100.000 |
| Cr | 3 | 6 | 0.333 | 0.770 | 0.297 | 1.428 | 5.972 | 91.200 | 100.000 |
| Cr | 3 | 6 | 0.316 | 0.796 | 0.270 | 1.914 | 5.662 | 91.042 | 100.000 |
| Cr | 3 | 14 | 0.371 | 1.098 | 0.321 | 2.101 | 6.287 | 89.823 | 100.000 |
| Cr | 3 | 14 | 0.384 | 1.488 | 0.313 | 0.941 | 6.792 | 90.082 | 100.000 |
| Cr | 3 | 14 | 0.363 | 0.974 | 0.316 | 0.790 | 6.148 | 91.409 | 100.000 |
| Cr | 3 | 15 | 0.386 | 1.712 | 0.299 | 1.554 | 6.677 | 89.373 | 100.000 |
| Cr | 3 | 15 | 0.376 | 1.109 | 0.318 | 1.857 | 6.759 | 89.581 | 100.000 |
| Cr | 3 | 15 | 0.392 | 0.990 | 0.340 | 0.494 | 6.996 | 90.788 | 100.000 |
| Cr | 4 | 8 | 0.330 | 1.328 | 0.280 | 1.036 | 5.747 | 91.279 | 100.000 |
| Cr | 4 | 8 | 0.377 | 1.303 | 0.328 | 0.995 | 6.541 | 90.456 | 100.000 |
| Cr | 4 | 8 | 0.359 | 1.394 | 0.282 | 1.865 | 6.068 | 90.032 | 100.000 |
| Cr | 4 | 10 | 0.321 | 0.974 | 0.268 | 1.463 | 5.495 | 91.480 | 100.000 |
| Cr | 4 | 10 | 0.316 | 0.891 | 0.266 | 0.876 | 5.941 | 91.710 | 100.000 |
| Cr | 4 | 10 | 1.263 | 1.230 | 0.300 | 1.410 | 6.239 | 89.558 | 100.000 |
| Cr | 4 | 13 | 0.353 | 0.995 | 0.307 | 0.835 | 6.374 | 91.136 | 100.000 |
| Cr | 4 | 13 | 0.343 | 1.135 | 0.291 | 1.516 | 4.402 | 92.314 | 100.000 |
| Cr | 4 | 13 | 0.330 | 1.164 | 0.278 | 0.953 | 5.284 | 91.992 | 100.000 |
| Cr | 5 | 1 | 0.309 | 1.109 | 0.246 | 0.891 | 4.639 | 92.807 | 100.000 |
| Cr | 5 | 1 | 0.330 | 1.094 | 0.287 | 0.976 | 5.439 | 91.873 | 100.000 |
| Cr | 5 | 1 | 0.299 | 0.905 | 0.249 | 0.885 | 4.966 | 92.697 | 100.000 |
| Cr | 5 | 11 | 0.321 | 0.903 | 0.275 | 1.039 | 4.895 | 92.568 | 100.000 |
| Cr | 5 | 11 | 0.349 | 1.054 | 0.303 | 1.469 | 6.279 | 90.547 | 100.000 |
| Cr | 5 | 11 | 0.307 | 0.799 | 0.272 | 0.932 | 5.592 | 92.098 | 100.000 |
| Cr | 5 | 12 | 0.330 | 0.976 | 0.287 | 1.434 | 5.127 | 91.847 | 100.000 |
| Cr | 5 | 12 | 0.300 | 0.995 | 0.241 | 0.905 | 5.061 | 92.498 | 100.000 |
| Cr | 5 | 12 | 0.326 | 0.851 | 0.282 | 1.789 | 6.161 | 90.590 | 100.000 |
| Cu | 1 | 2 | 31.423 | 0.000 | 18.170 | 30.263 | 13.299 | 6.844 | 100.000 |
| Cu | 1 | 2 | 27.856 | 0.000 | 18.851 | 30.368 | 12.989 | 9.936 | 100.000 |
| Cu | 1 | 2 | 21.063 | 0.000 | 15.071 | 21.361 | 10.907 | 31.598 | 100.000 |
| Cu | 1 | 5 | 17.984 | 0.000 | 12.085 | 17.669 | 9.823 | 42.438 | 100.000 |
| Cu | 1 | 5 | 11.875 | 0.000 | 7.124 | 12.014 | 5.632 | 63.354 | 100.000 |
| Cu | 1 | 5 | 18.121 | 0.000 | 11.776 | 18.593 | 9.620 | 41.891 | 100.000 |
| Cu | 1 | 9 | 25.848 | 0.000 | 18.585 | 25.251 | 14.734 | 15.583 | 100.000 |
| Cu | 1 | 9 | 25.162 | 0.000 | 16.975 | 28.243 | 14.396 | 15.224 | 100.000 |
| Cu | 1 | 9 | 25.640 | 0.000 | 13.716 | 25.334 | 14.560 | 20.750 | 100.000 |
| Cu | 2 | 3 | 0.140 | 0.200 | 6.669 | 14.003 | 4.594 | 74.394 | 100.000 |
| Cu | 2 | 3 | 0.139 | 0.320 | 6.831 | 16.039 | 2.170 | 74.500 | 100.000 |
| Cu | 2 | 3 | 0.148 | 0.363 | 7.920 | 16.481 | 3.789 | 71.299 | 100.000 |
| Cu | 2 | 4 | 0.333 | 0.666 | 17.320 | 33.804 | 8.601 | 39.276 | 100.000 |
| Cu | 2 | 4 | 0.277 | 0.553 | 16.124 | 28.611 | 6.806 | 47.630 | 100.000 |
| Cu | 2 | 4 | 0.235 | 0.471 | 12.842 | 26.943 | 4.233 | 55.276 | 100.000 |
| Cu | 2 | 7 | 0.485 | 0.692 | 27.848 | 51.166 | 10.815 | 8.993 | 100.000 |
| Cu | 2 | 7 | . | . | . | . | . | . | 0.000 |
| Cu | 2 | 7 | 0.383 | 0.592 | 23.989 | 46.361 | 8.404 | 20.273 | 100.000 |
| Cu | 3 | 6 | 0.229 | 0.326 | 14.194 | 26.507 | 8.205 | 50.539 | 100.000 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cu | 3 | 6 | 0.189 | 0.269 | 10.090 | 23.042 | 5.877 | 60.533 | 100.000 |
| Cu | 3 | 6 | 0.143 | 0.203 | 8.788 | 18.099 | 4.377 | 68.389 | 100.000 |
| Cu | 3 | 14 | 0.205 | 0.985 | 11.495 | 28.066 | 7.250 | 51.998 | 100.000 |
| Cu | 3 | 14 | 0.245 | 0.420 | 17.424 | 30.853 | 7.528 | 43.530 | 100.000 |
| Cu | 3 | 14 | 0.228 | 0.356 | 15.279 | 24.684 | 7.327 | 52.126 | 100.000 |
| Cu | 3 | 15 | 0.269 | 0.857 | 19.215 | 32.933 | 8.764 | 37.962 | 100.000 |
| Cu | 3 | 15 | 0.265 | 0.685 | 16.997 | 35.465 | 8.156 | 38.431 | 100.000 |
| Cu | 3 | 15 | 0.226 | 1.118 | 12.917 | 30.132 | 7.695 | 47.912 | 100.000 |
| Cu | 4 | 8 | 0.183 | 0.637 | 12.567 | 22.033 | 6.765 | 57.816 | 100.000 |
| Cu | 4 | 8 | 0.199 | 0.634 | 13.908 | 24.547 | 7.664 | 53.049 | 100.000 |
| Cu | 4 | 8 | 0.203 | 0.497 | 13.814 | 25.087 | 7.215 | 53.185 | 100.000 |
| Cu | 4 | 10 | 0.161 | 0.394 | 12.218 | 19.702 | 6.187 | 61.338 | 100.000 |
| Cu | 4 | 10 | 0.165 | 0.452 | 10.267 | 21.790 | 6.096 | 61.230 | 100.000 |
| Cu | 4 | 10 | 0.189 | 0.408 | 11.512 | 24.096 | 6.924 | 56.871 | 100.000 |
| Cu | 4 | 13 | 0.238 | 0.618 | 13.611 | 31.276 | 9.033 | 45.226 | 100.000 |
| Cu | 4 | 13 | 0.232 | 0.671 | 13.509 | 30.803 | 8.198 | 46.587 | 100.000 |
| Cu | 4 | 13 | 0.221 | 0.379 | 12.991 | 28.538 | 7.233 | 50.638 | 100.000 |
| Cu | 5 | 1 | 0.122 | 0.352 | 8.661 | 16.551 | 4.838 | 69.476 | 100.000 |
| Cu | 5 | 1 | 0.134 | 0.448 | 8.172 | 18.541 | 5.602 | 67.102 | 100.000 |
| Cu | 5 | 1 | 0.122 | 0.244 | 7.410 | 17.313 | 4.713 | 70.198 | 100.000 |
| Cu | 5 | 11 | 0.180 | 0.810 | 12.883 | 23.420 | 6.749 | 55.958 | 100.000 |
| Cu | 5 | 11 | 0.192 | 0.383 | 14.379 | 26.909 | 7.900 | 50.237 | 100.000 |
| Cu | 5 | 11 | 0.176 | 0.253 | 12.074 | 25.281 | 6.978 | 55.237 | 100.000 |
| Cu | 5 | 12 | 0.169 | 0.290 | 11.128 | 21.750 | 6.369 | 60.294 | 100.000 |
| Cu | 5 | 12 | 0.151 | 0.639 | 11.056 | 19.015 | 6.249 | 62.889 | 100.000 |
| Cu | 5 | 12 | 0.171 | 0.268 | 13.473 | 22.211 | 6.868 | 57.009 | 100.000 |
| Mn | 1 | 2 | 5.481 | 0.000 | 0.006 | 5.406 | 3.779 | 85.328 | 100.000 |
| Mn | 1 | 2 | . | . | . | . | . | . | 0.000 |
| Mn | 1 | 2 | 4.294 | 0.000 | 0.006 | 5.289 | 4.558 | 85.852 | 100.000 |
| Mn | 1 | 5 | 3.800 | 0.000 | 0.008 | 3.430 | 3.229 | 89.532 | 100.000 |
| Mn | 1 | 5 | . | . | . | . | . | . | 0.000 |
| Mn | 1 | 5 | 5.397 | 0.000 | 0.014 | 4.898 | 5.431 | 84.260 | 100.000 |
| Mn | 1 | 9 | 5.278 | 0.000 | 0.007 | 11.651 | 4.969 | 78.094 | 100.000 |
| Mn | 1 | 9 | 4.135 | 0.000 | 0.098 | 7.845 | 3.636 | 84.287 | 100.000 |
| Mn | 1 | 9 | . | . | . | . | . | . | 0.000 |
| Mn | 2 | 3 | 0.392 | 0.314 | 0.276 | 91.170 | 7.848 | 0.000 | 100.000 |
| Mn | 2 | 3 | 0.426 | 0.282 | 0.004 | 91.636 | 7.653 | 0.000 | 100.000 |
| Mn | 2 | 3 | 0.568 | 0.241 | 0.143 | 85.037 | 14.011 | 0.000 | 100.000 |
| Mn | 2 | 4 | 0.271 | 0.142 | 0.022 | 33.753 | 5.420 | 60.392 | 100.000 |
| Mn | 2 | 4 | 0.186 | 0.093 | 0.042 | 33.359 | 4.374 | 61.946 | 100.000 |
| Mn | 2 | 4 | 0.861 | 0.428 | 0.080 | 74.601 | 20.295 | 3.734 | 100.000 |
| Mn | 2 | 7 | 0.732 | 0.251 | 0.120 | 87.791 | 11.107 | 0.000 | 100.000 |
| Mn | 2 | 7 | 0.191 | 0.169 | 0.000 | 18.686 | 7.742 | 73.212 | 100.000 |
| Mn | 2 | 7 | 0.819 | 0.524 | 0.000 | 76.789 | 21.867 | 0.000 | 100.000 |
| Mn | 3 | 6 | 0.806 | 0.407 | 0.237 | 76.663 | 21.888 | 0.000 | 100.000 |
| Mn | 3 | 6 | 0.737 | 0.274 | 0.063 | 89.827 | 9.099 | 0.000 | 100.000 |
| Mn | 3 | 6 | 0.740 | 0.234 | 0.060 | 91.047 | 7.919 | 0.000 | 100.000 |
| Mn | 3 | 14 | 0.312 | 0.154 | 0.036 | 22.720 | 4.826 | 71.953 | 100.000 |
| Mn | 3 | 14 | 0.428 | 0.386 | 0.039 | 86.075 | 13.072 | 0.000 | 100.000 |
| Mn | 3 | 14 | 0.835 | 0.271 | 0.023 | 85.301 | 13.569 | 0.000 | 100.000 |
| Mn | 3 | 15 | 0.305 | 0.213 | 0.000 | 35.931 | 7.648 | 55.902 | 100.000 |
| Mn | 3 | 15 | 0.658 | 0.407 | 0.028 | 73.739 | 25.168 | 0.000 | 100.000 |
| Mn | 3 | 15 | 0.506 | 0.352 | 0.063 | 89.928 | 9.150 | 0.000 | 100.000 |
| Mn | 4 | 8 | 0.519 | 0.522 | 0.014 | 70.936 | 22.508 | 5.502 | 100.000 |
| Mn | 4 | 8 | 0.141 | 0.162 | 0.049 | 31.605 | 5.321 | 62.721 | 100.000 |
| Mn | 4 | 8 | 0.640 | 0.427 | 0.029 | 82.467 | 16.437 | 0.000 | 100.000 |
| Mn | 4 | 10 | 0.522 | 0.345 | 0.068 | 56.693 | 24.334 | 18.038 | 100.000 |
| Mn | 4 | 10 | 0.388 | 0.341 | 0.024 | 89.068 | 10.179 | 0.000 | 100.000 |
| Mn | 4 | 10 | 5.484 | 0.090 | 0.012 | 78.882 | 15.532 | 0.000 | 100.000 |
| Mn | 4 | 13 | 0.515 | 0.271 | 0.010 | 88.945 | 10.258 | 0.000 | 100.000 |
| Mn | 4 | 13 | 0.171 | 0.103 | 0.050 | 36.369 | 3.228 | 60.079 | 100.000 |
| Mn | 4 | 13 | 0.361 | 0.276 | 0.007 | 86.078 | 13.277 | 0.000 | 100.000 |
| Mn | 5 | 1 | 0.588 | 0.285 | 0.095 | 89.267 | 9.766 | 0.000 | 100.000 |
| Mn | 5 | 1 | 0.768 | 0.305 | 0.106 | 90.908 | 7.913 | 0.000 | 100.000 |
| Mn | 5 | 1 | 0.204 | 0.085 | 0.038 | 25.113 | 2.444 | 72.116 | 100.000 |
| Mn | 5 | 11 | 0.210 | 0.221 | 0.003 | 42.412 | 5.495 | 51.659 | 100.000 |
| Mn | 5 | 11 | 0.178 | 0.090 | 0.011 | 20.428 | 4.662 | 74.631 | 100.000 |
| Mn | 5 | 11 | 0.149 | 0.054 | 0.005 | 25.843 | 2.470 | 71.479 | 100.000 |
| Mn | 5 | 12 | 0.293 | 0.315 | 0.397 | 64.085 | 34.910 | 0.000 | 100.000 |
| Mn | 5 | 12 | 0.601 | 0.453 | 0.032 | 89.104 | 9.810 | 0.000 | 100.000 |
| Mn | 5 | 12 | 2.713 | 0.113 | 0.022 | 87.078 | 10.075 | 0.000 | 100.000 |
| Ni | 1 | 2 | 5.000 | 7.150 | 4.831 | 33.706 | 35.003 | 14.310 | 100.000 |
| Ni | 1 | 2 | 3.604 | 4.418 | 3.025 | 22.981 | 26.828 | 39.143 | 100.000 |
| Ni | 1 | 2 | 5.185 | 7.133 | 4.869 | 33.743 | 41.938 | 7.133 | 100.000 |
| Ni | 1 | 5 | 12.504 | 6.859 | 4.843 | 31.053 | 41.839 | 2.901 | 100.000 |
| Ni | 1 | 5 | 5.000 | 7.262 | 4.838 | 29.971 | 40.849 | 12.081 | 100.000 |
| Ni | 1 | 5 | 11.283 | 6.946 | 4.871 | 37.483 | 35.247 | 4.170 | 100.000 |
| Ni | 1 | 9 | 7.305 | 5.982 | 4.223 | 28.957 | 36.503 | 17.030 | 100.000 |
| Ni | 1 | 9 | 3.828 | 5.251 | 3.597 | 24.431 | 30.474 | 32.419 | 100.000 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Ni | 1 | 9 | 7.929 | 6.968 | 4.845 | 23.729 | 40.671 | 15.858 | 100.000 |
| Ni | 2 | 3 | 3.250 | 4.646 | 7.328 | 48.742 | 30.208 | 5.825 | 100.000 |
| Ni | 2 | 3 | 3.536 | 5.096 | 7.054 | 57.645 | 26.669 | 0.000 | 100.000 |
| Ni | 2 | 3 | 3.454 | 4.999 | 7.133 | 52.823 | 31.592 | 0.000 | 100.000 |
| Ni | 2 | 4 | 3.652 | 5.241 | 8.393 | 53.533 | 29.181 | 0.000 | 100.000 |
| Ni | 2 | 4 | 3.397 | 4.885 | 9.571 | 50.932 | 31.214 | 0.000 | 100.000 |
| Ni | 2 | 4 | 3.740 | 5.377 | 9.589 | 55.447 | 25.846 | 0.000 | 100.000 |
| Ni | 2 | 7 | 3.386 | 4.836 | 9.339 | 54.203 | 28.236 | 0.000 | 100.000 |
| Ni | 2 | 7 | 3.579 | 5.120 | 7.430 | 51.925 | 31.947 | 0.000 | 100.000 |
| Ni | 2 | 7 | 3.309 | 4.715 | 5.038 | 55.941 | 30.997 | 0.000 | 100.000 |
| Ni | 3 | 6 | 3.250 | 4.637 | 8.863 | 48.628 | 31.892 | 2.730 | 100.000 |
| Ni | 3 | 6 | 2.367 | 3.372 | 5.340 | 38.786 | 26.345 | 23.788 | 100.000 |
| Ni | 3 | 6 | 1.962 | 2.791 | 4.729 | 34.469 | 18.721 | 37.329 | 100.000 |
| Ni | 3 | 14 | 2.447 | 3.531 | 5.837 | 37.701 | 21.289 | 29.195 | 100.000 |
| Ni | 3 | 14 | 2.689 | 3.886 | 7.072 | 44.285 | 22.886 | 19.182 | 100.000 |
| Ni | 3 | 14 | 3.436 | 4.960 | 6.682 | 54.951 | 29.970 | 0.000 | 100.000 |
| Ni | 3 | 15 | 3.328 | 5.278 | 7.424 | 54.696 | 29.274 | 0.000 | 100.000 |
| Ni | 3 | 15 | 2.393 | 3.421 | 3.160 | 37.099 | 24.194 | 29.734 | 100.000 |
| Ni | 3 | 15 | 3.394 | 4.851 | 8.357 | 52.438 | 30.960 | 0.000 | 100.000 |
| Ni | 4 | 8 | 2.866 | 4.144 | 6.584 | 42.191 | 25.512 | 18.704 | 100.000 |
| Ni | 4 | 8 | 3.068 | 4.437 | 7.588 | 49.255 | 27.069 | 8.584 | 100.000 |
| Ni | 4 | 8 | 2.756 | 3.988 | 5.708 | 44.676 | 25.080 | 17.791 | 100.000 |
| Ni | 4 | 10 | 1.756 | 2.544 | 5.322 | 26.972 | 19.714 | 43.693 | 100.000 |
| Ni | 4 | 10 | 1.998 | 2.882 | 3.044 | 35.033 | 18.629 | 38.415 | 100.000 |
| Ni | 4 | 10 | 2.245 | 3.247 | 2.723 | 37.618 | 19.963 | 34.204 | 100.000 |
| Ni | 4 | 13 | 2.222 | 3.206 | 5.492 | 37.314 | 20.833 | 30.933 | 100.000 |
| Ni | 4 | 13 | 1.756 | 2.537 | 4.264 | 33.693 | 11.990 | 45.760 | 100.000 |
| Ni | 4 | 13 | 1.728 | 2.491 | 4.420 | 32.010 | 16.427 | 42.924 | 100.000 |
| Ni | 5 | 1 | 1.405 | 2.067 | 4.173 | 24.712 | 11.616 | 56.027 | 100.000 |
| Ni | 5 | 1 | 1.910 | 2.755 | 4.820 | 33.440 | 15.024 | 42.051 | 100.000 |
| Ni | 5 | 1 | 1.830 | 2.638 | 4.417 | 35.065 | 18.398 | 37.652 | 100.000 |
| Ni | 5 | 11 | 2.317 | 3.331 | 4.078 | 41.577 | 23.651 | 25.046 | 100.000 |
| Ni | 5 | 11 | 1.715 | 2.456 | 2.831 | 28.134 | 16.817 | 48.046 | 100.000 |
| Ni | 5 | 11 | 1.461 | 2.097 | 3.363 | 25.697 | 14.426 | 52.956 | 100.000 |
| Ni | 5 | 12 | 1.675 | 2.416 | 4.014 | 31.326 | 17.063 | 43.507 | 100.000 |
| Ni | 5 | 12 | 1.266 | 1.831 | 2.515 | 21.157 | 11.679 | 61.552 | 100.000 |
| Ni | 5 | 12 | 2.367 | 3.412 | 6.240 | 48.554 | 22.922 | 16.504 | 100.000 |
| Pb | 1 | 2 | 1.790 | 0.892 | 0.655 | 17.773 | 1.765 | 77.125 | 100.000 |
| Pb | 1 | 2 | 1.425 | 1.064 | 0.754 | 20.364 | 2.992 | 73.401 | 100.000 |
| Pb | 1 | 2 | 2.008 | 1.089 | 0.799 | 19.164 | 3.043 | 73.897 | 100.000 |
| Pb | 1 | 5 | 2.212 | 1.164 | 0.825 | 17.932 | 3.601 | 74.265 | 100.000 |
| Pb | 1 | 5 | 2.198 | 1.418 | 0.983 | 22.190 | 3.979 | 69.233 | 100.000 |
| Pb | 1 | 5 | 2.582 | 1.179 | 0.848 | 21.237 | 3.712 | 70.442 | 100.000 |
| Pb | 1 | 9 | 2.231 | 1.131 | 0.840 | 20.077 | 3.286 | 72.436 | 100.000 |
| Pb | 1 | 9 | 1.395 | 0.760 | 0.561 | 13.318 | 2.327 | 81.639 | 100.000 |
| Pb | 1 | 9 | 3.062 | 1.322 | 0.987 | 24.242 | 4.023 | 66.363 | 100.000 |
| Pb | 2 | 3 | 0.981 | 1.402 | 1.447 | 22.156 | 4.477 | 69.539 | 100.000 |
| Pb | 2 | 3 | 1.026 | 1.478 | 0.954 | 24.494 | 2.188 | 69.861 | 100.000 |
| Pb | 2 | 3 | 1.065 | 1.541 | 1.321 | 24.534 | 4.702 | 66.837 | 100.000 |
| Pb | 2 | 4 | 0.917 | 1.316 | 1.055 | 20.217 | 3.362 | 73.133 | 100.000 |
| Pb | 2 | 4 | 0.830 | 1.194 | 1.250 | 19.640 | 3.890 | 73.196 | 100.000 |
| Pb | 2 | 4 | 1.155 | 1.498 | 1.099 | 25.357 | 2.766 | 68.125 | 100.000 |
| Pb | 2 | 7 | 0.896 | 1.280 | 1.578 | 20.322 | 3.588 | 72.335 | 100.000 |
| Pb | 2 | 7 | 0.917 | 1.312 | 0.845 | 18.189 | 3.636 | 75.102 | 100.000 |
| Pb | 2 | 7 | 1.089 | 1.553 | 1.010 | 23.741 | 4.305 | 68.303 | 100.000 |
| Pb | 3 | 6 | 0.952 | 1.357 | 1.660 | 21.619 | 4.307 | 70.105 | 100.000 |
| Pb | 3 | 6 | 0.825 | 1.175 | 0.950 | 18.565 | 3.421 | 75.063 | 100.000 |
| Pb | 3 | 6 | 0.717 | 1.021 | 1.202 | 18.155 | 3.035 | 75.869 | 100.000 |
| Pb | 3 | 14 | 0.572 | 0.826 | 0.752 | 13.221 | 2.823 | 81.806 | 100.000 |
| Pb | 3 | 14 | 0.897 | 1.297 | 1.380 | 19.510 | 3.906 | 73.010 | 100.000 |
| Pb | 3 | 14 | 0.916 | 1.323 | 1.296 | 19.698 | 4.257 | 72.509 | 100.000 |
| Pb | 3 | 15 | 0.823 | 1.186 | 0.784 | 17.387 | 3.758 | 76.061 | 100.000 |
| Pb | 3 | 15 | 0.952 | 1.360 | 0.879 | 20.854 | 4.207 | 71.748 | 100.000 |
| Pb | 3 | 15 | 1.010 | 1.444 | 1.701 | 22.874 | 4.728 | 68.243 | 100.000 |
| Pb | 4 | 8 | 0.904 | 1.308 | 0.854 | 18.651 | 4.478 | 73.806 | 100.000 |
| Pb | 4 | 8 | 0.547 | 0.791 | 0.996 | 11.923 | 2.604 | 83.139 | 100.000 |
| Pb | 4 | 8 | 0.959 | 1.387 | 0.995 | 20.387 | 4.662 | 71.611 | 100.000 |
| Pb | 4 | 10 | 0.789 | 1.142 | 1.378 | 16.648 | 4.026 | 76.017 | 100.000 |
| Pb | 4 | 10 | 0.852 | 1.229 | 0.782 | 19.091 | 3.954 | 74.092 | 100.000 |
| Pb | 4 | 10 | 0.974 | 1.409 | 0.912 | 22.012 | 4.906 | 69.786 | 100.000 |
| Pb | 4 | 13 | 0.882 | 1.273 | 1.207 | 21.195 | 3.984 | 71.459 | 100.000 |
| Pb | 4 | 13 | 0.821 | 1.186 | 1.079 | 19.230 | 2.545 | 75.139 | 100.000 |
| Pb | 4 | 13 | 0.867 | 1.250 | 0.999 | 22.293 | 4.066 | 70.524 | 100.000 |
| Pb | 5 | 1 | 0.732 | 1.057 | 1.367 | 17.554 | 2.365 | 76.925 | 100.000 |
| Pb | 5 | 1 | 0.827 | 1.193 | 1.386 | 18.971 | 3.500 | 74.122 | 100.000 |
| Pb | 5 | 1 | 0.545 | 0.786 | 0.723 | 13.667 | 2.750 | 81.529 | 100.000 |
| Pb | 5 | 11 | 0.701 | 1.007 | 0.648 | 14.425 | 3.244 | 79.975 | 100.000 |
| Pb | 5 | 11 | 0.790 | 1.132 | 0.739 | 17.070 | 3.965 | 76.304 | 100.000 |
| Pb | 5 | 11 | 0.446 | 0.640 | 0.756 | 11.112 | 2.277 | 84.769 | 100.000 |

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|---|---|---|---|---|---|---|---|---|---|
| Pb | 5 | 12 | 0.769 | 1.109 | 1.617 | 16.546 | 3.367 | 76.592 | 100.000 |
| Pb | 5 | 12 | 0.829 | 1.199 | 0.756 | 18.971 | 4.096 | 74.149 | 100.000 |
| Pb | 5 | 12 | 0.914 | 1.317 | 1.784 | 25.581 | 4.684 | 65.720 | 100.000 |
| Sr | 1 | 2 | 0.063 | 0.022 | 0.017 | 10.932 | 0.025 | 88.942 | 100.000 |
| Sr | 1 | 2 | 0.141 | 0.064 | 0.048 | 30.950 | 0.668 | 68.129 | 100.000 |
| Sr | 1 | 2 | 0.066 | 0.032 | 0.024 | 16.239 | 0.166 | 83.472 | 100.000 |
| Sr | 1 | 5 | 0.063 | 0.030 | 0.022 | 14.205 | 0.178 | 85.502 | 100.000 |
| Sr | 1 | 5 | 0.158 | 0.066 | 0.047 | 29.022 | 0.855 | 69.851 | 100.000 |
| Sr | 1 | 5 | 0.072 | 0.030 | 0.022 | 12.153 | 0.474 | 87.250 | 100.000 |
| Sr | 1 | 9 | 0.077 | 0.030 | 0.023 | 13.392 | 0.503 | 85.975 | 100.000 |
| Sr | 1 | 9 | 0.055 | 0.027 | 0.020 | 13.877 | 0.421 | 85.600 | 100.000 |
| Sr | 1 | 9 | 0.161 | 0.060 | 0.045 | 28.161 | 0.838 | 70.736 | 100.000 |
| Sr | 2 | 3 | 1.422 | 0.050 | 0.047 | 24.353 | 0.970 | 73.157 | 100.000 |
| Sr | 2 | 3 | 1.381 | 0.000 | 0.047 | 25.275 | 0.000 | 73.298 | 100.000 |
| Sr | 2 | 3 | 1.349 | 0.007 | 0.047 | 25.550 | 1.202 | 71.844 | 100.000 |
| Sr | 2 | 4 | 0.549 | 0.000 | 0.019 | 10.479 | 0.394 | 88.559 | 100.000 |
| Sr | 2 | 4 | 0.510 | 0.000 | 0.016 | 8.884 | 0.303 | 90.287 | 100.000 |
| Sr | 2 | 4 | 1.637 | 0.003 | 0.053 | 29.468 | 0.000 | 68.840 | 100.000 |
| Sr | 2 | 7 | 1.407 | 0.000 | 0.045 | 23.875 | 1.053 | 73.621 | 100.000 |
| Sr | 2 | 7 | 0.682 | 0.002 | 0.024 | 12.189 | 0.411 | 86.693 | 100.000 |
| Sr | 2 | 7 | 1.446 | 0.000 | 0.048 | 24.872 | 0.770 | 72.863 | 100.000 |
| Sr | 3 | 6 | 3.758 | 0.000 | 0.029 | 33.533 | 3.864 | 58.817 | 100.000 |
| Sr | 3 | 6 | 3.018 | 0.000 | 0.026 | 19.783 | 3.000 | 74.172 | 100.000 |
| Sr | 3 | 6 | 3.097 | 0.000 | 0.025 | 22.074 | 2.861 | 71.944 | 100.000 |
| Sr | 3 | 14 | 1.951 | 0.021 | 0.011 | 11.762 | 2.116 | 84.140 | 100.000 |
| Sr | 3 | 14 | 3.491 | 0.000 | 0.027 | 21.382 | 3.745 | 71.355 | 100.000 |
| Sr | 3 | 14 | 3.143 | 0.000 | 0.028 | 22.010 | 3.698 | 71.120 | 100.000 |
| Sr | 3 | 15 | 1.818 | 0.000 | 0.013 | 12.553 | 2.197 | 83.418 | 100.000 |
| Sr | 3 | 15 | 3.805 | 0.000 | 0.030 | 22.173 | 3.932 | 70.060 | 100.000 |
| Sr | 3 | 15 | 3.515 | 0.000 | 0.021 | 19.925 | 4.004 | 72.536 | 100.000 |
| Sr | 4 | 8 | 3.208 | 0.000 | 0.019 | 18.738 | 3.874 | 74.161 | 100.000 |
| Sr | 4 | 8 | 2.481 | 0.000 | 0.062 | 12.343 | 2.711 | 82.403 | 100.000 |
| Sr | 4 | 8 | 3.851 | 0.000 | 0.019 | 20.142 | 4.300 | 71.687 | 100.000 |
| Sr | 4 | 10 | 3.046 | 0.000 | 0.020 | 17.364 | 4.112 | 75.458 | 100.000 |
| Sr | 4 | 10 | 3.138 | 0.000 | 0.018 | 15.139 | 4.005 | 77.701 | 100.000 |
| Sr | 4 | 10 | 3.519 | 0.000 | 0.022 | 18.528 | 4.354 | 73.577 | 100.000 |
| Sr | 4 | 13 | 3.653 | 0.000 | 0.024 | 19.764 | 4.590 | 71.969 | 100.000 |
| Sr | 4 | 13 | 2.455 | 0.000 | 0.014 | 13.101 | 2.507 | 81.923 | 100.000 |
| Sr | 4 | 13 | 3.440 | 0.000 | 0.021 | 18.299 | 3.362 | 74.878 | 100.000 |
| Sr | 5 | 1 | 3.453 | 0.000 | 0.016 | 18.021 | 4.208 | 74.303 | 100.000 |
| Sr | 5 | 1 | 3.860 | 0.000 | 0.019 | 17.758 | 5.061 | 73.301 | 100.000 |
| Sr | 5 | 1 | 1.626 | 0.000 | 0.008 | 7.997 | 1.925 | 88.445 | 100.000 |
| Sr | 5 | 11 | 2.329 | 0.000 | 0.008 | 10.408 | 2.421 | 84.835 | 100.000 |
| Sr | 5 | 11 | 2.872 | 0.000 | 0.013 | 12.894 | 3.290 | 80.931 | 100.000 |
| Sr | 5 | 11 | 1.872 | 0.000 | 0.009 | 8.755 | 2.142 | 87.223 | 100.000 |
| Sr | 5 | 12 | 3.672 | 0.000 | 0.018 | 17.365 | 4.146 | 74.799 | 100.000 |
| Sr | 5 | 12 | 3.084 | 0.000 | 0.010 | 16.142 | 4.058 | 76.706 | 100.000 |
| Sr | 5 | 12 | 3.763 | 0.000 | 0.020 | 20.538 | 4.447 | 71.231 | 100.000 |
| Zn | 1 | 2 | 6.168 | 0.000 | 0.333 | 11.360 | 17.131 | 65.008 | 100.000 |
| Zn | 1 | 2 | 6.247 | 0.000 | 0.282 | 11.777 | 19.771 | 61.923 | 100.000 |
| Zn | 1 | 2 | | | | | | | 0.000 |
| Zn | 1 | 5 | 4.062 | 0.050 | 0.200 | 6.264 | 12.970 | 76.455 | 100.000 |
| Zn | 1 | 5 | 7.047 | 0.100 | 1.158 | 12.337 | 20.555 | 58.803 | 100.000 |
| Zn | 1 | 5 | 5.956 | 0.095 | 0.567 | 11.795 | 18.154 | 63.433 | 100.000 |
| Zn | 1 | 9 | 6.369 | 0.000 | 0.269 | 12.400 | 19.984 | 60.979 | 100.000 |
| Zn | 1 | 9 | 4.520 | 0.000 | 0.506 | 8.721 | 14.695 | 71.558 | 100.000 |
| Zn | 1 | 9 | 6.906 | 0.000 | 0.282 | 12.982 | 21.223 | 58.607 | 100.000 |
| Zn | 2 | 3 | 0.200 | 0.635 | 0.517 | 29.764 | 20.525 | 48.360 | 100.000 |
| Zn | 2 | 3 | 0.190 | 0.642 | 0.495 | 31.107 | 15.398 | 52.168 | 100.000 |
| Zn | 2 | 3 | 0.210 | 0.644 | 0.330 | 33.268 | 19.406 | 46.142 | 100.000 |
| Zn | 2 | 4 | 0.200 | 0.631 | 0.270 | 26.751 | 18.100 | 54.048 | 100.000 |
| Zn | 2 | 4 | 0.157 | 0.881 | 0.168 | 24.718 | 14.833 | 59.243 | 100.000 |
| Zn | 2 | 4 | 0.234 | 0.790 | 0.342 | 35.147 | 18.448 | 45.040 | 100.000 |
| Zn | 2 | 7 | 0.200 | 0.590 | 0.281 | 30.415 | 18.101 | 50.413 | 100.000 |
| Zn | 2 | 7 | 0.169 | 0.670 | 0.427 | 19.333 | 16.452 | 62.949 | 100.000 |
| Zn | 2 | 7 | 0.217 | 0.694 | 0.475 | 29.907 | 20.639 | 48.069 | 100.000 |
| Zn | 3 | 6 | 0.220 | 0.691 | 0.574 | 31.332 | 21.807 | 45.376 | 100.000 |
| Zn | 3 | 6 | 0.192 | 0.512 | 0.479 | 31.466 | 18.601 | 48.750 | 100.000 |
| Zn | 3 | 6 | 0.152 | 0.390 | 0.279 | 26.184 | 13.870 | 59.125 | 100.000 |
| Zn | 3 | 14 | 0.162 | 0.766 | 0.555 | 29.241 | 15.240 | 54.036 | 100.000 |
| Zn | 3 | 14 | 0.227 | 0.855 | 0.921 | 39.083 | 19.968 | 38.946 | 100.000 |
| Zn | 3 | 14 | 0.210 | 0.672 | 0.667 | 30.777 | 18.919 | 48.754 | 100.000 |
| Zn | 3 | 15 | 0.197 | 0.900 | 0.598 | 30.610 | 18.102 | 49.592 | 100.000 |
| Zn | 3 | 15 | 0.216 | 0.630 | 0.615 | 33.200 | 20.795 | 44.544 | 100.000 |
| Zn | 3 | 15 | 0.202 | 0.740 | 0.630 | 35.754 | 18.208 | 44.466 | 100.000 |
| Zn | 4 | 8 | 0.198 | 0.855 | 0.760 | 28.399 | 17.974 | 51.814 | 100.000 |
| Zn | 4 | 8 | 0.164 | 0.670 | 1.457 | 26.572 | 14.530 | 56.608 | 100.000 |
| Zn | 4 | 8 | 0.208 | 0.819 | 0.729 | 29.964 | 18.396 | 49.884 | 100.000 |
| Zn | 4 | 10 | 0.179 | 0.510 | 0.752 | 26.959 | 18.739 | 52.860 | 100.000 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Zn | 4 | 10 | 0.187 | 0.559 | 0.527 | 32.388 | 16.302 | 50.037 | 100.000 |
| Zn | 4 | 10 | 1.292 | 0.704 | 0.685 | 34.333 | 18.008 | 44.978 | 100.000 |
| Zn | 4 | 13 | 0.199 | 0.673 | 0.575 | 34.003 | 17.545 | 47.006 | 100.000 |
| Zn | 4 | 13 | 0.099 | 0.305 | 0.268 | 17.500 | 6.685 | 75.143 | 100.000 |
| Zn | 4 | 13 | 0.179 | 0.548 | 0.365 | 30.953 | 14.127 | 53.828 | 100.000 |
| Zn | 5 | 1 | 0.166 | 0.578 | 0.456 | 30.717 | 12.963 | 55.119 | 100.000 |
| Zn | 5 | 1 | 0.185 | 0.584 | 0.660 | 32.973 | 14.813 | 50.785 | 100.000 |
| Zn | 5 | 1 | 0.141 | 0.477 | 0.418 | 27.159 | 11.441 | 60.364 | 100.000 |
| Zn | 5 | 11 | 0.098 | 0.376 | 0.336 | 16.037 | 8.169 | 74.984 | 100.000 |
| Zn | 5 | 11 | 0.117 | 0.339 | 0.493 | 18.656 | 10.551 | 69.844 | 100.000 |
| Zn | 5 | 11 | 0.163 | 0.367 | 0.611 | 33.002 | 13.445 | 52.412 | 100.000 |
| Zn | 5 | 12 | 0.195 | 0.639 | 1.541 | 30.648 | 17.101 | 49.876 | 100.000 |
| Zn | 5 | 12 | 0.178 | 0.762 | 0.681 | 29.999 | 14.565 | 53.814 | 100.000 |
| Zn | 5 | 12 | 0.235 | 0.508 | 0.947 | 35.218 | 17.399 | 45.693 | 100.000 |

18 week weathering cycle: sequential selective dissolution

| | | | KNO3 | Di water | NaOH | EDTA | HNO3 | | TOTALS | | % (OF TOTAL) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| elem | trt | sample name | ug/g | ug/g | ug/g | ug/g | ug/g | SUM SSD | ug/g | RESIDUAL | RESIDUAL |
| Ba | 1 | 2 | 1.659 | 0.000 | 0.048 | 66.866 | 2.665 | 71.238 | 495.345 | 424.107 | 85.618 |
| Ba | 1 | 2 | 1.448 | 0.000 | 0.049 | 69.449 | 4.977 | 75.922 | . | . | . |
| Ba | 1 | 2 | 1.122 | 0.000 | 0.049 | 63.120 | 4.791 | 69.082 | . | . | . |
| Ba | 1 | 5 | 1.220 | 0.013 | 0.110 | 58.177 | 4.486 | 64.005 | 411.190 | 347.185 | 84.434 |
| Ba | 1 | 5 | 1.106 | 1.415 | 0.054 | 60.991 | 5.210 | 68.777 | . | . | . |
| Ba | 1 | 5 | 1.122 | 0.020 | 0.101 | 60.882 | 5.635 | 67.760 | . | . | . |
| Ba | 1 | 9 | 0.878 | 0.105 | 0.047 | 60.666 | 5.059 | 66.755 | 465.470 | 398.715 | 85.659 |
| Ba | 1 | 9 | 1.008 | 0.000 | 0.056 | 68.545 | 5.514 | 75.124 | . | . | . |
| Ba | 1 | 9 | 0.927 | 0.013 | 0.048 | 60.213 | 5.500 | 66.701 | . | . | . |
| Ba | 2 | 3 | 1.578 | 0.971 | 0.001 | 62.970 | 4.850 | 70.370 | 464.330 | 393.960 | 84.845 |
| Ba | 2 | 3 | 1.496 | 0.881 | 0.005 | 70.446 | 2.273 | 75.100 | 437.420 | 362.320 | 82.831 |
| Ba | 2 | 3 | 1.464 | 1.049 | 0.000 | 65.001 | 6.421 | 73.935 | 403.210 | 329.275 | 81.663 |
| Ba | 2 | 4 | 1.643 | 2.188 | 0.000 | 67.405 | 5.791 | 77.026 | . | . | . |
| Ba | 2 | 4 | 1.675 | 0.879 | 0.007 | 69.261 | 5.320 | 77.143 | . | . | . |
| Ba | 2 | 4 | 2.033 | 0.971 | 0.006 | 72.017 | 2.791 | 77.817 | 415.295 | 337.478 | 81.262 |
| Ba | 2 | 7 | 1.675 | 1.177 | 0.000 | 66.275 | 5.762 | 74.889 | 456.805 | 381.916 | 83.606 |
| Ba | 2 | 7 | 1.578 | 1.074 | 0.000 | 67.143 | 6.109 | 75.904 | . | . | . |
| Ba | 2 | 7 | 1.692 | 1.284 | 0.000 | 72.210 | 4.512 | 79.698 | 410.505 | 330.807 | 80.585 |
| Ba | 3 | 6 | 4.018 | 0.988 | 0.000 | 95.471 | 12.108 | 112.584 | 458.625 | 346.041 | 75.452 |
| Ba | 3 | 6 | 3.985 | 0.540 | 0.012 | 84.903 | 8.929 | 98.369 | 523.855 | 425.486 | 81.222 |
| Ba | 3 | 6 | 4.375 | 0.388 | 0.009 | 102.736 | 8.400 | 115.908 | 603.445 | 487.537 | 80.792 |
| Ba | 3 | 14 | 4.392 | 1.075 | 0.000 | 88.896 | 10.873 | 105.237 | . | . | . |
| Ba | 3 | 14 | 3.774 | 1.161 | 0.020 | 82.046 | 9.104 | 96.105 | 512.220 | 416.115 | 81.237 |
| Ba | 3 | 14 | 3.757 | 0.686 | 0.032 | 87.819 | 11.934 | 104.228 | 500.360 | 396.132 | 79.169 |
| Ba | 3 | 15 | 4.083 | 1.168 | 0.000 | 94.865 | 12.740 | 112.856 | . | . | . |
| Ba | 3 | 15 | 4.229 | 0.755 | 0.000 | 92.271 | 11.425 | 108.680 | 444.490 | 335.810 | 75.550 |
| Ba | 3 | 15 | 4.066 | 0.866 | 0.000 | 82.623 | 10.494 | 98.050 | 443.120 | 345.070 | 77.873 |
| Ba | 4 | 8 | 4.652 | 1.331 | 0.000 | 93.633 | 13.930 | 113.546 | 527.730 | 414.184 | 78.484 |
| Ba | 4 | 8 | 5.124 | 2.375 | 0.172 | 94.712 | 12.753 | 115.137 | . | . | . |
| Ba | 4 | 8 | 4.977 | 1.146 | 0.000 | 92.748 | 12.254 | 111.125 | 490.100 | 378.975 | 77.326 |
| Ba | 4 | 10 | 4.636 | 0.915 | 0.041 | 89.583 | 16.265 | 111.439 | 564.675 | 453.236 | 80.265 |
| Ba | 4 | 10 | 5.286 | 3.573 | 0.000 | 90.463 | 12.140 | 111.462 | 541.415 | 429.953 | 79.413 |
| Ba | 4 | 10 | 4.798 | 0.897 | 0.001 | 89.042 | 12.051 | 106.789 | 483.485 | 376.696 | 77.913 |
| Ba | 4 | 13 | 4.945 | 0.986 | 0.000 | 91.743 | 12.654 | 110.327 | 535.255 | 424.928 | 79.388 |
| Ba | 4 | 13 | 5.091 | 0.999 | 0.000 | 92.061 | 11.751 | 109.901 | . | . | . |
| Ba | 4 | 13 | 5.140 | 0.781 | 0.002 | 92.573 | 12.037 | 110.534 | 543.010 | 432.476 | 79.644 |
| Ba | 5 | 1 | 6.783 | 0.829 | 0.000 | 100.456 | 15.474 | 123.542 | 621.005 | 497.463 | 80.106 |
| Ba | 5 | 1 | 6.815 | 1.160 | 0.000 | 95.401 | 16.325 | 119.701 | 533.885 | 414.184 | 77.579 |
| Ba | 5 | 1 | 6.864 | 0.741 | 0.000 | 102.400 | 13.830 | 123.835 | . | . | . |
| Ba | 5 | 11 | 6.815 | 0.730 | 0.000 | 96.673 | 12.527 | 116.745 | . | . | . |
| Ba | 5 | 11 | 6.913 | 0.930 | 0.000 | 105.089 | 14.259 | 127.191 | . | . | . |
| Ba | 5 | 11 | 6.571 | 2.608 | 0.000 | 99.944 | 13.748 | 122.870 | . | . | . |
| Ba | 5 | 12 | 6.327 | 1.089 | 0.124 | 105.903 | 28.130 | 141.573 | 573.800 | 432.227 | 75.327 |
| Ba | 5 | 12 | 5.872 | 0.994 | 0.000 | 98.462 | 14.454 | 119.782 | 584.290 | 464.508 | 79.500 |
| Ba | 5 | 12 | 5.921 | 0.465 | 0.008 | 105.179 | 16.441 | 128.014 | 564.445 | 436.431 | 77.320 |
| Co | 1 | 2 | 0.523 | 0.188 | 0.145 | 1.348 | 1.624 | 3.828 | 15.260 | 11.432 | 74.916 |
| Co | 1 | 2 | 0.369 | 0.200 | 0.146 | 1.427 | 1.715 | 3.856 | 10.775 | 6.919 | 64.215 |
| Co | 1 | 2 | 0.277 | 0.205 | 0.146 | 1.335 | 1.749 | 3.712 | 18.450 | 14.738 | 79.883 |
| Co | 1 | 5 | 0.400 | 0.205 | 0.145 | 1.124 | 1.716 | 3.589 | 17.985 | 14.396 | 80.042 |
| Co | 1 | 5 | 0.415 | 0.205 | 0.145 | 1.270 | 1.710 | 3.746 | 15.770 | 12.024 | 76.245 |
| Co | 1 | 5 | 0.554 | 0.198 | 0.146 | 1.271 | 1.661 | 3.829 | 16.660 | 12.831 | 77.016 |
| Co | 1 | 9 | 0.431 | 0.193 | 0.145 | 1.418 | 1.694 | 3.881 | 15.830 | 11.949 | 75.484 |
| Co | 1 | 9 | 0.369 | 0.198 | 0.146 | 1.576 | 1.723 | 4.012 | 17.030 | 13.018 | 76.441 |
| Co | 1 | 9 | 0.462 | 0.194 | 0.145 | 1.384 | 1.636 | 3.821 | 9.435 | 5.614 | 59.504 |
| Co | 2 | 3 | 0.150 | 0.214 | 0.240 | 2.678 | 1.850 | 5.132 | 10.460 | 5.328 | 50.935 |
| Co | 2 | 3 | 0.150 | 0.216 | 0.148 | 3.105 | 1.774 | 5.393 | 11.785 | 6.392 | 54.240 |
| Co | 2 | 3 | 0.150 | 0.217 | 0.306 | 2.239 | 1.931 | 4.843 | 10.685 | 5.842 | 54.674 |
| Co | 2 | 4 | 0.150 | 0.215 | 0.263 | 2.292 | 1.978 | 4.898 | 16.190 | 11.292 | 69.746 |
| Co | 2 | 4 | 0.150 | 0.216 | 0.400 | 2.763 | 1.952 | 5.480 | 16.670 | 11.190 | 67.127 |
| Co | 2 | 4 | 0.150 | 0.216 | 0.141 | 1.745 | 1.617 | 3.868 | 10.920 | 7.052 | 64.581 |
| Co | 2 | 7 | 0.150 | 0.214 | 0.329 | 2.418 | 1.908 | 5.019 | 11.235 | 6.216 | 55.328 |
| Co | 2 | 7 | 0.150 | 0.215 | 0.138 | 1.715 | 2.141 | 4.359 | 18.050 | 13.691 | 75.849 |
| Co | 2 | 7 | 0.150 | 0.214 | 0.139 | 1.939 | 2.049 | 4.491 | 14.100 | 9.609 | 68.146 |
| Co | 3 | 6 | 0.150 | 0.214 | 0.513 | 1.929 | 2.322 | 5.129 | 15.065 | 9.936 | 65.956 |
| Co | 3 | 6 | 0.150 | 0.214 | 0.308 | 2.459 | 2.241 | 5.372 | 15.575 | 10.203 | 65.507 |
| Co | 3 | 6 | 0.150 | 0.213 | 0.306 | 2.824 | 2.014 | 5.507 | 17.775 | 12.268 | 69.017 |
| Co | 3 | 14 | 0.150 | 0.216 | 0.263 | 1.877 | 2.256 | 4.762 | 22.000 | 17.238 | 78.354 |
| Co | 3 | 14 | 0.150 | 0.217 | 0.288 | 2.450 | 2.065 | 5.170 | 14.050 | 8.880 | 63.206 |
| Co | 3 | 14 | 0.150 | 0.217 | 0.288 | 2.414 | 2.131 | 5.200 | 14.350 | 9.150 | 63.766 |
| Co | 3 | 15 | 0.150 | 0.216 | 0.139 | 2.580 | 2.196 | 5.281 | 19.750 | 14.469 | 73.259 |
| Co | 3 | 15 | 0.150 | 0.214 | 0.139 | 1.782 | 2.367 | 4.652 | 12.895 | 8.243 | 63.924 |
| Co | 3 | 15 | 0.150 | 0.214 | 0.307 | 2.987 | 2.240 | 5.898 | 23.680 | 17.782 | 75.091 |
| Co | 4 | 8 | 0.150 | 0.217 | 0.142 | 1.848 | 2.345 | 4.702 | 18.915 | 14.213 | 75.143 |
| Co | 4 | 8 | 0.150 | 0.217 | 0.514 | 2.412 | 2.399 | 5.692 | 23.185 | 17.493 | 75.450 |
| Co | 4 | 8 | 0.150 | 0.217 | 0.138 | 2.272 | 2.209 | 4.985 | 16.815 | 11.830 | 70.352 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Co | 4 | 10 | 0.150 | 0.217 | 0.323 | 1.699 | 2.577 | 4.967 | 24.010 | 19.043 | 79.312 |
| Co | 4 | 10 | 0.150 | 0.216 | 0.138 | 2.567 | 2.212 | 5.283 | 18.135 | 12.852 | 70.871 |
| Co | 4 | 10 | 0.150 | 0.217 | 0.140 | 2.077 | 2.156 | 4.740 | 17.000 | 12.260 | 72.116 |
| Co | 4 | 13 | 0.150 | 0.216 | 0.286 | 2.530 | 2.193 | 5.375 | 17.120 | 11.745 | 68.604 |
| Co | 4 | 13 | 0.150 | 0.217 | 0.445 | 2.692 | 1.720 | 5.223 | 23.065 | 17.842 | 77.354 |
| Co | 4 | 13 | 0.150 | 0.216 | 0.331 | 3.054 | 2.001 | 5.752 | 17.490 | 11.738 | 67.114 |
| Co | 5 | 1 | 0.150 | 0.217 | 0.534 | 3.590 | 2.020 | 6.510 | 27.460 | 20.950 | 76.294 |
| Co | 5 | 1 | 0.150 | 0.216 | 0.447 | 2.391 | 1.861 | 5.065 | 20.905 | 15.840 | 75.773 |
| Co | 5 | 1 | 0.150 | 0.216 | 0.443 | 2.615 | 2.036 | 5.460 | 33.485 | 28.025 | 83.694 |
| Co | 5 | 11 | 0.150 | 0.216 | 0.157 | 3.360 | 2.301 | 6.182 | 29.810 | 23.628 | 79.261 |
| Co | 5 | 11 | 0.150 | 0.215 | 0.200 | 2.015 | 2.346 | 4.926 | 26.165 | 21.239 | 81.174 |
| Co | 5 | 11 | 0.150 | 0.215 | 0.468 | 2.540 | 2.162 | 5.536 | 29.080 | 23.544 | 80.964 |
| Co | 5 | 12 | 0.150 | 0.216 | 0.345 | 2.639 | 2.635 | 5.984 | 20.755 | 14.771 | 71.166 |
| Co | 5 | 12 | 0.150 | 0.217 | 0.239 | 2.639 | 2.232 | 5.476 | 21.370 | 15.894 | 74.373 |
| Co | 5 | 12 | 0.150 | 0.216 | 0.324 | 3.198 | 2.175 | 6.063 | 18.315 | 12.252 | 66.896 |
| Cr | 1 | 2 | 0.250 | 0.357 | 0.241 | 5.701 | 3.137 | 9.687 | 63.370 | 53.683 | 84.714 |
| Cr | 1 | 2 | 0.250 | 0.357 | 0.243 | 5.548 | 3.499 | 9.897 | 73.870 | 63.973 | 86.602 |
| Cr | 1 | 2 | 0.250 | 0.357 | 0.243 | 3.420 | 3.593 | 7.864 | 70.625 | 62.761 | 88.866 |
| Cr | 1 | 5 | 0.250 | 0.362 | 0.242 | 3.859 | 3.530 | 8.242 | 65.470 | 57.228 | 87.410 |
| Cr | 1 | 5 | 0.250 | 0.363 | 0.242 | 3.373 | 3.553 | 7.780 | 64.325 | 56.545 | 87.906 |
| Cr | 1 | 5 | 0.250 | 0.362 | 0.243 | 5.213 | 3.532 | 9.601 | 64.325 | 54.724 | 85.075 |
| Cr | 1 | 9 | 0.250 | 0.356 | 0.242 | 4.549 | 3.502 | 8.899 | 67.000 | 58.101 | 86.718 |
| Cr | 1 | 9 | 0.250 | 0.356 | 0.243 | 3.619 | 3.917 | 8.385 | 74.635 | 66.250 | 88.766 |
| Cr | 1 | 9 | 0.250 | 0.358 | 0.242 | 3.742 | 3.573 | 8.165 | 72.150 | 63.985 | 88.683 |
| Cr | 2 | 3 | 0.250 | 0.736 | 0.215 | 0.261 | 4.548 | 6.011 | 68.335 | 62.324 | 91.204 |
| Cr | 2 | 3 | 0.250 | 0.757 | 0.214 | 0.776 | 3.922 | 5.917 | 72.535 | 66.618 | 91.842 |
| Cr | 2 | 3 | 0.250 | 0.793 | 0.204 | 0.919 | 4.185 | 6.351 | 66.615 | 60.264 | 90.467 |
| Cr | 2 | 4 | 0.250 | 0.720 | 0.216 | 0.827 | 3.794 | 5.807 | 58.980 | 53.173 | 90.154 |
| Cr | 2 | 4 | 0.250 | 0.774 | 0.215 | 0.260 | 4.711 | 6.209 | 75.970 | 69.761 | 91.826 |
| Cr | 2 | 4 | 0.250 | 0.809 | 0.217 | 1.080 | 3.769 | 6.124 | 63.560 | 57.436 | 90.365 |
| Cr | 2 | 7 | 0.250 | 0.701 | 0.211 | 0.234 | 4.518 | 5.913 | 73.870 | 67.957 | 91.995 |
| Cr | 2 | 7 | 0.250 | 1.052 | 0.194 | 1.140 | 3.957 | 6.592 | 61.655 | 55.063 | 89.308 |
| Cr | 2 | 7 | 0.250 | 0.840 | 0.208 | 1.070 | 4.286 | 6.654 | 66.235 | 59.581 | 89.954 |
| Cr | 3 | 6 | 0.250 | 0.753 | 0.214 | 0.938 | 4.607 | 6.761 | 63.945 | 57.184 | 89.427 |
| Cr | 3 | 6 | 0.250 | 0.577 | 0.223 | 1.071 | 4.480 | 6.601 | 75.015 | 68.414 | 91.200 |
| Cr | 3 | 6 | 0.250 | 0.629 | 0.213 | 1.513 | 4.474 | 7.079 | 79.025 | 71.946 | 91.042 |
| Cr | 3 | 14 | 0.250 | 0.740 | 0.216 | 1.415 | 4.236 | 6.857 | 67.380 | 60.523 | 89.823 |
| Cr | 3 | 14 | 0.250 | 0.968 | 0.204 | 0.613 | 4.421 | 6.456 | 65.090 | 58.634 | 90.082 |
| Cr | 3 | 14 | 0.250 | 0.670 | 0.217 | 0.543 | 4.224 | 5.904 | 68.715 | 62.811 | 91.409 |
| Cr | 3 | 15 | 0.250 | 1.107 | 0.193 | 1.006 | 4.320 | 6.876 | 64.705 | 57.829 | 89.373 |
| Cr | 3 | 15 | 0.250 | 0.736 | 0.212 | 1.234 | 4.489 | 6.921 | 66.425 | 59.504 | 89.581 |
| Cr | 3 | 15 | 0.250 | 0.631 | 0.217 | 0.315 | 4.460 | 5.873 | 63.755 | 57.882 | 90.788 |
| Cr | 4 | 8 | 0.250 | 1.004 | 0.212 | 0.783 | 4.344 | 6.592 | 75.585 | 68.993 | 91.279 |
| Cr | 4 | 8 | 0.250 | 0.863 | 0.217 | 0.659 | 4.332 | 6.322 | 66.235 | 59.913 | 90.456 |
| Cr | 4 | 8 | 0.250 | 0.969 | 0.196 | 1.295 | 4.216 | 6.926 | 69.480 | 62.554 | 90.032 |
| Cr | 4 | 10 | 0.250 | 0.758 | 0.209 | 1.139 | 4.279 | 6.635 | 77.880 | 71.245 | 91.480 |
| Cr | 4 | 10 | 0.250 | 0.704 | 0.210 | 0.692 | 4.695 | 6.552 | 79.025 | 72.473 | 91.710 |
| Cr | 4 | 10 | 0.888 | 0.864 | 0.211 | 0.990 | 4.382 | 7.335 | 70.245 | 62.910 | 89.558 |
| Cr | 4 | 13 | 0.250 | 0.705 | 0.218 | 0.591 | 4.514 | 6.277 | 70.815 | 64.538 | 91.136 |
| Cr | 4 | 13 | 0.250 | 0.828 | 0.212 | 1.105 | 3.210 | 5.604 | 72.915 | 67.311 | 92.314 |
| Cr | 4 | 13 | 0.250 | 0.880 | 0.210 | 0.720 | 3.994 | 6.053 | 75.585 | 69.532 | 91.992 |
| Cr | 5 | 1 | 0.250 | 0.898 | 0.199 | 0.721 | 3.754 | 5.822 | 80.930 | 75.108 | 92.807 |
| Cr | 5 | 1 | 0.250 | 0.827 | 0.217 | 0.738 | 4.111 | 6.143 | 75.585 | 69.442 | 91.873 |
| Cr | 5 | 1 | 0.250 | 0.757 | 0.208 | 0.740 | 4.152 | 6.106 | 83.605 | 77.499 | 92.697 |
| Cr | 5 | 11 | 0.250 | 0.703 | 0.214 | 0.809 | 3.812 | 5.788 | 77.880 | 72.092 | 92.568 |
| Cr | 5 | 11 | 0.250 | 0.755 | 0.217 | 1.051 | 4.495 | 6.767 | 71.580 | 64.813 | 90.547 |
| Cr | 5 | 11 | 0.250 | 0.650 | 0.221 | 0.758 | 4.547 | 6.425 | 81.315 | 74.890 | 92.098 |
| Cr | 5 | 12 | 0.250 | 0.740 | 0.217 | 1.087 | 3.885 | 6.179 | 75.780 | 69.601 | 91.847 |
| Cr | 5 | 12 | 0.250 | 0.828 | 0.200 | 0.753 | 4.212 | 6.243 | 83.225 | 76.982 | 92.498 |
| Cr | 5 | 12 | 0.250 | 0.652 | 0.216 | 1.370 | 4.715 | 7.202 | 76.540 | 69.338 | 90.590 |
| Cu | 1 | 2 | 3.703 | 0.000 | 2.141 | 3.567 | 1.567 | 10.978 | 11.785 | 0.807 | 6.844 |
| Cu | 1 | 2 | 3.284 | 0.000 | 2.223 | 3.580 | 1.531 | 10.619 | 11.790 | 1.171 | 9.936 |
| Cu | 1 | 2 | 3.244 | 0.000 | 2.321 | 3.290 | 1.680 | 10.534 | 15.400 | 4.866 | 31.598 |
| Cu | 1 | 5 | 3.190 | 0.000 | 2.143 | 3.134 | 1.742 | 10.209 | 17.735 | 7.526 | 42.438 |
| Cu | 1 | 5 | 3.406 | 0.000 | 2.043 | 3.446 | 1.615 | 10.510 | 28.680 | 18.170 | 63.354 |
| Cu | 1 | 5 | 3.217 | 0.000 | 2.090 | 3.300 | 1.708 | 10.314 | 17.750 | 7.436 | 41.891 |
| Cu | 1 | 9 | 3.041 | 0.000 | 2.186 | 2.971 | 1.733 | 9.932 | 11.765 | 1.833 | 15.583 |
| Cu | 1 | 9 | 3.149 | 0.000 | 2.124 | 3.535 | 1.802 | 10.610 | 12.515 | 1.905 | 15.224 |
| Cu | 1 | 9 | 3.217 | 0.000 | 1.721 | 3.178 | 1.827 | 9.942 | 12.545 | 2.603 | 20.750 |
| Cu | 2 | 3 | 0.100 | 0.143 | 4.770 | 10.015 | 3.286 | 18.314 | 71.525 | 53.211 | 74.394 |
| Cu | 2 | 3 | 0.100 | 0.230 | 4.903 | 11.512 | 1.557 | 18.303 | 71.775 | 53.472 | 74.500 |
| Cu | 2 | 3 | 0.100 | 0.245 | 5.354 | 11.142 | 2.562 | 19.403 | 67.605 | 48.202 | 71.299 |
| Cu | 2 | 4 | 0.100 | 0.200 | 5.196 | 10.141 | 2.580 | 18.217 | 30.000 | 11.783 | 39.276 |
| Cu | 2 | 4 | 0.100 | 0.200 | 5.831 | 10.347 | 2.461 | 18.940 | 36.165 | 17.225 | 47.630 |
| Cu | 2 | 4 | 0.100 | 0.200 | 5.454 | 11.444 | 1.798 | 18.996 | 42.475 | 23.479 | 55.276 |
| Cu | 2 | 7 | 0.100 | 0.143 | 5.746 | 10.558 | 2.232 | 18.779 | 20.635 | 1.856 | 8.993 |
| Cu | 2 | 7 | 0.100 | 0.185 | 6.461 | 10.646 | 2.593 | 19.984 | | | |
| Cu | 2 | 7 | 0.100 | 0.155 | 6.266 | 12.109 | 2.195 | 20.825 | 26.120 | 5.295 | 20.273 |
| Cu | 3 | 6 | 0.100 | 0.143 | 6.202 | 11.582 | 3.585 | 21.612 | 43.695 | 22.083 | 50.539 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cu | 3 | 6 | 0.100 | 0.142 | 5.345 | 12.205 | 3.113 | 20.905 | 52.970 | 32.065 | 60.533 |
| Cu | 3 | 6 | 0.100 | 0.142 | 6.158 | 12.681 | 3.067 | 22.148 | 70.065 | 47.917 | 68.389 |
| Cu | 3 | 14 | 0.100 | 0.481 | 5.613 | 13.703 | 3.540 | 23.437 | 48.825 | 25.388 | 51.998 |
| Cu | 3 | 14 | 0.100 | 0.172 | 7.114 | 12.597 | 3.074 | 23.057 | 40.830 | 17.773 | 43.530 |
| Cu | 3 | 14 | 0.100 | 0.156 | 6.711 | 10.841 | 3.218 | 21.026 | 43.920 | 22.894 | 52.126 |
| Cu | 3 | 15 | 0.100 | 0.318 | 7.142 | 12.241 | 3.258 | 23.059 | 37.170 | 14.111 | 37.962 |
| Cu | 3 | 15 | 0.100 | 0.258 | 6.412 | 13.379 | 3.077 | 23.227 | 37.725 | 14.498 | 38.431 |
| Cu | 3 | 15 | 0.100 | 0.494 | 5.712 | 13.325 | 3.403 | 23.033 | 44.220 | 21.187 | 47.912 |
| Cu | 4 | 8 | 0.100 | 0.349 | 6.877 | 12.058 | 3.702 | 23.085 | 54.725 | 31.640 | 57.816 |
| Cu | 4 | 8 | 0.100 | 0.319 | 7.003 | 12.359 | 3.859 | 23.640 | 50.350 | 26.710 | 53.049 |
| Cu | 4 | 8 | 0.100 | 0.245 | 6.812 | 12.371 | 3.558 | 23.087 | 49.315 | 26.228 | 53.185 |
| Cu | 4 | 10 | 0.100 | 0.245 | 7.603 | 12.260 | 3.850 | 24.059 | 62.230 | 38.171 | 61.338 |
| Cu | 4 | 10 | 0.100 | 0.274 | 6.227 | 13.216 | 3.697 | 23.514 | 60.650 | 37.136 | 61.230 |
| Cu | 4 | 10 | 0.100 | 0.216 | 6.095 | 12.756 | 3.666 | 22.832 | 52.940 | 30.108 | 56.871 |
| Cu | 4 | 13 | 0.100 | 0.260 | 5.725 | 13.156 | 3.800 | 23.041 | 42.065 | 19.024 | 45.226 |
| Cu | 4 | 13 | 0.100 | 0.289 | 5.818 | 13.267 | 3.531 | 23.005 | 43.070 | 20.065 | 46.587 |
| Cu | 4 | 13 | 0.100 | 0.171 | 5.867 | 12.888 | 3.266 | 22.292 | 45.160 | 22.868 | 50.638 |
| Cu | 5 | 1 | 0.100 | 0.289 | 7.119 | 13.603 | 3.976 | 25.088 | 82.190 | 57.102 | 69.476 |
| Cu | 5 | 1 | 0.100 | 0.333 | 6.084 | 13.804 | 4.171 | 24.492 | 74.450 | 49.958 | 67.102 |
| Cu | 5 | 1 | 0.100 | 0.200 | 6.086 | 14.220 | 3.871 | 24.478 | 82.135 | 57.657 | 70.198 |
| Cu | 5 | 11 | 0.100 | 0.451 | 7.171 | 13.037 | 3.757 | 24.516 | 55.665 | 31.149 | 55.958 |
| Cu | 5 | 11 | 0.100 | 0.199 | 7.489 | 14.016 | 4.115 | 25.919 | 52.085 | 26.166 | 50.237 |
| Cu | 5 | 11 | 0.100 | 0.143 | 6.846 | 14.335 | 3.957 | 25.380 | 56.700 | 31.320 | 55.237 |
| Cu | 5 | 12 | 0.100 | 0.171 | 6.576 | 12.853 | 3.764 | 23.464 | 59.095 | 35.631 | 60.294 |
| Cu | 5 | 12 | 0.100 | 0.422 | 7.303 | 12.560 | 4.128 | 24.514 | 66.055 | 41.541 | 62.889 |
| Cu | 5 | 12 | 0.100 | 0.156 | 7.856 | 12.951 | 4.005 | 25.068 | 58.310 | 33.242 | 57.009 |
| Mn | 1 | 2 | 28.164 | 0.000 | 0.032 | 27.777 | 19.419 | 75.393 | 513.870 | 438.477 | 85.328 |
| Mn | 1 | 2 | 30.256 | 0.000 | 0.032 | 42.091 | 21.985 | 94.363 | . | . | . |
| Mn | 1 | 2 | 24.896 | 0.000 | 0.037 | 30.663 | 26.426 | 82.022 | 579.745 | 497.723 | 85.852 |
| Mn | 1 | 5 | 24.105 | 0.000 | 0.051 | 21.757 | 20.484 | 66.397 | 634.295 | 567.898 | 89.532 |
| Mn | 1 | 5 | 23.800 | 0.000 | 0.874 | 26.193 | 24.122 | 74.988 | . | . | . |
| Mn | 1 | 5 | 22.899 | 0.000 | 0.058 | 20.785 | 23.046 | 66.788 | 424.315 | 357.527 | 84.260 |
| Mn | 1 | 9 | 22.990 | 0.000 | 0.033 | 50.747 | 21.645 | 95.414 | 435.565 | 340.151 | 78.094 |
| Mn | 1 | 9 | 22.556 | 0.000 | 0.533 | 42.796 | 19.832 | 85.717 | 545.510 | 459.793 | 84.287 |
| Mn | 1 | 9 | 22.732 | 0.000 | 0.152 | 35.676 | 20.044 | 78.604 | . | . | . |
| Mn | 2 | 3 | 0.886 | 0.709 | 0.625 | 206.192 | 17.750 | 226.163 | 177.850 | 0.000 | 0.000 |
| Mn | 2 | 3 | 1.177 | 0.780 | 0.010 | 253.404 | 21.163 | 276.534 | 183.615 | 0.000 | 0.000 |
| Mn | 2 | 3 | 1.191 | 0.506 | 0.301 | 178.422 | 29.398 | 209.818 | 174.760 | 0.000 | 0.000 |
| Mn | 2 | 4 | 1.334 | 0.699 | 0.109 | 166.352 | 26.715 | 195.209 | 492.855 | 297.646 | 60.392 |
| Mn | 2 | 4 | 1.220 | 0.612 | 0.278 | 218.604 | 28.661 | 249.375 | 655.315 | 405.940 | 61.946 |
| Mn | 2 | 4 | 1.306 | 0.649 | 0.121 | 113.066 | 30.759 | 145.900 | 151.560 | 5.660 | 3.734 |
| Mn | 2 | 7 | 1.658 | 0.569 | 0.271 | 198.860 | 25.158 | 226.517 | 184.880 | 0.000 | 0.000 |
| Mn | 2 | 7 | 1.210 | 1.067 | 0.000 | 118.224 | 48.982 | 169.483 | 632.675 | 463.192 | 73.212 |
| Mn | 2 | 7 | 1.415 | 0.905 | 0.001 | 132.617 | 37.765 | 172.702 | 171.875 | 0.000 | 0.000 |
| Mn | 3 | 6 | 1.372 | 0.692 | 0.403 | 130.546 | 37.272 | 170.285 | 155.075 | 0.000 | 0.000 |
| Mn | 3 | 6 | 1.553 | 0.578 | 0.132 | 189.393 | 19.185 | 210.841 | 177.850 | 0.000 | 0.000 |
| Mn | 3 | 6 | 1.639 | 0.519 | 0.133 | 201.710 | 17.545 | 221.546 | 184.880 | 0.000 | 0.000 |
| Mn | 3 | 14 | 1.772 | 0.874 | 0.202 | 129.211 | 27.445 | 159.504 | 568.705 | 409.201 | 71.953 |
| Mn | 3 | 14 | 0.867 | 0.780 | 0.080 | 174.248 | 26.462 | 202.438 | 144.880 | 0.000 | 0.000 |
| Mn | 3 | 14 | 1.677 | 0.544 | 0.047 | 171.253 | 27.241 | 200.761 | 148.675 | 0.000 | 0.000 |
| Mn | 3 | 15 | 1.410 | 0.983 | 0.000 | 165.925 | 35.319 | 203.637 | 461.785 | 258.148 | 55.902 |
| Mn | 3 | 15 | 1.129 | 0.699 | 0.047 | 126.509 | 43.180 | 171.565 | 156.200 | 0.000 | 0.000 |
| Mn | 3 | 15 | 1.191 | 0.828 | 0.149 | 211.572 | 21.528 | 235.268 | 164.915 | 0.000 | 0.000 |
| Mn | 4 | 8 | 0.862 | 0.866 | 0.024 | 117.782 | 37.371 | 156.905 | 166.040 | 9.135 | 5.502 |
| Mn | 4 | 8 | 0.777 | 0.892 | 0.270 | 173.587 | 29.225 | 204.750 | 549.235 | 344.485 | 62.721 |
| Mn | 4 | 8 | 1.091 | 0.728 | 0.050 | 140.603 | 28.024 | 170.496 | 149.380 | 0.000 | 0.000 |
| Mn | 4 | 10 | 0.858 | 0.566 | 0.112 | 93.098 | 39.961 | 134.594 | 164.215 | 29.621 | 18.038 |
| Mn | 4 | 10 | 0.772 | 0.678 | 0.048 | 177.149 | 20.244 | 198.891 | 156.900 | 0.000 | 0.000 |
| Mn | 4 | 10 | 9.801 | 0.162 | 0.021 | 140.972 | 27.758 | 178.713 | 143.125 | 0.000 | 0.000 |
| Mn | 4 | 13 | 1.082 | 0.570 | 0.022 | 186.663 | 21.528 | 209.864 | 162.875 | 0.000 | 0.000 |
| Mn | 4 | 13 | 0.967 | 0.585 | 0.286 | 206.038 | 18.289 | 226.165 | 566.525 | 340.360 | 60.079 |
| Mn | 4 | 13 | 0.896 | 0.684 | 0.017 | 213.297 | 32.900 | 247.794 | 169.625 | 0.000 | 0.000 |
| Mn | 5 | 1 | 1.515 | 0.735 | 0.244 | 230.081 | 25.171 | 257.746 | 182.560 | 0.000 | 0.000 |
| Mn | 5 | 1 | 1.572 | 0.625 | 0.217 | 186.128 | 16.201 | 204.743 | 167.940 | 0.000 | 0.000 |
| Mn | 5 | 1 | 1.534 | 0.640 | 0.287 | 189.264 | 18.423 | 210.148 | 753.660 | 543.512 | 72.116 |
| Mn | 5 | 11 | 1.310 | 1.378 | 0.020 | 264.274 | 34.240 | 301.222 | 623.115 | 321.893 | 51.659 |
| Mn | 5 | 11 | 1.063 | 0.539 | 0.066 | 122.281 | 27.905 | 151.854 | 598.585 | 446.731 | 74.631 |
| Mn | 5 | 11 | 1.015 | 0.369 | 0.031 | 175.420 | 16.765 | 193.599 | 678.795 | 485.196 | 71.479 |
| Mn | 5 | 12 | 1.029 | 1.106 | 1.393 | 224.979 | 122.555 | 351.062 | 148.960 | 0.000 | 0.000 |
| Mn | 5 | 12 | 1.139 | 0.858 | 0.062 | 168.863 | 18.591 | 189.512 | 162.315 | 0.000 | 0.000 |
| Mn | 5 | 12 | 5.741 | 0.239 | 0.046 | 184.293 | 21.323 | 211.641 | 149.380 | 0.000 | 0.000 |
| Ni | 1 | 2 | 0.500 | 0.715 | 0.483 | 3.369 | 3.499 | 8.565 | 9.995 | 1.430 | 14.310 |
| Ni | 1 | 2 | 0.579 | 0.710 | 0.486 | 3.692 | 4.310 | 9.777 | 16.065 | 6.288 | 39.143 |
| Ni | 1 | 2 | 0.518 | 0.713 | 0.487 | 3.373 | 4.192 | 9.282 | 9.995 | 0.713 | 7.133 |
| Ni | 1 | 5 | 1.250 | 0.686 | 0.484 | 3.104 | 4.182 | 9.705 | 9.995 | 0.290 | 2.901 |
| Ni | 1 | 5 | 0.500 | 0.726 | 0.484 | 2.996 | 4.083 | 8.787 | 9.995 | 1.208 | 12.081 |
| Ni | 1 | 5 | 1.128 | 0.694 | 0.487 | 3.746 | 3.523 | 9.578 | 9.995 | 0.417 | 4.170 |
| Ni | 1 | 9 | 0.838 | 0.686 | 0.485 | 3.323 | 4.189 | 9.521 | 11.475 | 1.954 | 17.030 |
| Ni | 1 | 9 | 0.518 | 0.711 | 0.487 | 3.308 | 4.126 | 9.150 | 13.540 | 4.390 | 32.419 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ni | 1 | 9 | 0.793 | 0.696 | 0.484 | 2.372 | 4.065 | 8.410 | 9.995 | 1.585 | 15.858 |
| Ni | 2 | 3 | 0.500 | 0.714 | 1.127 | 7.494 | 4.644 | 14.479 | 15.375 | 0.896 | 5.825 |
| Ni | 2 | 3 | 0.500 | 0.720 | 0.997 | 8.147 | 3.769 | 14.133 | 12.390 | 0.000 | 0.000 |
| Ni | 2 | 3 | 0.500 | 0.723 | 1.032 | 7.643 | 4.571 | 14.470 | 10.785 | 0.000 | 0.000 |
| Ni | 2 | 4 | 0.500 | 0.717 | 1.148 | 7.326 | 3.993 | 13.684 | 9.995 | 0.000 | 0.000 |
| Ni | 2 | 4 | 0.500 | 0.719 | 1.408 | 7.492 | 4.592 | 14.710 | 9.995 | 0.000 | 0.000 |
| Ni | 2 | 4 | 0.500 | 0.719 | 1.281 | 7.409 | 3.454 | 13.363 | 10.325 | 0.000 | 0.000 |
| Ni | 2 | 7 | 0.500 | 0.714 | 1.379 | 8.001 | 4.168 | 14.761 | 13.080 | 0.000 | 0.000 |
| Ni | 2 | 7 | 0.500 | 0.715 | 1.038 | 7.251 | 4.461 | 13.965 | 9.995 | 0.000 | 0.000 |
| Ni | 2 | 7 | 0.500 | 0.712 | 0.761 | 8.450 | 4.682 | 15.104 | 9.995 | 0.000 | 0.000 |
| Ni | 3 | 6 | 0.500 | 0.713 | 1.363 | 7.477 | 4.903 | 14.955 | 15.375 | 0.420 | 2.730 |
| Ni | 3 | 6 | 0.500 | 0.712 | 1.127 | 8.188 | 5.562 | 16.088 | 21.110 | 5.022 | 23.788 |
| Ni | 3 | 6 | 0.500 | 0.711 | 1.205 | 8.781 | 4.769 | 15.965 | 25.475 | 9.510 | 37.329 |
| Ni | 3 | 14 | 0.500 | 0.721 | 1.192 | 7.700 | 4.348 | 14.462 | 20.425 | 5.963 | 29.195 |
| Ni | 3 | 14 | 0.500 | 0.722 | 1.314 | 8.230 | 4.253 | 15.020 | 18.585 | 3.565 | 19.182 |
| Ni | 3 | 14 | 0.500 | 0.721 | 0.972 | 7.992 | 4.359 | 14.544 | 11.930 | 0.000 | 0.000 |
| Ni | 3 | 15 | 0.500 | 0.793 | 1.115 | 8.213 | 4.396 | 15.017 | 12.390 | 0.000 | 0.000 |
| Ni | 3 | 15 | 0.500 | 0.714 | 0.660 | 7.746 | 5.052 | 14.672 | 20.880 | 6.208 | 29.734 |
| Ni | 3 | 15 | 0.500 | 0.714 | 1.230 | 7.720 | 4.558 | 14.723 | 13.310 | 0.000 | 0.000 |
| Ni | 4 | 8 | 0.500 | 0.723 | 1.148 | 7.358 | 4.449 | 14.178 | 17.440 | 3.262 | 18.704 |
| Ni | 4 | 8 | 0.500 | 0.723 | 1.236 | 8.024 | 4.410 | 14.892 | 16.290 | 1.398 | 8.584 |
| Ni | 4 | 8 | 0.500 | 0.723 | 1.035 | 8.100 | 4.547 | 14.904 | 18.130 | 3.226 | 17.791 |
| Ni | 4 | 10 | 0.500 | 0.724 | 1.514 | 7.675 | 5.610 | 16.022 | 28.455 | 12.433 | 43.693 |
| Ni | 4 | 10 | 0.500 | 0.721 | 0.761 | 8.763 | 4.660 | 15.405 | 25.015 | 9.610 | 38.415 |
| Ni | 4 | 10 | 0.500 | 0.723 | 0.606 | 8.374 | 4.444 | 14.646 | 22.260 | 7.614 | 34.204 |
| Ni | 4 | 13 | 0.500 | 0.721 | 1.235 | 8.392 | 4.685 | 15.533 | 22.490 | 6.957 | 30.933 |
| Ni | 4 | 13 | 0.500 | 0.722 | 1.213 | 9.587 | 3.412 | 15.434 | 28.455 | 13.021 | 45.760 |
| Ni | 4 | 13 | 0.500 | 0.720 | 1.278 | 9.256 | 4.750 | 16.504 | 28.915 | 12.411 | 42.924 |
| Ni | 5 | 1 | 0.500 | 0.735 | 1.484 | 8.790 | 4.132 | 15.641 | 35.570 | 19.929 | 56.027 |
| Ni | 5 | 1 | 0.500 | 0.721 | 1.261 | 8.748 | 3.930 | 15.160 | 26.160 | 11.000 | 42.051 |
| Ni | 5 | 1 | 0.500 | 0.721 | 1.206 | 9.576 | 5.024 | 17.027 | 27.310 | 10.283 | 37.652 |
| Ni | 5 | 11 | 0.500 | 0.718 | 0.880 | 8.968 | 5.102 | 16.168 | 21.570 | 5.402 | 25.046 |
| Ni | 5 | 11 | 0.500 | 0.716 | 0.825 | 8.200 | 4.901 | 15.142 | 29.145 | 14.003 | 48.046 |
| Ni | 5 | 11 | 0.500 | 0.717 | 1.150 | 8.787 | 4.933 | 16.087 | 34.195 | 18.108 | 52.956 |
| Ni | 5 | 12 | 0.500 | 0.721 | 1.197 | 9.346 | 5.091 | 16.855 | 29.835 | 12.980 | 43.507 |
| Ni | 5 | 12 | 0.500 | 0.723 | 0.993 | 8.351 | 4.610 | 15.175 | 39.470 | 24.295 | 61.552 |
| Ni | 5 | 12 | 0.500 | 0.720 | 1.317 | 10.250 | 4.839 | 17.626 | 21.110 | 3.484 | 16.504 |
| Pb | 1 | 2 | 3.301 | 1.644 | 1.208 | 32.773 | 3.255 | 42.180 | 184.395 | 142.215 | 77.125 |
| Pb | 1 | 2 | 2.300 | 1.717 | 1.216 | 32.854 | 4.827 | 42.913 | 161.335 | 118.422 | 73.401 |
| Pb | 1 | 2 | 3.057 | 1.659 | 1.217 | 29.180 | 4.634 | 39.746 | 152.265 | 112.519 | 73.897 |
| Pb | 1 | 5 | 3.246 | 1.709 | 1.211 | 26.312 | 5.284 | 37.762 | 146.735 | 108.973 | 74.265 |
| Pb | 1 | 5 | 2.705 | 1.746 | 1.209 | 27.314 | 4.897 | 37.872 | 123.090 | 85.218 | 69.233 |
| Pb | 1 | 5 | 3.706 | 1.693 | 1.218 | 30.485 | 5.328 | 42.430 | 143.550 | 101.120 | 70.442 |
| Pb | 1 | 9 | 3.219 | 1.632 | 1.212 | 28.974 | 4.742 | 39.779 | 144.315 | 104.536 | 72.436 |
| Pb | 1 | 9 | 3.030 | 1.649 | 1.218 | 28.919 | 5.054 | 39.871 | 217.145 | 177.274 | 81.639 |
| Pb | 1 | 9 | 3.760 | 1.623 | 1.211 | 29.766 | 4.940 | 41.301 | 122.785 | 81.484 | 66.363 |
| Pb | 2 | 3 | 1.250 | 1.787 | 1.844 | 28.241 | 5.706 | 38.827 | 127.465 | 88.638 | 69.539 |
| Pb | 2 | 3 | 1.250 | 1.801 | 1.162 | 29.851 | 2.666 | 36.730 | 121.870 | 85.140 | 69.861 |
| Pb | 2 | 3 | 1.250 | 1.809 | 1.552 | 28.804 | 5.521 | 38.936 | 117.405 | 78.469 | 66.837 |
| Pb | 2 | 4 | 1.250 | 1.794 | 1.438 | 27.561 | 4.583 | 36.627 | 136.325 | 99.698 | 73.133 |
| Pb | 2 | 4 | 1.250 | 1.798 | 1.882 | 29.575 | 5.858 | 40.362 | 150.585 | 110.223 | 73.196 |
| Pb | 2 | 4 | 1.380 | 1.789 | 1.313 | 30.286 | 3.304 | 38.071 | 119.440 | 81.369 | 68.125 |
| Pb | 2 | 7 | 1.250 | 1.786 | 2.200 | 28.343 | 5.004 | 38.584 | 139.470 | 100.886 | 72.335 |
| Pb | 2 | 7 | 1.250 | 1.789 | 1.153 | 24.801 | 4.958 | 33.950 | 136.355 | 102.405 | 75.102 |
| Pb | 2 | 7 | 1.250 | 1.781 | 1.159 | 27.240 | 4.939 | 36.369 | 114.740 | 78.371 | 68.303 |
| Pb | 3 | 6 | 1.250 | 1.783 | 2.181 | 28.401 | 5.658 | 39.273 | 131.370 | 92.097 | 70.105 |
| Pb | 3 | 6 | 1.250 | 1.781 | 1.439 | 28.127 | 5.184 | 37.780 | 151.505 | 113.725 | 75.063 |
| Pb | 3 | 6 | 1.250 | 1.778 | 2.094 | 31.631 | 5.288 | 42.042 | 174.225 | 132.183 | 75.869 |
| Pb | 3 | 14 | 1.250 | 1.804 | 1.643 | 28.885 | 6.168 | 39.750 | 218.485 | 178.735 | 81.806 |
| Pb | 3 | 14 | 1.250 | 1.806 | 1.922 | 27.177 | 5.441 | 37.596 | 139.295 | 101.699 | 73.010 |
| Pb | 3 | 14 | 1.250 | 1.805 | 1.768 | 26.867 | 5.806 | 37.496 | 136.395 | 98.899 | 72.509 |
| Pb | 3 | 15 | 1.250 | 1.801 | 1.190 | 26.395 | 5.705 | 36.342 | 151.810 | 115.468 | 76.061 |
| Pb | 3 | 15 | 1.250 | 1.787 | 1.155 | 27.390 | 5.526 | 37.107 | 131.345 | 94.238 | 71.748 |
| Pb | 3 | 15 | 1.250 | 1.786 | 2.105 | 28.302 | 5.850 | 39.293 | 123.730 | 84.437 | 68.243 |
| Pb | 4 | 8 | 1.250 | 1.808 | 1.180 | 25.780 | 6.189 | 36.207 | 138.225 | 102.018 | 73.806 |
| Pb | 4 | 8 | 1.250 | 1.808 | 2.275 | 27.241 | 5.950 | 38.524 | 228.475 | 189.951 | 83.139 |
| Pb | 4 | 8 | 1.250 | 1.809 | 1.297 | 26.582 | 6.078 | 37.017 | 130.390 | 93.373 | 71.611 |
| Pb | 4 | 10 | 1.250 | 1.810 | 2.183 | 26.383 | 6.380 | 38.006 | 158.470 | 120.464 | 76.017 |
| Pb | 4 | 10 | 1.250 | 1.803 | 1.147 | 28.000 | 5.799 | 37.998 | 146.665 | 108.667 | 74.092 |
| Pb | 4 | 10 | 1.250 | 1.808 | 1.170 | 28.239 | 6.294 | 38.761 | 128.290 | 89.529 | 69.786 |
| Pb | 4 | 13 | 1.250 | 1.803 | 1.710 | 30.035 | 5.645 | 40.444 | 141.705 | 101.261 | 71.459 |
| Pb | 4 | 13 | 1.250 | 1.805 | 1.642 | 29.266 | 3.873 | 37.836 | 152.190 | 114.354 | 75.139 |
| Pb | 4 | 13 | 1.250 | 1.802 | 1.439 | 32.123 | 5.859 | 42.473 | 144.095 | 101.622 | 70.524 |
| Pb | 5 | 1 | 1.250 | 1.805 | 2.333 | 29.959 | 4.036 | 39.382 | 170.670 | 131.288 | 76.925 |
| Pb | 5 | 1 | 1.250 | 1.803 | 2.094 | 28.657 | 5.287 | 39.091 | 151.060 | 111.969 | 74.122 |
| Pb | 5 | 1 | 1.250 | 1.802 | 1.658 | 31.349 | 6.308 | 42.367 | 229.375 | 187.008 | 81.529 |
| Pb | 5 | 11 | 1.250 | 1.797 | 1.157 | 25.736 | 5.787 | 35.726 | 178.410 | 142.684 | 79.975 |
| Pb | 5 | 11 | 1.250 | 1.791 | 1.170 | 27.002 | 6.272 | 37.485 | 158.190 | 120.705 | 76.304 |
| Pb | 5 | 11 | 1.250 | 1.794 | 2.119 | 31.141 | 6.381 | 42.684 | 280.245 | 237.561 | 84.769 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pb | 5 | 12 | 1.250 | 1.803 | 2.629 | 26.895 | 5.473 | 38.049 | 162.545 | 124.496 | 76.592 |
| Pb | 5 | 12 | 1.250 | 1.808 | 1.140 | 28.594 | 6.173 | 38.964 | 150.725 | 111.761 | 74.149 |
| Pb | 5 | 12 | 1.250 | 1.802 | 2.440 | 34.989 | 6.406 | 46.887 | 136.775 | 89.888 | 65.720 |
| Sr | 1 | 2 | 0.181 | 0.062 | 0.048 | 31.496 | 0.072 | 31.860 | 288.125 | 256.265 | 88.942 |
| Sr | 1 | 2 | 0.143 | 0.065 | 0.049 | 31.344 | 0.676 | 32.277 | 101.275 | 68.998 | 68.129 |
| Sr | 1 | 2 | 0.133 | 0.066 | 0.049 | 32.781 | 0.335 | 33.364 | 201.865 | 168.501 | 83.472 |
| Sr | 1 | 5 | 0.143 | 0.068 | 0.048 | 31.983 | 0.402 | 32.644 | 225.155 | 192.511 | 85.502 |
| Sr | 1 | 5 | 0.162 | 0.067 | 0.048 | 29.592 | 0.872 | 30.741 | 101.965 | 71.224 | 69.851 |
| Sr | 1 | 5 | 0.162 | 0.067 | 0.049 | 27.347 | 1.066 | 28.690 | 225.015 | 196.325 | 87.250 |
| Sr | 1 | 9 | 0.162 | 0.063 | 0.048 | 28.049 | 1.054 | 29.376 | 209.445 | 180.069 | 85.975 |
| Sr | 1 | 9 | 0.133 | 0.065 | 0.049 | 33.654 | 1.022 | 34.923 | 242.515 | 207.592 | 85.600 |
| Sr | 1 | 9 | 0.171 | 0.064 | 0.048 | 29.994 | 0.893 | 31.169 | 106.510 | 75.341 | 70.736 |
| Sr | 2 | 3 | 1.311 | 0.046 | 0.044 | 22.449 | 0.894 | 24.744 | 92.180 | 67.436 | 73.157 |
| Sr | 2 | 3 | 1.378 | 0.000 | 0.046 | 25.214 | 0.000 | 26.638 | 99.760 | 73.122 | 73.298 |
| Sr | 2 | 3 | 1.302 | 0.006 | 0.046 | 24.644 | 1.160 | 27.158 | 96.455 | 69.297 | 71.844 |
| Sr | 2 | 4 | 1.349 | 0.000 | 0.047 | 25.760 | 0.968 | 28.123 | 245.820 | 217.697 | 88.559 |
| Sr | 2 | 4 | 1.482 | 0.000 | 0.046 | 25.817 | 0.881 | 28.226 | 290.605 | 262.379 | 90.287 |
| Sr | 2 | 4 | 1.444 | 0.003 | 0.046 | 25.986 | 0.000 | 27.479 | 88.185 | 60.706 | 68.840 |
| Sr | 2 | 7 | 1.444 | 0.000 | 0.046 | 24.509 | 1.081 | 27.079 | 102.655 | 75.576 | 73.621 |
| Sr | 2 | 7 | 1.292 | 0.003 | 0.045 | 23.093 | 0.780 | 25.213 | 189.465 | 164.252 | 86.693 |
| Sr | 2 | 7 | 1.387 | 0.000 | 0.046 | 23.852 | 0.739 | 26.024 | 95.900 | 69.876 | 72.863 |
| Sr | 3 | 6 | 5.463 | 0.000 | 0.042 | 48.747 | 5.617 | 59.868 | 145.370 | 85.502 | 58.817 |
| Sr | 3 | 6 | 5.244 | 0.000 | 0.046 | 34.375 | 5.212 | 44.877 | 173.755 | 128.878 | 74.172 |
| Sr | 3 | 6 | 5.586 | 0.000 | 0.045 | 39.814 | 5.160 | 50.605 | 180.370 | 129.765 | 71.944 |
| Sr | 3 | 14 | 5.757 | 0.061 | 0.033 | 34.715 | 6.247 | 46.812 | 295.155 | 248.343 | 84.140 |
| Sr | 3 | 14 | 5.254 | 0.000 | 0.041 | 32.174 | 5.635 | 43.102 | 150.470 | 107.368 | 71.355 |
| Sr | 3 | 14 | 5.159 | 0.000 | 0.046 | 36.121 | 6.069 | 47.395 | 164.110 | 116.715 | 71.120 |
| Sr | 3 | 15 | 5.377 | 0.000 | 0.040 | 37.120 | 6.496 | 49.033 | 295.705 | 246.672 | 83.418 |
| Sr | 3 | 15 | 5.767 | 0.000 | 0.045 | 33.608 | 5.960 | 45.380 | 151.570 | 106.190 | 70.060 |
| Sr | 3 | 15 | 5.643 | 0.000 | 0.034 | 31.985 | 6.427 | 44.088 | 160.530 | 116.442 | 72.536 |
| Sr | 4 | 8 | 6.764 | 0.000 | 0.040 | 39.505 | 8.167 | 54.476 | 210.825 | 156.349 | 74.161 |
| Sr | 4 | 8 | 7.534 | 0.000 | 0.189 | 37.484 | 8.234 | 53.440 | 303.695 | 250.255 | 82.403 |
| Sr | 4 | 8 | 7.287 | 0.000 | 0.036 | 38.107 | 8.135 | 53.565 | 189.190 | 135.625 | 71.687 |
| Sr | 4 | 10 | 6.679 | 0.000 | 0.043 | 38.068 | 9.014 | 53.804 | 219.230 | 165.426 | 75.458 |
| Sr | 4 | 10 | 7.135 | 0.000 | 0.040 | 34.419 | 9.106 | 50.700 | 227.360 | 176.660 | 77.701 |
| Sr | 4 | 10 | 6.745 | 0.000 | 0.042 | 35.513 | 8.345 | 50.645 | 191.670 | 141.025 | 73.577 |
| Sr | 4 | 13 | 6.821 | 0.000 | 0.045 | 36.901 | 8.570 | 52.337 | 186.710 | 134.373 | 71.969 |
| Sr | 4 | 13 | 7.192 | 0.000 | 0.042 | 38.380 | 7.344 | 52.957 | 292.950 | 239.993 | 81.923 |
| Sr | 4 | 13 | 7.135 | 0.000 | 0.043 | 37.948 | 6.972 | 52.097 | 207.380 | 155.283 | 74.878 |
| Sr | 5 | 1 | 8.721 | 0.000 | 0.040 | 45.515 | 10.628 | 64.904 | 252.575 | 187.671 | 74.303 |
| Sr | 5 | 1 | 8.835 | 0.000 | 0.044 | 40.645 | 11.583 | 61.108 | 228.875 | 167.767 | 73.301 |
| Sr | 5 | 1 | 8.436 | 0.000 | 0.042 | 41.498 | 9.988 | 59.964 | 518.930 | 458.966 | 88.445 |
| Sr | 5 | 11 | 8.940 | 0.000 | 0.032 | 39.955 | 9.292 | 58.218 | 383.890 | 325.672 | 84.835 |
| Sr | 5 | 11 | 9.386 | 0.000 | 0.042 | 42.143 | 10.754 | 62.326 | 326.845 | 264.519 | 80.931 |
| Sr | 5 | 11 | 9.130 | 0.000 | 0.043 | 42.705 | 10.448 | 62.325 | 487.790 | 425.465 | 87.223 |
| Sr | 5 | 12 | 8.465 | 0.000 | 0.042 | 40.030 | 9.558 | 58.095 | 230.525 | 172.430 | 74.799 |
| Sr | 5 | 12 | 7.857 | 0.000 | 0.026 | 41.126 | 10.339 | 59.348 | 254.780 | 195.432 | 76.706 |
| Sr | 5 | 12 | 8.541 | 0.000 | 0.045 | 46.611 | 10.093 | 65.289 | 226.945 | 161.656 | 71.231 |
| Zn | 1 | 2 | 5.347 | 0.000 | 0.288 | 9.847 | 14.849 | 30.331 | 86.680 | 56.349 | 65.008 |
| Zn | 1 | 2 | 4.898 | 0.000 | 0.221 | 9.234 | 15.503 | 29.856 | 78.410 | 48.554 | 61.923 |
| Zn | 1 | 2 | 4.715 | 0.000 | 0.195 | 8.284 | 14.928 | 28.122 | | | |
| Zn | 1 | 5 | 4.729 | 0.058 | 0.232 | 7.293 | 15.101 | 27.413 | 116.430 | 89.017 | 76.455 |
| Zn | 1 | 5 | 4.851 | 0.069 | 0.797 | 8.492 | 14.148 | 28.356 | 68.830 | 40.474 | 58.803 |
| Zn | 1 | 5 | 4.607 | 0.074 | 0.439 | 9.125 | 14.044 | 28.289 | 77.360 | 49.071 | 63.433 |
| Zn | 1 | 9 | 4.599 | 0.000 | 0.194 | 8.954 | 14.431 | 28.177 | 72.210 | 44.033 | 60.979 |
| Zn | 1 | 9 | 4.644 | 0.000 | 0.520 | 8.959 | 15.096 | 29.219 | 102.730 | 73.511 | 71.558 |
| Zn | 1 | 9 | 4.748 | 0.000 | 0.194 | 8.926 | 14.592 | 28.460 | 68.755 | 40.295 | 58.607 |
| Zn | 2 | 3 | 0.200 | 0.636 | 0.518 | 29.816 | 20.561 | 51.731 | 100.175 | 48.444 | 48.360 |
| Zn | 2 | 3 | 0.200 | 0.676 | 0.521 | 32.731 | 16.201 | 50.329 | 105.220 | 54.891 | 52.168 |
| Zn | 2 | 3 | 0.200 | 0.613 | 0.314 | 31.663 | 18.470 | 51.260 | 95.175 | 43.915 | 46.142 |
| Zn | 2 | 4 | 0.200 | 0.631 | 0.270 | 26.732 | 18.087 | 45.920 | 99.930 | 54.010 | 54.048 |
| Zn | 2 | 4 | 0.200 | 1.121 | 0.213 | 31.448 | 18.871 | 51.853 | 127.225 | 75.372 | 59.243 |
| Zn | 2 | 4 | 0.200 | 0.676 | 0.293 | 30.089 | 15.793 | 47.051 | 85.610 | 38.559 | 45.040 |
| Zn | 2 | 7 | 0.200 | 0.591 | 0.281 | 30.419 | 18.104 | 49.594 | 100.015 | 50.421 | 50.413 |
| Zn | 2 | 7 | 0.200 | 0.791 | 0.505 | 22.846 | 19.441 | 43.784 | 118.170 | 74.386 | 62.949 |
| Zn | 2 | 7 | 0.200 | 0.641 | 0.438 | 27.604 | 19.050 | 47.933 | 92.300 | 44.367 | 48.069 |
| Zn | 3 | 6 | 0.200 | 0.629 | 0.522 | 28.517 | 19.848 | 49.716 | 91.015 | 41.299 | 45.376 |
| Zn | 3 | 6 | 0.200 | 0.532 | 0.498 | 32.736 | 19.352 | 53.318 | 104.035 | 50.717 | 48.750 |
| Zn | 3 | 6 | 0.200 | 0.512 | 0.366 | 34.389 | 18.216 | 53.683 | 131.335 | 77.652 | 59.125 |
| Zn | 3 | 14 | 0.200 | 0.947 | 0.685 | 36.142 | 18.836 | 56.811 | 123.600 | 66.789 | 54.036 |
| Zn | 3 | 14 | 0.200 | 0.755 | 0.813 | 34.501 | 17.626 | 53.895 | 88.275 | 34.380 | 38.946 |
| Zn | 3 | 14 | 0.200 | 0.639 | 0.634 | 29.262 | 17.989 | 48.724 | 95.080 | 46.356 | 48.754 |
| Zn | 3 | 15 | 0.200 | 0.913 | 0.607 | 31.054 | 18.364 | 51.139 | 101.450 | 50.311 | 49.592 |
| Zn | 3 | 15 | 0.200 | 0.584 | 0.570 | 30.785 | 19.282 | 51.421 | 92.725 | 41.304 | 44.544 |
| Zn | 3 | 15 | 0.200 | 0.732 | 0.623 | 35.348 | 18.001 | 54.903 | 98.865 | 43.962 | 44.466 |
| Zn | 4 | 8 | 0.200 | 0.864 | 0.769 | 28.710 | 18.171 | 48.713 | 101.095 | 52.382 | 51.814 |
| Zn | 4 | 8 | 0.200 | 0.819 | 1.780 | 32.479 | 17.760 | 53.038 | 122.230 | 69.192 | 56.608 |
| Zn | 4 | 8 | 0.200 | 0.787 | 0.700 | 28.791 | 17.676 | 48.154 | 96.085 | 47.931 | 49.884 |
| Zn | 4 | 10 | 0.200 | 0.568 | 0.839 | 30.057 | 20.893 | 52.557 | 111.490 | 58.933 | 52.860 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Zn | 4 | 10 | 0.200 | 0.599 | 0.564 | 34.675 | 17.453 | 53.491 | 107.060 | 53.569 | 50.037 |
| Zn | 4 | 10 | 1.225 | 0.667 | 0.650 | 32.553 | 17.074 | 52.169 | 94.815 | 42.646 | 44.978 |
| Zn | 4 | 13 | 0.200 | 0.678 | 0.579 | 34.256 | 17.676 | 53.389 | 100.745 | 47.356 | 47.006 |
| Zn | 4 | 13 | 0.200 | 0.618 | 0.543 | 35.461 | 13.546 | 50.368 | 202.635 | 152.267 | 75.143 |
| Zn | 4 | 13 | 0.200 | 0.613 | 0.408 | 34.593 | 15.789 | 51.602 | 111.760 | 60.158 | 53.828 |
| Zn | 5 | 1 | 0.200 | 0.694 | 0.548 | 36.904 | 15.574 | 53.920 | 120.140 | 66.220 | 55.119 |
| Zn | 5 | 1 | 0.200 | 0.630 | 0.712 | 35.603 | 15.995 | 53.140 | 107.975 | 54.835 | 50.785 |
| Zn | 5 | 1 | 0.200 | 0.677 | 0.594 | 38.584 | 16.254 | 56.309 | 142.065 | 85.756 | 60.364 |
| Zn | 5 | 11 | 0.200 | 0.772 | 0.689 | 32.889 | 16.753 | 51.304 | 205.085 | 153.781 | 74.984 |
| Zn | 5 | 11 | 0.200 | 0.579 | 0.843 | 31.867 | 18.024 | 51.513 | 170.820 | 119.307 | 69.844 |
| Zn | 5 | 11 | 0.200 | 0.450 | 0.748 | 40.421 | 16.467 | 58.286 | 122.480 | 64.194 | 52.412 |
| Zn | 5 | 12 | 0.200 | 0.656 | 1.583 | 31.488 | 17.569 | 51.497 | 102.740 | 51.243 | 49.876 |
| Zn | 5 | 12 | 0.200 | 0.856 | 0.765 | 33.706 | 16.365 | 51.892 | 112.355 | 60.463 | 53.814 |
| Zn | 5 | 12 | 0.240 | 0.520 | 0.969 | 36.009 | 17.789 | 55.526 | 102.245 | 46.719 | 45.693 |

# Vita

Darlene Elizabeth Allred was born on May 22, 1972 in West Palm Beach, Florida. She graduated as valedictorian from Oliver Springs High School in 1990. She accepted an academic scholarship to Tennessee Technological University and studied in the College of Engineering until 1992. In January of 1993, she transferred to The University of Tennessee, Knoxville to study soils and the physical sciences. While studying towards her Bachelor of Science degree, she acquired membership to Phi Kappa Phi National Honor Society. In December of 1994, she graduated Magna Cum Laude with a Bachelor of Science Degree in Agriculture. Spring term of 1995, she accepted a graduate research assistantship at The University of Tennessee, Knoxville and began study towards the Master of Science degree in Plant and Soil Science, Soil Chemistry. Employment plans were undecided during the preparation of this vita.