Natural Environment Research Council

Institute of Geological Sciences

Mineral Reconnaissance Programme Report

A report prepared for the Department of Industry

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No. 72

A geochemical drainage survey of the Preseli Hills, south-west Dyfed, Wales

BRITISH GEOLOGICAL SURVEY

Natural Environment Research Council

Mineral Reconnaissance Programme

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A geochemical drainage survey of the Preseli Hills, south-west Dyfed, Wales

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Mineral Reconnaissance Programme Reports

31 Geophysical investigations in the Closehouse–Lunedale area

32 Investigations at Polyphant, near Launceston, Cornwall

33 Mineral investigations at Carrock Fell, Cumbria. Part 1—Geophysical survey

34 Results of a gravity survey of the south-west margin of Dartmoor, Devon

35 Geophysical investigation of chromite-bearing ultrabasic rocks in the Baltasound–Hagdale area, Unst, Shetland Islands

36 An appraisal of the VLF ground resistivity technique as an aid to mineral exploration

37 Compilation of stratabound mineralisation in the Scottish Caledonides

38 Geophysical evidence for a concealed eastern extension of the Tanygrisiau microgranite and its possible relationship, to mineralisation

39 Copper-bearing intrusive rocks at Cairngarroch Bay, south-west Scotland

40 Stratabound barium-zinc mineralisation in Dalradian schist near Aberfeldy, Scotland; Final report

41 Metalliferous mineralisation near Lutton, Ivybridge, Devon

42 Mineral exploration in the area around Culvennan Fell, Kirkcowan, south-western Scotland

43 Disseminated copper-molybdenum mineralisation near Ballachulish, Highland Region

44 Reconnaissance geochemical maps of parts of south Devon and Cornwall

45 Mineral investigations near Bodmin, Cornwall. Part 2—New uranium, tin and copper occurrence in the Tremayne area of St Columb Major

46 Gold mineralisation at the southern margin of the Loch Doon granitoid complex, south-west Scotland

47 An airborne geophysical survey of the Whin Sill between Haltwhistle and Scots' Gap, south Northumberland

48 Mineral investigations near Bodmin, Cornwall. Part 3—The Mulberry and Wheal Prosper area

49 Seismic and gravity surveys over the concealed granite ridge at Bosworgy, Cornwall

50 Geochemical drainage survey of central Argyll, Scotland

51 A reconnaissance geochemical survey of Anglesey

52 Miscellaneous investigations on mineralisation in sedimentary rocks

53 Investigation of polymetallic mineralisation in Lower Devonian volcanics near Alva, central Scotland

54 Copper mineralisation near Middleton Tyas, North Yorkshire

55 Mineral exploration in the area of the Fore Burn igneous complex, south-western Scotland

56 Geophysical and geochemical investigations over the Long Rake, Haddon Fields, Derbyshire

57 Mineral exploration in the Ravenstonedale area, Cumbria

58 Investigation of small intrusions in southern Scotland

59 Stratabound arsenic and vein antimony mineralisation in Silurian greywackes at Glendinning, south Scotland

60 Mineral investigations at Carrock Fell, Cumbria. Part 2—Geochemical investigations

61 Mineral reconnaissance at the Highland Boundary with special reference to the Loch Lomond and Aberfoyle areas

62 Mineral reconnaissance in the Northumberland Trough

63 Exploration for volcanogenic sulphide mineralisation at Benglog, North Wales

64 A mineral reconnaissance of the Dent–Ingleton area of the Askrigg Block, northern England

65 Geophysical investigations in Swaledale, North Yorkshire

66 Mineral reconnaissance surveys in the Craven Basin

67 Baryte and copper mineralisation in the Renfrewshire Hills, central Scotland

68 Polymetallic mineralisation in Carboniferous rocks at Hilderston, near Bathgate, central Scotland

69 Base metal mineralisation associated with Ordovician shales in south-west Scotland

70 Regional geochemical and geophysical surveys in the Berwyn Dome and adjacent areas, North Wales

71 A regional geochemical soil investigation of the Carboniferous Limestone areas south of Kendal (south Cumbria and north Lancashire)

72 A geochemical drainage survey of the Preseli Hills, south-west Dyfed, Wales

On 1 January 1984 the Institute of Geological Sciences was renamed the British Geological Survey. It continues to carry out the geological survey of Great Britain and Northern Ireland (the latter as an agency service for the government of Northern Ireland), and of the surrounding continental shelf, as well as its basic research projects; it also undertakes programmes of British technical aid in geology in developing countries as arranged by the Overseas Development Administration.

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CONTENTS

FIGURES

TABLES

SUMMARY

A geochemical drainage survey at a density of 1 sample per km^2 was carried out across the Preseli Hills, southwest Dyfed. Stream sediment, water and panned concentrate samples were collected from each of 358 sites, and Cu, Pb, Zn, Ba, Fe, Mn, Co, Ni, V, Cr, B, Zr, As, Mo and Sn were determined in sediment, Cu, Pb, Zn, Ba, Fe, Mn, Ti, Ni, Sn, As, Ca, Ce, Sr, Sb, Zr, U and Mo in panned concentrate and Cu and Zn in water.

From a study of regional variation patterns and multivariate statistical analysis, the main sources of geochemical variation in the data were found to be bedrock lithology, mineralisation, contamination and hydromorphic processes. Strong geochemical signatures were shown by dolerite intrusions and by acid volcanics of the Fishguard Volcanic Group. Dark mudstones of the D. murchisoni Beds and Sealyham Volcanic Series also showed characteristic geochemical features whose impact was limited by their restricted and sinuous outcrops. A feature of most of the area is the presence of monazite nodules, generating high levels of rare earth elements and uranium in the panned concentrates. These are particularly high over the Llandeilo-Ashgill sedimentary rocks.

Geological thresholds were established using cumulative frequency plots and percentile division. Anomalies due to contamination could be discriminated satisfactorily from those arising from mineralisation only by field observation and mineralogical examination of panned concentrates. In major streams crossing lowland areas and in the vicinity of roads, widespread contamination proved to be the source of most large base metal anomalies.

Anomalies related to known mineralisation are located in the southeast of the area, around Llanfyrnach in the Taf valley. Anomalies reflecting hitherto unrecorded bedrock mineralisation may be present in the following areas:

a) Llanfyrnach; anomalies for Cu, Pb, Zn and Ba are more extensive than can be accounted for by the known vein mineralisation. High levels of other elements suggest an association with shales.

b) Crosswell-Crymmych; barium and base metal anomalies are associated with the Fishguard Volcanic Group and overlying pyritiferous dark mudstones of the D. murchisoni Beds. The geological setting of these rocks, deposited in a sulphurous environment on the flanks of an acid volcanic pile, suggests that massive sulphide deposits are a possible target here. Locally, weak arsenic anomalies, old trials and ancient mining records suggest that there is also some potential for Au mineralisation associated with pyrite in veins and mudstones.

c) Minas Dinas and Pentre Ifan; small amounts of gold and chalcopyrite were found in panned concentrates.

d) Very small amounts of cassiterite were found in panned concentrates from several localities, but no source was readily identifiable.

The anomalies in the Llanfyrnach and Crosswell areas were considered to merit more detailed investigation and are the subject of further work by BGS.

INTRODUCTION

A reconnaissance drainage survey of the Preseli Hills in Dyfed, South Wales, was carried out as a means of assessing the mineral potential of the area and to provide baseline geochemical data on the region. The work formed part of a larger project to assess the mineral potential of Precambrian and Lower Palaeozoic rocks of southwest Dyfed (Pembrokeshire). The geochemical drainage survey was restricted to this area, as previous studies (Allen and others, in prep) showed that this technique was ineffective in lowland areas, failing to detect a substantial area of copper enrichment associated with disseminated porphyry style mineralisation.

The survey area (Figure 1) consists of the east-west ridge of the Preseli Hills rising to over 500 m, the surrounding lower plateau of 100 to 200 m in height and a small section of coastal platform 50 to 60 m in height. Most of the area was subject to glacial and periglacial processes during the Pleistocene era. The plateau area is gently rounded in the east, with several fairly broad river valleys running north-south, while the west is more severely incised where sub-glacial channels have cut deep narrow gorges in places. The coastal platform has also been cut into by ice-marginal or sub-glacial streams forming several deep gorges (Jones, 1965). Most of the lower plateau and coastal platform is farmed, while the higher ground is mainly rough grass and heath. High rainfall assists peat formation, and large areas of ill-drained wetland are present. Rock outcrop is poor because of extensive till and head deposits (Bradley, 1976) being largely restricted to the sides of incised river valleys and to the characteristic carns of the main ridge.

Previous work

Geologically, the area covered by the drainage survey has been studied as a whole only by W. D. Evans (1938, 1940, 1945), most other mapping having concentrated on the igneous rocks to the west of the Preseli Hills. Part of the area was mapped by Cowper Reed (1885), followed by Part (1922), who described the igneous rocks of the Preseli Hills. The area east of Fishguard has been remapped by Lowman (1977; Lowman and Bloxam, 1981), while further west Elsden (1905), Thomas and Cox (1924), Cox (1930), Williams (1933), Thomas and Thomas (1956) and Bevins and Roach (1979a, 1979b) studied primarily the igneous series of rocks between St David's and Fishguard. O. T. Jones (1912) covered the Cardiganshire area and D. C. Evans (1906) Western Carmarthenshire. The Quaternary geology of the St. David's peninsula and the Preseli Hills has been studied by Charlesworth (1929), Griffiths (1939), O. T. Jones (1965) and John (1965, 1967, 1970, 1971).

Some geochemical studies have been made of the area. The Wolfson Geochemical Atlas, (Imperial College of Science and Technology, 1978) can be used to delineate broad regional trends and Urquiddi-Barrau (1973) used this as baseline data for further work in Wales, including soil traverses across four areas in the Preseli Hills. No anomalies adjudged to have any economic potential were discovered. Bradley and others (1976) also covered part of the Preseli area in a survey of the distribution of trace elements in northwest Pembrokeshire soils.

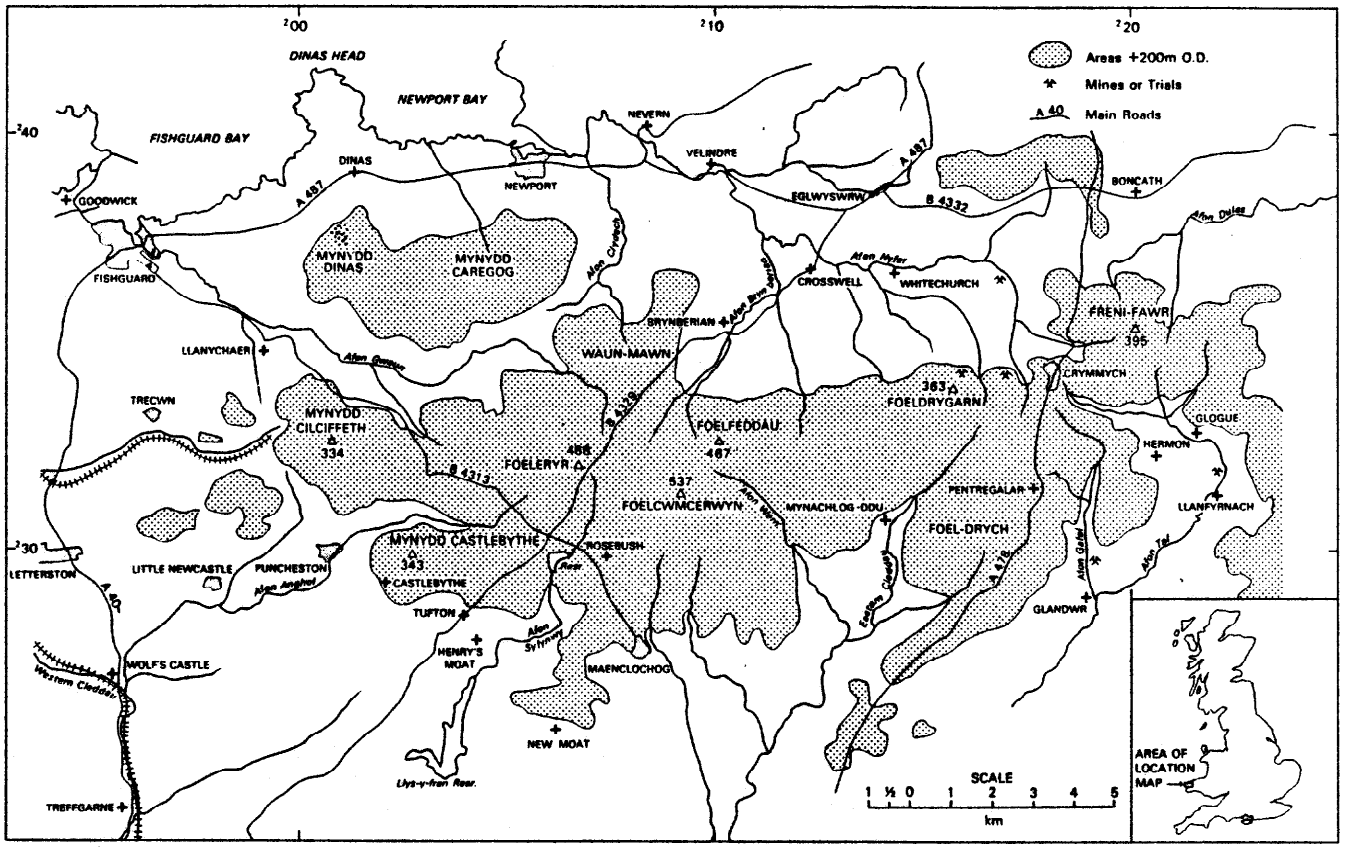


Figure 1 Location of the survey area

Regional gravity and aeromagnetic surveys have been carried out by the (British Geological Survey) (Cornwell and Cave, in preperation).

GEOLOGY AND MINERALISATION

The rocks, predominantly Ordovician in age with small faulted inliers of Cambrian sedimentary rocks in the west, make up a sedimentary and volcanic succesion some 1.3 km thick, with some contemporaneous intrusions (Figure 2). The rocks were folded and, according to Bevins (1978), metamorphosed to prehnite-pumpellyite facies during the Caledonian orogeny. The area lies close to the Hercynian and the rocks are almost certainly affected by earth movements related to this orogeny. Much of the area is thought to have been glaciated during the Pleistocene.

Stratigraphy

The stratigraphical succession for Ordovician rocks given by Evans (1945) for the eastern half of the area and Lowman and Bloxam (1981) for the western part, is shown in Table 1.

Cambrian

The oldest rocks in the area occur in small faulted inliers in South Fishguard and along the Gwaun Valley. Lowman (1977) correlated them with the Lingula Flags. A larger inlier north of Ysgubor Mountain (SM 965 315) consists of the Llanfair Beds, which are of either Cambrian or Arenig age.

Ordovician: Arenig-Llanvirn

Foel Tyrch Beds

These rocks, not distinguished on Figure 2, are confined to the northeastern end of the Foel Tyrch anticline. They consist, in ascending order, of splintery 'chinastone' ashes, blue-grey and greenish grey slates, and ashy mudstones with interbedded feldspathic sandstones. They resemble the lower Arenig Brunel Beds, which, elsewhere in Pembrokeshire, occur at or near the base of the Ordovician succession Evans (1945) recorded the graptolite *Didymograptus extensus* from the upper part.

Sealyham Beds

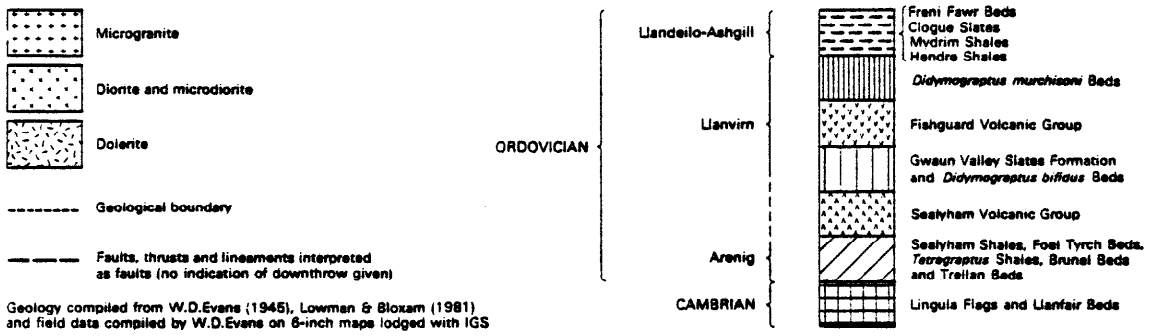
Most of the southern half of the area is underlain by unfossiliferous blue-black slate and cleaved mudstone, which Thomas and Cox (1924) considered were equivalent to the upper part of the *Tetragraptus* Shales. They are most likely to be uppermost Arenig in age. In other parts of the county, the *Tetragraptus* Shales mark a quiescent period between the early Arenig volcanism, represented by the Treffgarne Andesites and the prolific Llanvirn volcanism.

Sealyham Volcanic Group

Several small, generally fault-bounded, areas of volcanic rocks in the southern Preseli Hills were correlated by Evans (1945) with the Sealyham Volcanic Group (Series, in the original publications). The group is no more than 80 m thick and consists of rhyolites and minor tuffs. Part (1922) gave the first descriptions of these rocks, which include perlitic and brecciated soda-rhyolites and soda-trachytes. The volcanic rocks are generally believed to be upper Arenig or lowermost Llanvirn in age, conformably followed by mudstones containing the diagnostic lower Llanvirn graptolite *Didymograptus* bifidus. However, some doubt about this age is indicated by Part (1922) and the rocks may be younger, possibly equivalent to the Fishguard Volcanic Group.

Didymograptus bifidus Beds

The greater part of the Preseli Hills is underlain by blue-black mudstones and slates with thin bands of tuffaceous or tuffitic rocks in a succession likely to be over 300 m thick. Very few fossils have been found in this succession (which is generally attributed to the lower Llanvirn) and only at Carn Meini (SN 142 327) are they undoubtedly of the *bifidus* zone (Evans, 1945). As a result of the doubt about their age, Lowman and Bloxam (1981), preferred to name the formation Gwaun Valley Slates.



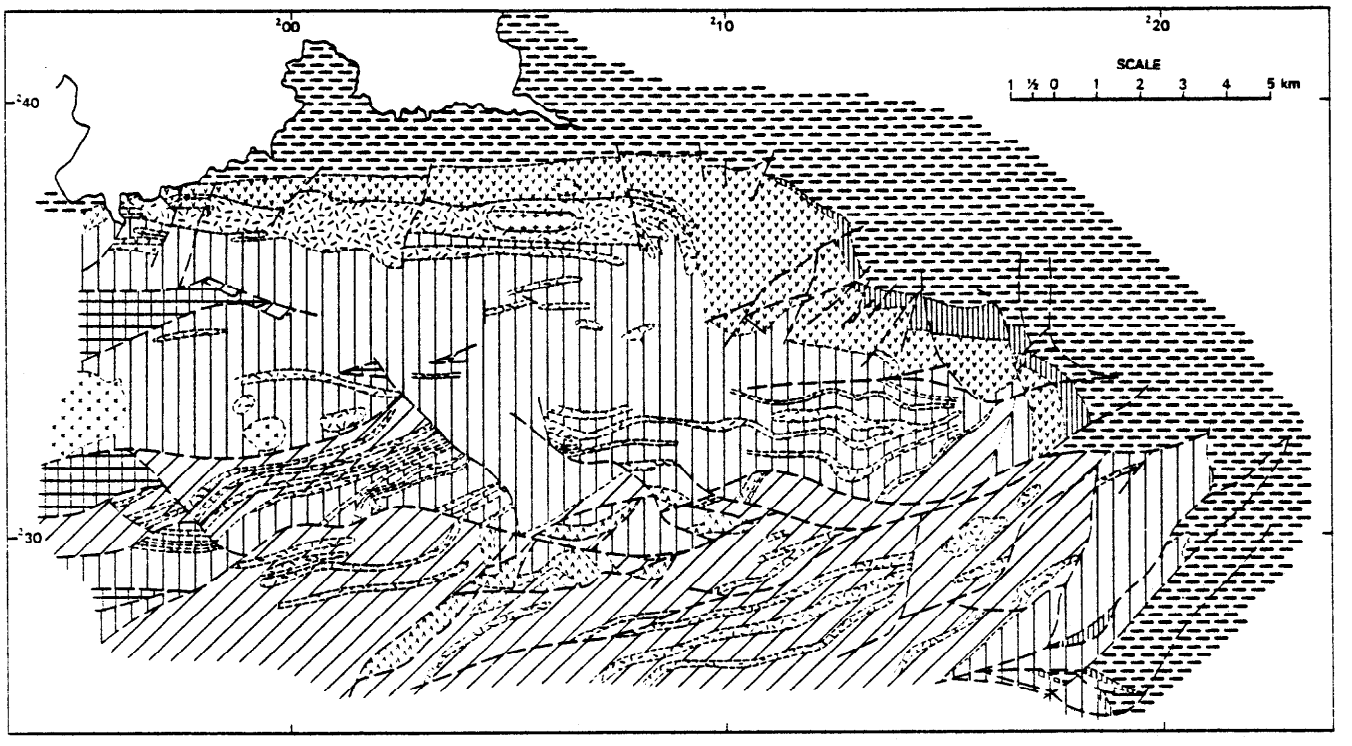


Figure 2 Simplified geological map of the Preseli Hills

Fishguard Volcanic Group

Evans (1945) noted that the D. bifidus Beds thinned eastwards, more than could be accounted for structurally and suggested that the Fishguard Volcanic Group, which follows the D. bifidus Beds, may overlie them, unconformably, here. On the Pen Caer peninsula, however, Cox (1930) and Thomas and Thomas (1956) did not question the conformable nature of the junction. In addition, on the strength of specimens of *D. bifidus* in the shales overlying the volcanic rocks, on the east of Fishguard Harbour, Thomas and Thomas (1956) referred to the volcanic rocks as lower Llanvirn in age. Lowman (1977), however, disputes this, having identified *D. murchisoni* Zone fossils in mudstone within the volcanic group on Castle Point.

The thickest development of this group is on Strumble Head, where about 1.8 km of acid and basic volcanic rocks were divided into three major divisions by Cox (1930) and Thomas and Thomas (1956). East of Fishguard, Lowman and Bloxam (1981) were unable to subdivide the Fishguard Volcanic Group into lithostratigraphic units. The group thins towards the east, being no more than 870 m thick near Newport (Lowman, 1977) and 90 m in the Preseli Hills (Evans, 1945).

Within the group, Lowman and Bloxam (1981) recognised vitric pyroclastic flows, pyroclastic fall deposits, epiclastic deposits, rhyolitic lavas, basaltic pillow lavas and hyaloclastites. The tuffs show evidence for both subaqueous and subaerial eruption and deposition. Acid rocks predominate, the only basic extrusives forming a

Table 1 Ordovician stratigraphy of the Preseli Hills

	Eastern Area	Western Area	Other Areas
Ashgill to Llandeilo	Freni Fawr Bed Glogue Slates Mydrim Shales Hendre Shales	Hendre Shales Castle Point Beds	
	D. murchisoni Beds		
Llanvirn	Fishguard Volcanic Series	Fishguard Volcanic Group	
	D. bifidus Beds	Gwaun Valley Slates	
	Sealyham Volcanic Series		
Arenig	Sealyham Beds		*Tetragraptus* Shales
	Foel Tyrch Beds		Brunel Beds

small outcrop near Carn Gelli (SM 981 376). Alloclastic dykes occur within welded tuff locally. Evans (1945) describes 'ashy' mudstones within the group in the Preseli Hills.

Chemical studies carried out west of the area, indicate tholeiitic affinities for the basic intrusions and lavas. Bevins and Roach (1979a) argue, using only the trace-element chemistry, that the rhyolites on Strumble Head are also tholeiitic. Lowman and Bloxam (1981), on the other hand, claim that the acid rocks are calc-alkaline.

Didymograptus murchisoni Beds

In the Preseli Hills, Evans (1945) described 15 to 25 m of dense black, commonly pyritous, mudstones and shales with upper Llanvirn *D. murchisoni* Zone fossils, overlying the Fishguard Volcanic Group. The uppermost 'ashy' mudstones in the volcanic group pass either conformably or with a minor non-sequence into the black mudstones. The D.murchisoni Beds thin westwards and are overstepped by the Hendre Shales of Llandeilo age, which rest directly on the volcanic group near Dyffryn-benglog farm (approx. SN 107 385). Near Fishguard, Lowman and Bloxam (1981) claim that the Fishguard Volcanic Group itself is upper Llanvirn in age.

Ovdovician: Llandeilo-Ashgill

Calcareous flagstones, the Castle Point Beds, considered to be Llandeilo in age by Cox (1930) and Thomas and Thomas (1956), unconformably overlie the Fishguard Volcanic Group immediately east of Fishguard Harbour. They are followed by the Hendre Shales, some 60 m thick, which Evans (1945) suspected lie unconformably on both the volcanic group and the D. murchisoni Beds. They are monotonous, brown-weathering, blue-grey, slightly calcareous, poorly fossiliferous mudstones and shales.

Rocks of Caradoc and younger age are represented by the Mydrim Shales, Glogue Shales and Freni Fawr Beds in the northeastern and eastern parts of the area. The Mydrim Shales consist of pale-weathering blue-black shales and mudstones, locally fissile and crowded with poorly preserved graptolites. The shales are, according to Evans (1945), from over 50 to 100 m thick and are overlain unconformably by the arenaceous Glogue Slates. The Freni Fawr Beds consist of interbedded turbiditic sandstones and mudstones. A conglomerate consisting of sandstone, mudstone and shale pebbles in a silicified matrix is recorded in the succession at the type locality.

Environment of deposition

Though little is known about the earliest Ordovician rocks in this area, the equivalents of the Foel Tyrch and Brunel Beds elsewhere suggest deposition in shallow, turbulent, littoral or sub-littoral waters. Much of the clastic material in them is of volcanic origin, derived from either the Treffgarne Andesites or earlier volcanic piles.

Deeper water sedimentation began during the Arenig, from which time the predominant lithology was mudstone. A profound change in basinal development took place in late Ordovician times, with the onset of turbidite sedimentation, represented by the Freni Fawr Beds. Until then, several minor unconformities suggest that the volcanic rocks represented by the Sealyham and Fishguard volcanic groups were erupted from a series of volcanic islands. Evidence of subaerial erosion and deposition is present in the Fishguard Volcanic Group.

The age of the Sealyham Volcanic Group , commonly put at Arenig-Llanvirn, is not certain. The presence of *D. murchisoni* Zone fossils, within and above the Fishguard Volcanic Group, indicates that the latest volcanism in the area is of this age. The Fishguard Volcanic Group is thickest on Strumble Head, probably near the centre of the eruption and thins eastwards so that the outcrop in the Preseli Hills is probably part of the lower flanks of the volcano. There is evidence that, west of Newport, the uppermost volcanic rocks have been above sea level. To the southeast of Newport, the volcanic rocks are most likely to have been erupted or deposited below sea level and there are sedimentary intercalations throughout the volcanic group in this area.

Formation of the black, pyritous mudstones of the D. murchisoni Beds may have been enhanced by volcanogenic sulphide emission. They provide the most promising environment for the formation of exhalative sulphide deposits.

Intrusions

Lowman (1977) described intrusions of microgranite near Newport, intruding dolerite associated with the Fishguard Volcanic Group and he notes some microdiorite intrusions emplaced in both the volcanic group and the underlying rocks. Most numerous, however, are dolerite intrusions, mostly forming sills, confined entirely to the lower part of the Fishguard Volcanic Group and formations below it. Evans (1945) describes the dolerites in detail. They are most likely to be products of the Fishguard Volcanic Group magmatism, though Evans (1945) considered them to post-date the main folding.

Structure

The structure of the area has been interpreted by Evans (1945). He described a series of major, broad, east-trending folds called, from north to south, the Nevern Anticline, Brynberian Syncline, and Crug-yr-Hwch and Foel Tyrch anticlines. Minor, in places tight, folds with the same trend are common and the southern half of the area has been further complicated by a series of south or southeasterly directed thrusts. Rocks associated with the thrusts are either intensely sheared or tightly folded.

Glaciation

Pembrokeshire was subjected to glaciation during Pleistocene time, but the effects are not particularly obvious in most areas. The earliest glaciation of the era resulted in Irish Sea ice covering the peninsula, giving rise to the Older Drift (Charlesworth, 1929). The second and last glaciation followed a prolonged periglacial period but left relatively little evidence in the Hills proper; the area being in a marginal position to the main ice sheet. The South Wales End Moraine, thought to mark the limit of the ice, was mapped along the coastal platform by Charlesworth (1929). Local ice-related features are found on the higher ground, and some periglacial deposits are found in the valleys (John, 1972). With the wasting of the ice, large amounts of outwash material were deposited along the northern coastal plateau, and large valleys were cut by subglacial and ice-marginal channels. In the west, the large Gwaun-Jordanston system was originally thought to have been cut by overflow channels (Charlesworth, 1929), but is now thought to have been formed below the ice, indicating that the margin was further south than the 'South Wales End Moraine' (John, 1972).

Mineralisation

Known workings and trials are restricted to the eastern part of the survey area, some seven sites being known. The second most productive metal mine in South Wales was situated at Llanfyrnach in the valley of the Taf (SN 225 316). It had a recorded production of 15 653 tons of lead concentrate, 763 tons of zinc concentrate and profitable amounts of silver, during its operations between the middle of the eighteenth century and 1890 (Hall, 1971). Several veins were worked, all of which cut the black Mydrim Shales; no other rock type being present on the dumps (Evans, 1940). Foster-Smith (1981) states that the gangue minerals were quartz and calcite with galena, sphalerite and pyrite. Evans (1940) also reports the presence of chalcopyrite. In close proximity to the main Llanfyrnach workings are two trials at Llwyn-yr-Hwrdd (SN 225 324) and Llwyncelyn (SN 232 314) which were made to find extensions of the Llanfyrnach veins. These were not successful. At Pont-y-Gafel, on a tributary of the Taf, a level was driven into a quartz vein cutting D. bifidus Beds. Little is known of the object of the working, which was abandoned.

On the northern slopes of the Hills, immediately west of Crymmych, two trials are reported at Llanfair-nant-Gwyn (SN 172 365), tried unsuccessfully for lead ore in the late nineteenth century, and Fron Las (SN 166 340), an unsuccessful trial for copper. At Fron Lwyd (SN 178 339) a small mine was operated from 1864 until 1875, exploiting east-west striking veins containing lead and copper ores. Production here was limited and no traces remain of any of these three workings.

Evans (1938, 1940, 1945) reports sulphide mineralisation at various localities in the black shales and mudstones of the D. bifidus Shales, D. murchisoni Shales and Mydrim Shales as well as tuffs of the Fishguard Volcanic Group. Some localities include pyritised D. bifidus Shales on Carn Goedig and Carn Breseb; tuffs with pyrite in the valley of the Afon Whitehook, in addition to pyritised D. murchisoni Shales at the same locality. This latter lithology is noted as highly pyritised elsewhere (see above).

SAMPLING AND ANALYSIS

Sampling was carried out at a nominal density of one sample site per km^2, but the relative lack of surface drainage in the west of the area reduced the density to as low as 0.7 site per km^2. At each site, a sediment, panned concentrate and water sample were collected.

Sediment samples were collected by wet sieving at site, through 8 mesh and 100 mesh nylon into a pan. The resulting -100 mesh material was allowed to settle during collection of the other samples. Excess water was decanted and the sample bagged in a 'kraft' paper bag which was then air dried. In the laboratory, samples were disaggregated and ground for 30 minutes in a P5 ball grinder. Cu, Pb and Zn were determined by Atomic Absorption Spectrophotometry (AAS), after digestion of a 0.5 g sub-sample in hot concentrated nitric acid for one hour. Other elements were determined by Optical Emmission Spectrography (OES), with the exception of As for which a further subsample was prepared for analysis by X-Ray Fluorescence Spectrometry (XRF), as outlined below. Panned concentrates were obtained by panning approximately 4 kg of -8 mesh stream sediment. They were examined on site for any evidence of mineralisation. In the laboratory, the samples were dried and a 12 g subsample was taken and ground for 6 minutes with 3 g 'Elvacite' binder in a Tema mill prior to pelletising and analysis by XRF for a range of elements.

Ni and Pb in panned concentrate results are enhanced by REE interference when Ce levels are high (>c.3000 ppm). Ba in panned concentrate results are depressed by high levels of Ce.

Water samples were collected in 30 ml polyethylene bottles, acidified in the field with 0.3 ml $HClO_4$ to prevent sorption of metals by the container walls and subsequently analysed by AAS for Cu and Zn.

INTERPRETATION OF RESULTS

All analytical results are given in Appendix 1 and a summary is shown in Table 2. Results less than the detection limit (Table 2) were reported as half that level, and these values were used for statistical analysis. It proved impossible to subdivide sample populations on the basis of background geology because of the rapid alternation of lithotypes within catchments; so for initial statistical interpretation the data were treated as a single population.

For brevity, 'in sediment', 'in panned concentrate' and 'in water' are abbreviated to subscripts s, p and w respectively.

Frequencey distribution

Cumulative frequency probability graphs and histograms were plotted to examine element distributions (Lepeltier, 1969; Parslow, 1974; Sinclair, 1976). Five types were identified:

a) Normal, shown by Fe_S, V_S and B_S.

b) Lognormal, the largest group, consisting of Cu, Zn, Co, Ni, As and Zr in sediment, and Ti, Sn, As, Ca and Ce in panned concentrate. Some of these distributions are only very approximately lognormal. Cu and Zn in sediment could be interpreted as consisting of a lower normal population and an overlapping lognormal population. Ce_p and probably Sn_p populations consist almost entirely of results which would be considered as anomalous in most other parts of Britain. A separate background population probably exists but is ill-defined in the case of Ce_p and truncated in the case of Sn_p.

c) Two overlapping lognormal populations yielding sigmoidal plots on logscale cumulative frequency graphs. Pb, Ba and Mn in sediment and Cu, Mn, Zr and possibly U in panned concentrate are of this type, but the last named is heavily truncated.

d) Two populations consisting of a normally distributed lower population and an upper population of uncertain but probably lognormal form. Zn, Fe, Ba and Ni in panned concentrate are of this type. In the case of Ba, the upper lognormal form is quite clear but the whole disribution is distorted by Ce analytical interference. Cr_s and Sr_p show bi-normal plots, suggesting the presence of two normal populations.

e) Complex. Pb_p shows a complex form which can be interpreted in terms of three overlapping lognormal populations.

The full distributions of Sn, Sb, U and Mo in panned concentrates, Cu and Zn in water and Mo and Sn in stream sediment were indeterminate as a result of heavy truncation (>40% of samples <detection limit). As_p suffers less severely, with 25 % of results below detection limit. All distributions, for example, Cu_p, Sn_p (Figures 5, 11), tend to a normal form below the detection limits. These features have been excluded from the above descriptions, though in many cases they can be used to assess the practical detection limit.

Definition of anomalies

Threshold levels were defined and anomalies subdivided by a combination of cumulative frequency curve analysis and percentile division (Table 3).

For normal and lognormal sample populations, where no distinct population which might be related to mineralisation appeared to be present, a threshold was set at the 95% level for normal distributions and 97.5% level for lognormal forms, equivalent in each case to the mean + 2 standard deviations for a perfect distribution. For variables consisting of two or more sample populations, threshold levels were set where significant deviations

Table 2 Summary of analytical results in ppm for 358 stream sediment, water and panned concentrate samples.

Stream sediments	*Mean*	*Median*	*Standard deviation*	*Maximum*	*Minimum*	*Geometric mean*	*Geo. mean +geo. dev.*	*Geo. mean +2 geo. dev.*	*Detection limit*
Cu	21	20	9	60	5	19	30	46	3
Pb	61	40	260	4700	20	40	68	115	5
Zn	177	150	103	1300	30	158	251	398	5
Ba	676	532	594	5190	197	575	912	1145	100
Fe	46911	45800	11456	91900	13200	45709	58884	75858	5000
Mn	3088	1780	3328	25700	124	1995	5012	12589	50
Co	35	25	32.8	261	<10	25	59	138	10
Ni	45	43	19.8	129	<10	40	66	110	10
V	119	119	35.8	242	14	112	166	245	10
Cr	99	93	35.8	220	21	93	138	204	10
B	74	75	20.7	133	13	71	100	141	5
Zr	344	293	302	4230	117	302	457	692	20
As	17	14	10.5	90	2	15	24	39	1
Mo*	-	<1	-	19	<1	-	-	-	1
Sn*	-	<5	-	106	<5	-	-	-	5
Water									
Cu*	-	<0.01	-	0.13	<0.01	-	-	-	0.01
Zn*	-	<0.01	-	0.18	<0.01	-	-	-	0.01
Panned concentrates									
Cu	40	17	203	3740	<6	18	47	120	6
Pb	168	42	1178	21884	<13	51	151	447	13
Zn	189	146	531	9915	24	141	257	468	3
Ba	349	242	827	14200	<27	145	646	2884	27
Fe	74401	72420	29297	234530	13690	69183	104713	158489	-
Mn	2629	1240	3258	18840	210	1514	4169	11482	6
Ti	29488	18000	34902	241000	2310	17783	147863	128825	-
Ni	39	39	17.5	103	<5	35	60	105	5
Sn	61	12	173	2455	<9	18	72	295	9
As	6	5	6.4	66	<2	4	11	26	2
Ca	5910	3640	6640	44840	200	3311	10233	31623	-
Ce	5727	1231	11774	84500	37	1259	7762	47863	21
Sb*	-	<11	-	111	<11	-	-	-	11
Sr	101	90	44.7	300	<1	89	155	269	1
Zr	425	280	408	4270	90	339	631	1175	2
U*	-	<2	-	100	<2	-	-	-	2
Mo*	-	<2	-	19	<2	-	-	-	2

All results less than detection limits are set to half that value.

* Variables in which >50 per cent of values are below detection limit.

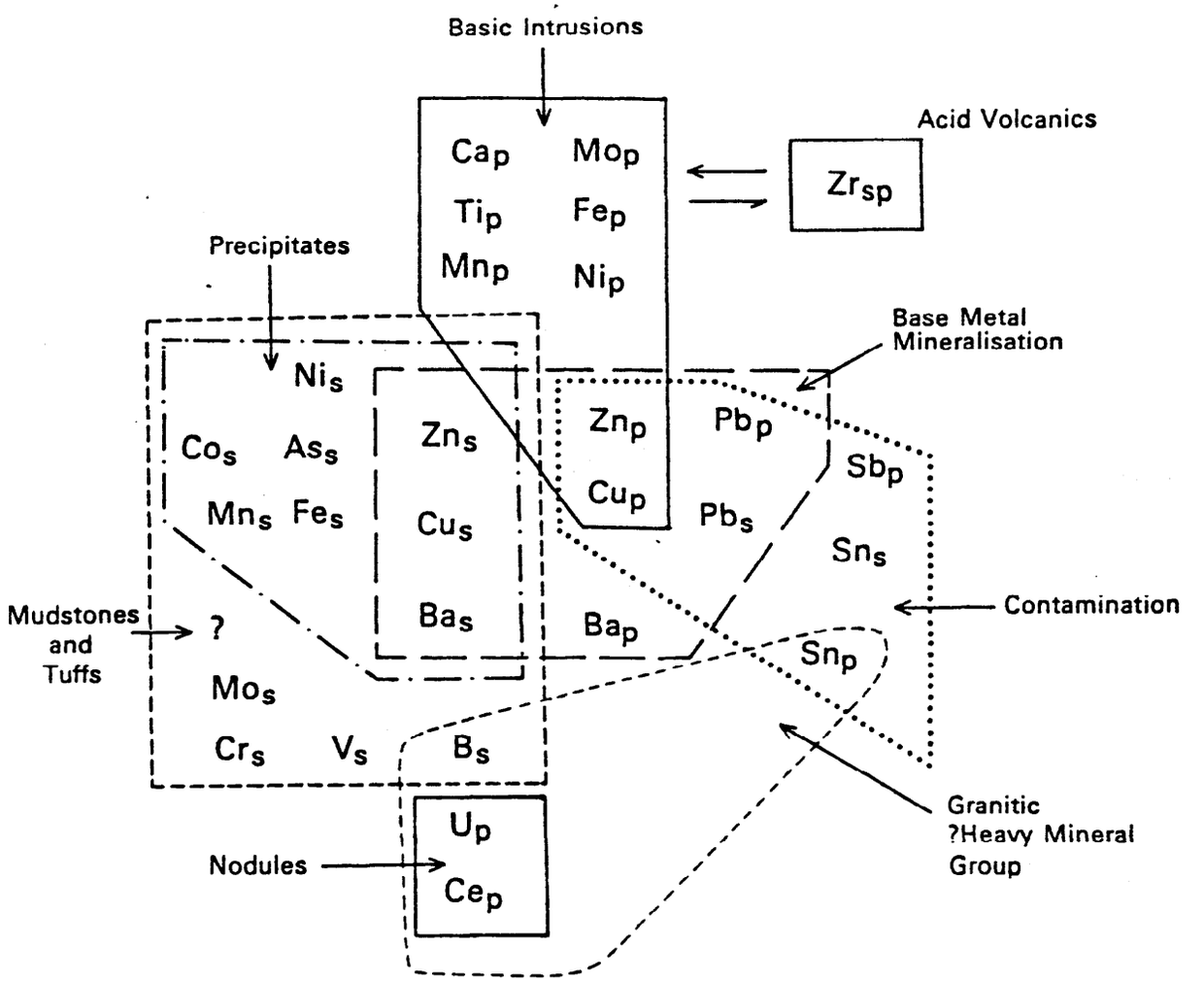


Figure 3 Diagrammatic summary of most highly significant inter-element associations

from the background population ocurred on the cumulative frequency plot (Sinclair, 1976). The higher sample population (defined as anomalous) contains a proportion of the background population, particularly close to threshold, but few samples belonging to the upper anomalous population will escape identification. Threshold levels set on this criterion are underlined in Table 3. Sn in panned concentrates and sediments were treated as special cases because of their role as indicators of contamination: all results above the detection limits, which coincided approximately with the maximum background levels likely to be encountered in common rocks, were taken as anomalous. All Ce in panned concentrate results except the lowest 5%, were regarded as anomalous: there is a clear inflexion point on the log-scale plot at this level and the upper population values would be considered anomalous in other comparable areas, such as Anglesey (Cooper and others, 1982).

Above the threshold level, anomalies were divided into classes based on the 90, 95, 97.5 and 99 percentile levels (Table 3), which were used in plotting anomaly maps for certain elements (Figures 4-12).

Mineralogical examination of panned concentrates

Fifty nine anomalous panned concentrates were selected for detailed examination in an attempt to identify mineral phases responsible for high metal levels and thereby indicate the most likely causes of anomalies. After removal of the ferromagnetic fraction, the 3.3 sink fraction was sieved and the 30-60 mesh subsample separated into fractions according to magnetic susceptibility. Each fraction was examined microscopically and where necessary, by XRF and X-ray diffraction (XRD) to aid identification of natural and artificial phases responsible for metal anomalies.

Major sources of Element Variation

Inter-element relationships were investigated using a variety of multivariate statistical methods and spatial distribution plots.

Gross variations of the data across the area were studied using greyscale maps (Appendix 2). Each symbol on these maps represents the mean value over nine cells, each cell being 0.15 km^2. The classes represented by the symbols were normally constructed on the basis of the (0, 30, 50, 70 and 90 percentile levels. Bearing in mind their limitations, these maps fulfill the purpose of drawing attention to relatively large areas characterised by particular levels of a given element.

Elements whose distributions approximated to log-normal form and others whose skewness was reduced by the process, were log-transformed prior to applying parametric statistical methods. Following the removal of highly truncated and suspect variables and setting very high significance levels,sensible results were obtained from multivariate statistical analysis despite the theoretically unsound database, so these were used with caution in the overall interpretation.

The following major sources of element variation, in the data set were identified by a combination of statistical analyses, mineralogical examination of the panned concentrates and spatial distribution plots (Appendix 2)

Copper in Stream Sediment.

< 43 ppm

43-48 ppm

≥ 49 ppm

KEY

Major roads

Disused railway

Railway

Sample site

Old mine or trial

Marsh

Hill-top

Cumulative Frequency Plot

ppm Cu

Probability

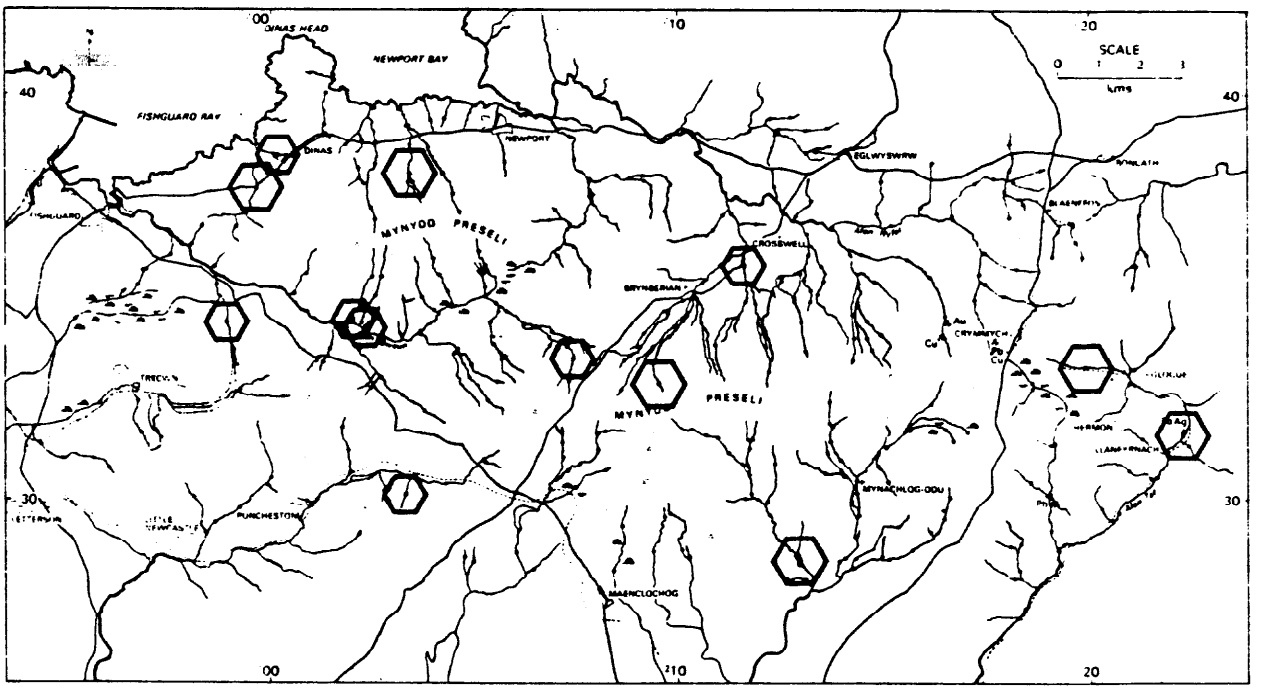


Figure 4 Copper in stream sediment

Copper in Panned Concentrate.

< 50 ppm

50-100 ppm

101-170 ppm

171-354 ppm

≥355 ppm

KEY

Major roads

Disused railway

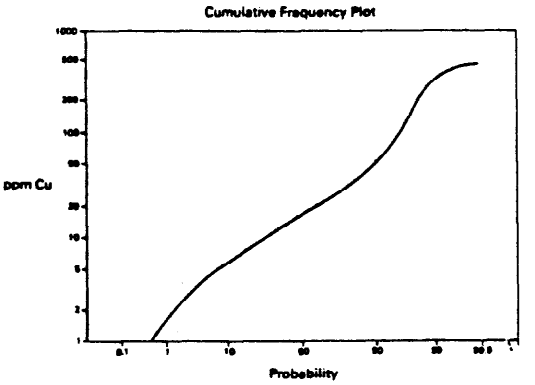
Railway

Sample site

Old mine or trial

Marsh

Hill-top



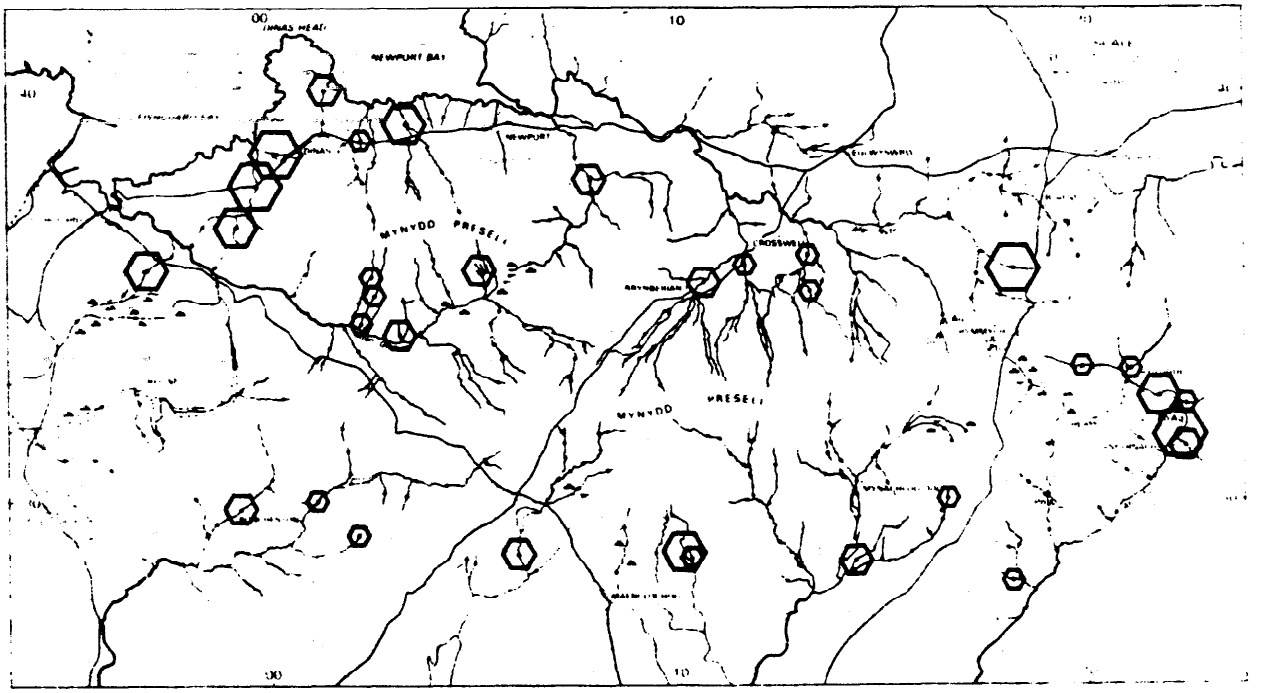


Figure 5 Copper in panned concentrate

Table 3 Threshold levels and class intervals for anomalous results, in ppm.

	Percentile level				
	<90%	90%	95%	97.5%	99%
Sediments					
Cu	26	31	36	43	49
Pb		51	71	111	625
Zn	150	271	341	371	481
Ba		901	1400	3100	3500
Fe			67950	72850	76850
Mn	1300	6900	9500	13250	15400
Co				118	140
Ni				90	110
V			175	194	203
Cr	102	150	169	181	192
B			106.5	114	120.5
Zr				810	950
As				45	60
Mo				4.75	7.15
Sn	5.6	13.5	21.5	28	41
Water					
Cu				0.015	0.025
Zn				0.035	0.085
Panned concentrates					
Cu		50 (91%)	101	171	355
Pb	90 (80%)	201	401	951	1201
Zn		250 (92.5%)	302	441	615
Ba			750 (95.5%)	1100	2400
Fe				130000	160000
Mn	735	6350	8990	13550	16650
Ti				130000	170000
Ni			67	79.5	90
Sn	9.5	139	255	435	620
As				20.5	30.5
Ca				24200	33100
Ce	70 (5%)	17000	28500	40000	64000
Sb				12.5	18
Sr	131	151	181	211	221
Zr	331 (60%)	761	1061	1701	2201
U				45	65
Mo				6.5	10.5

related to geological, topographical and agricultural features. A summary diagram of inter-element associations is shown in Figure 3; this is based on the cluster and factor analysis and correlation matrix.

Hydrous oxide precipitates

Some metals, soluble in the acid groundwater of the peaty upland areas, are much less soluble in the more oxygenated and less acidic conditions which prevail in the surface streams and groundwater at lower altitudes. This results mainly in the formation of hydrous manganese and iron oxide precipitates although other metals may also precipitate out or be scavenged by precipitates (Nowlan, 1976; Reedman, 1979). The process is illustrated by the formation of Fe and Mn rich coatings on pebbles in upland streams. Although mainly affecting sediment results, panned concentrates may be affected where coatings are not removed during the rubbing and sieving process. Known geochemical behaviour, strong inter-element associations, a contrast between sediment and concentrate sample results and a correlation of high results with peaty uplands and their margins rather than geology, indicates that the elements affected in this area are Fe, Mn, Co, As, Zn and Ni in sediment and that Mn, Ni and Fe in panned concentrate also form part of this association. Elements involved in this process form a clear group in R-mode cluster and factor analysis models of the data and show a negative relationship to Zr_S because of contrasting modes of occurrence and concentration in the primary and secondary environments.

Contamination

The mineralogical examination of panned concentrates showed tin to be present both as cassiterite and as artificial phases. The amounts of cassiterite found were, however, very small (one or two grains) and all large tin anomalies were caused by contaminants such as tin cans and solder. It was concluded therefore that, with caution, the tin content of samples could be employed as an indicator of contamination in this area. Lead was found also to be present both in contaminants (mostly yellow or brownish glass) and in the form of galena, both phases being present together in some samples. High antimony levels correlated very closely with high levels of lead in contaminated samples and as no natural antimony source was identified, antimony could be regarded as an indicator of contamination in this area.

Wire containing copper and zinc was seen in many panned concentrates. Since tin, copper, lead and zinc

occurred in both natural and artifical phases, a clearly defined group of elements indicating the presence of contamination could not be defined by multivariate statistical methods. Mineralogical examination was the only effective means of discriminating between metal anomalies related to contaminants and those related to mineralisation.

Base metal mineralisation
Multivariate statistical methods were also relatively inneffective in delineating any mineralisation in this area. This is a result of the elements involved having other sources of variation which accounted for a larger proportion of that variance. In addition, Ba_p results, often useful indicators of mineralisation, were variably depressed by Ce interference, making any meaningful associations with other elements. Consequently R-mode cluster and factor analysis models yield a grouping of metals (Pb_s, Pb_p, Cu_p, Zn_p, Sn_p, As_p), due to both mineralisation and contamination.

The lack of a distinct factor identifiable with mineralisation suggests that it is of minor significance in terms of geochemical variation in this area. Site inspection and mineralogical examination were the main tools used for distinguishing anomalies caused by mineralisation. Mineral examination identified chalcopyrite in the panned concentrate from one site and gold in another. In addition, gold was noted during the on-site examination of another panned concentrate.

Monazite
Exceptionally high Ce values were found in panned concentrates over much of the area, and mineralogical examination showed this to be due to the presence of monazite nodules in the concentrates. Research in other parts of Wales suggests that there is no single source for the nodules, that they occur dispersed through a great thickness of Ordovician and Silurian sedimentary rocks deposited in the Welsh Basin and that they have a pre-metamorphic origin (Cooper, Basham and Smith, 1983). The source rocks in Central Wales show Ce levels indistinguishable from typical background levels in similiar lithologies. Separation from these rocks showed the presence of 400-600 nodules in each 15 kg sample, roughly equivalent to 18-27 ppm Ce in a whole rock analysis (Read, in prep). The high levels in the concentrates are a product of upgrading by the present weathering cycle and the sampling process. Detailed work on the origin of the nodules will be reported elsewhere (Cooper, Basham and Smith, 1983; Read, in preparation).

U_p anomalies are also related to high concentrations of monazite in panned concentrates. The presence of U and Th in nodules was confirmed by XRF analysis during mineralogical examination. The highly negative correlation of Ce_p with Ba_p is the product of analytical interference.

Lithology
Some of the rock groups outcropping in the area provide distinct geochemical signatures and give rise to anomalous levels of some elements.

Dolerites intruded into the Lower Llanvirn
These rocks give rise to high Ti_p values, associated with Mn_p, Ni_p, Fe_p, Ca_p and, locally, Mo_p, due to the presence of abundant Fe-Ti oxides and silicate phases typically concentrated in basic rocks. These rocks also provide a source of metals which are subject to hydrous oxide precipitation processes, variables such as Mo_p, Zn_p, Co_s and Ni_s. They generate very strong features on geochemical maps, due to their presence in peaty uplands and areas of active weathering.

Mudstones, shales and tuffs of Arenig and Llanvirn age
High levels of Cr_s, V_s, Fe_s, Ni_s, Co_s, As_s, B_s, Mo_s, Zn_s, Ti_p and Cu_s are characteristic. They strongly reflect the amount of shales and mudstones in the catchments. Some local subdivisions are evident: high levels of Ba_s, are a prominent feature of the *D. murchisoni* mudstones and high levels of Cr and V are associated with the Sealyham Volcanics. High Ba_p levels, accompanied locally by V and Cr, are a feature of the Foel Tyrch Beds. Again, these lithologies provide a source of metals subject to hydrous oxide precipitation processes. Poor exposure and limited outcrop reduce the impact of lithologies such as the D. murchisoni Beds.

Fishguard Volcanic Group
Zr values are high over most of the outcrop, whilst spatial distribution plots (Appendix 2) of Ti_p, Ni_p and B_s show clearly defined zones of low values, reflecting the predominance of acid volcanics in the succession.

Llandeilo-Ashgill succession
These rocks display high levels of B_s, Ce_p, U_p and erratically Zr_s and Mo_s. Low levels of Ti_p, Mn_p and Fe_p are also seen. There are high values for a range of elements along the outcrop of the Hendre and Mydrim shales of the Taf valley which may originate from these lithologies or from associated mineralisation. Elements affected are: Cu_p, Pb_{sp}, Zn_{sp}, Ba_{sp}, B_s, Ni_p, As_{sp}, Mo_{sp}, Ce_p, Sr_p, Zr_p and U_p.

Assessment of anomalous results
The survey area is divided into ten sub-areas on the basis of overall geochemical similarity and catchment boundaries (Figure 13). Anomalous results and geochemical features in each sub-area are briefly discussed.

Afon Taf, Afon Gafel
The catchment of the Taf contains Llanfyrnach silver-lead mine, which worked galena and sphalerite in a gangue of calcite and quartz (Foster-Smith, 1981) Spatial distribution maps of several elements (Cu_s, Pb_s, Zn_s, Mo_s, As_s, B_s, Cu_p, Pb_p, Zn_p, Ba_p, Ni_p, Mo_p, As_p, Sn_p, Sr_p), indicate a broad zone of anomalies which cannot be solely accounted for by dispersion from the worked mineralisation. In addition, Ce_p, Zr_{sp} and U_p values are high over this area as well as the remainder of the Llandeilo-Ashgill Series. The mine dumps are situated on the west bank of the Taf and contribute material to the river, giving rise to Pb and Zn anomalies downstream. Apart from this obvious source, there are other Pb and Zn anomalies on the Taf and its tributaries. Above the mine workings some anomalies, e.g. at SN 2196 3250 (no. 184), may be partly due to observable contamination, but galena was recorded in the panned concentrate at SN 2260 3229 (no. 129), suggesting the presence of further base metal mineralisation. Ba_{sp} is also high and baryte is recorded in several panned concentrates, e.g. SN 2164 3043 (no. 130), SN 2254 3128 (no. 131) and, possibly, SN 2005 3318 (no. 116). In other anomalous samples, Ba_s is usually greater than Ba_p, suggesting another source for the barium, such as feldspar or muscovite, but analytical interference from Ce suppressing Bap could also be the cause. For example, at SN 2254 3128 (no. 131), baryte was found during examination of the panned concentrate even though Bap was reported below the detection limit (Ce 54000 ppm). Thus baryte may not be revealed as anomalous Ba levels in pan concentrates when Ce is very high. There are probably at least two sources of the barium anomalies, firstly, baryte associated with Pb mineralisation and, secondly, feldspar or muscovite from the Hendre and Mydrim Shales. As far as is known, baryte mineralistion has not previously been recorded in this area.

Table 4 Summary of highly significant inter-element correlations (Pearson method)

	Correlation coefficients significant at 99.95% confidence level					
	0.19–0.29	0.30–0.39	0.40–0.49	0.50–0.59	0.60–0.69	>0.70
Stream sediments (s)						
Cu	As_s Sn_s Sn_p Mo_p $-Zr_s$ As_p B_s Zn_s Zr_p	Pb_s Fe_s Mn_s Co_s Pb_p Mn_p	Zn_p Fe_p Ni_p	Ni_s Cu_p		
Pb	Ni_p As_p Mo_p	Cu_s Sn_s Cu_p Sb_p Sn_p	Zn_s Ba_s As_s Mo_s Zn_p	Pb_p		
Zn	Cu_s Ba_s V_s $-Zr_s$ Pb_p Ba_p Fe_p Ti_p Ni_p As_p Sr_p	Mn_p Ca_p	Pb_s Ni_s As_s	Fe_s Mn_s Co_s Zn_p		
Ba	Zn_s B_s As_s As_p Sr_p $-Zr_p$	Pb_p Zn_p Ba_p	Pb_s Mo_s			
Fe	Sr_p $-Zr_p$	Cu_s Cr_s Ti_p	Zn_p Fe_p Ni_p	Zn_s $-Zr_s$ As_s	Mn_s V_s	Co_s Ni_s
Mn	V_s Ni_p $-Zr_p$	Cu_p Zn_p Fe_p Ti_p	$-Zr_s$	Zn_s Ni_s As_s Mn_p	Fe_s	Co_s
Co	Sn_p $-Zr_p$	Cu_s Cr_s Ti_p	V_s Zn_p Fe_p Ni_p	Zn_s $-Zr_s$ As_s Mn_p		Fe_s Mn_s Ni_s
Ni	Cu_p Ti_p	$-Zr_p$	Zn_s B_s As_s Zn_p Fe_p Mn_p	Cu_s Mn_s Cr_s $-Zr_p$ Ni_p	V_s	Co_s Fe_s
V	Zn_s Mn_s Mo_s Sn_s Zn_p Mn_p Ti_p $-Zr_s$	Cu_s B_s $-Zr_s$ As_s Fe_p Ni_p	Co_s	Cr_s	Fe_s Ni_s	
Cr	As_s $-Zn_w$	Fe_s Co_s B_s Mo_s Ni_p		Ni_s V_s		
B	Cu_s Ba_s	V_s Cr_s $-Zr_s$ Ni_p $-Ca_p$ Ce_p $-Zr_p$ U_p	Ni_s			
Zr	$-Cu_s$ $-Zn_s$ $-As_s$ $-Cu_p$ $-Ba_p$ $-Mo_p$	$-V_s$ $-B_s$ $-Ti_p$ Zr_p	$-Mn_p$ $-Zn_p$ $-Fe_p$ $-Mn_p$ $-Ni_p$	$-Fe_s$ $-Co_s$ $-Ni_s$		
As	Cu_s Ba_s Cr_s $-Zr_s$ $-Zn_w$	Pb_s V_s Mo_s Zn_p Ni_p As_p	Zn_s Ni_s	Fe_s Mn_s Co_s		
Mo	V_s $-Zn_w$ $-Mn_p$ $-Ti_p$	Pb_s Cr_s As_s	Ba_s			
Sn	Cu_s Cu_p	Pb_s	Pb_s Sn_p			
Waters (w)						
Cu		Zn_w				
Zn	$-Cr_s$ $-As_s$ $-Mo_s$	Cu_w				
Panned concentrates (p)						
Cu	Ni_s $-Zr_s$ Sn_s Mn_p Sn_p As_p Sb_p Mo_p	Pb_s	Pb_p Zn_p Fe_p Ni_p	Cu_s		
Pb	Zn_p Ba_p Mo_p	Cu_s Ba_s As_p	Sn_s Zn_p Cu_p Sb_p	Pb_s Sn_p		
Zn	As_p Sb_p Sr_p V_s	Ba_s Mn_s Ti_p Mo_p	Cu_s Pb_s Ba_p Fe_s Co_s Ni_s Cu_p Pb_p $-Zr_s$ Mn_p	Ni_p		
Be	Zn_s Fe_s $-Zr_s$ Pb_p Fe_p $-Sn_p$	Ba_s	Zn_p	$-U_p$	$-Ce_p$	
Fe	Zn_s Ba_p Asp Ca_p $-U_p$	Mn_s V_s Ni_p $-Ce_p$	Cu_s Fe_s Co_s Ni_s Cu_p $-Zr_s$	Mo_p	Zn_p Ti_p	Mn_p
Mn	V_s $-Mo_s$ Cu_p Ni_p	Cu_s Zn_s Ca_p	Fe_s Ni_s $-Zr_s$ Zn_p	Mn_s Co_s Mo_p		Fe_p Ti_p
Ti	Zn_s Ni_s V_s $-Mo_s$ $-Snp$ $-Ca_p$	Fe_s Mn_s Co_s $-Zr_s$ $-Zn_p$ $-U_p$	Mo_p	Ca_p	Fe_p	Mn_p
Ni	Pb_s Zn_s Mn_s Mn_p Ce_p $-Zr_p$	V_s Cr_s B_s As_s Fe_p Sr_p U_p	Cu_s Fe_s Co_s $-Zr_s$ Cu_p	Ni_s Zn_p		
Sn	Cu_s $-Co_s$ Cu_p $-Ba_p$ $-Ti_p$ U_p $-Fe_s$	Pb_s Ce_p	$Sn_s Pb_p$			
As	Cu_s Pb_s Zn_s Ba_s Cu_p Zn_p Fe_p	As_s Pb_p				
Ca	Fe_s $-Ce_p$ Fe_s	Zn_s $-B_s$ Mn_p Sr_p $-U_p$		Ti_p		
Ce	$-Ti_p$ Ni_p $-Ca_p$	B_s $-Fe_s$ Sn_p				
Sb	Cu_p Zn_p	Pb_s	Pb_p			
Sr	Zn_s Ba_s Fe_s Zn_s	Ni_p Ca_p				
Zr	$-Cu_s$ Ba_s $-Fe_s$ $-Mn_s$ $-Co_s$ $-V_s$ $-Ni_p$	$-Ni_s$ $-B_s$ Zr_s				
U	$-Fe_p$ $-Mn_p$ Sn_p	B_s Ti_p Ni_p $-Ce_p$		$-Ba_p$		Ce_p
Mo	Cu_s Pb_s $-Zr_s$ Cu_p Pb_p	Zn_s	Ti_p	Fe_p Mn_p		

Copper values in sediment and panned concentrate are anomalous at sites SN 2005 3318 (no. 116), SN 2244 3155 (no. 120) and panned concentrate anomalies, additionally, at others, for example, SN 2260 3229 (no. 129), SN 2196 3250 (no. 184), SN 2044 2967 (no. 132). The source of these copper anomalies is unclear, though they are in part due to contaminants, such as copper wire, found in the sample from SN 2196 3250.

Another source is the lead zinc mineralisation, Evans (1940) recording chalcopyrite on the dumps. No chalopyrite was noted during the working of the mine (Foster-Smith, 1981).

High levels of As_{sp}, Mo_{sp}, Zr_{sp}, Ce_p, U_p, B_s and Ni_{sp} are also found in this area, the zone of high Mop being particularly prominent on greyscale maps (Appendix 2). At SN 1872 3280 (no. 135), the presence of cassiterite indicates that not all high Sn values were due to contamination and that Sn_{sp}, Zr_{sp}, Ce_p, U_p and B_s highs may reflect a granitic heavy mineral association, particularly as zircon was noted in the mineral examination of some of the panned concentrates, e.g. SN 1834 2798 (no. 144). There is, however, no known local source for such an assemblage.

To summarise, anomalies can be attributed to three sources besides contamination: vein mineralisation, dark shales and granitic heavy minerals of unknown provenance.

Brynberian to Crymmych

This area consists of the catchments of the Afon Whitehook (or Bannon), Afon Clyn-maen, Afon Brynberian and southern Afon Nyfer (or Nevern). These drain northwards off rocks of the Fishguard Volcanic Group, overlain by D. murchisoni Shales, in turn, overstepped by Hendre shales. The area is characterised by Ba_s anomalies in the east and scattered base metal anomalies elsewhere. The spatial distribution of Ba_s anomalies clearly indicates that they are nearly all derived from the D. murchisoni Beds. High and anomalous levels of Basp are recorded from sites downstream of Fron-las (SN 1660 3447, no. 152; SN 1614 3546, no. 353) and Fron-lwyd (SN 1730 3482, no. 110) and baryte was identified in the pan at SN 1660 3447 (no. 152). This suggests some barium mineralisation in the vicinity, perhaps accompanying the weak base metal and possible gold mineralisation tried at these localities. The presence at SN 1730 3482 (no. 110), of As_p and Mo_s anomalies gives support to the possibility of a dark shale-associated gold enrichment in this area.

Base metal anomalies (Pb_s, Zn_p) are recorded downstream of the Fron-las trials, but with the exception of possible galena at SN 1456 3596 (no. 137), mineralogical examination suggested that the anomalies were mainly caused by contaminants. Where examined mineralogically, base metal anomalies from elsewhere in the area were found to be principally due to contamination.

Pyrite was commonly reported, the sources lying in the volcanics and the dark mudstones (SN 1167 3574 (no. 326); SN 1312 3534 (no. 236). The Pb_p anomaly at SN 1130 3584 (no. 317) probably results from Pb occurring as a minor constituent of rocks forming minerals and weak Pb_s anomalies along the Afon Whitehook are probably derived from D. murchisoni Beds.

High Sr_p levels are found in three samples draining the upper reaches of the Afon Clyn-maen (SN 1434 3334, no. 222; SN 1434 3387, no. 223; SN 1430 3445, no. 224). Ca_p values are moderate, and no obvious local source for the Sr can be seen.

The volcanics outcropping here are characterised by high Zr and low Ti_p, Ni_p and Bs levels which separate them quite distinctly from the overlying mudstones and basic intrusions on the greyscale maps (Appendix 2).

The rocks in this area are believed to have formed in an environment which was suitable for the formation of volcanogenic mineral deposits. A gravity low is centred on the area to the west of Crosswell, over the volcanics (Cornwell and Cave, in preparation) which might represent a buried intrusion or feeder to the volcanics. The D. murchisoni Beds are of limited extent here and consist of pyritiferous dark shales and mudstones, suggestive of formation in a sulphurous basin on the flanks of the 'Fishguard Volcano'. On theroretical grounds, three styles of mineralisation may exist in the area: massive sulphide deposits, 'fine' gold, and vein Au and sulphides. The latter may be derived from the remobilisation of metals in the mudstones, perhaps driven by any of the intrusives, or, alternatively, they may be derived from the intrusives themselves. Although the drainage results are inconclusive, they indicate the presence of some metalliferous enrichments and further work is being carried out to investigate them.

Eglwyswrw to the Freni-fawr area

The catchments of the Nant Gafren, the northern tributaries of the Afon Nyfer and the western Afon Dulas cover the Llandeilo-Ashgill succession and contain very few anomalies unrelated to widespread contamination or monazite nodules. The area is characterised on the greyscale maps (Appendix 2), by high values of Ce, U, Ni and B and moderately high levels of Zr, Ce and U. Ce and U levels are closely correlated and relate to monazite. Some high Ni values are generated by REE interference, though some may be enhanced by a high natural background in the shales. Bs anomalies (Figure 12) show no relation to any particular lithology and it is not known if they represent a shale or granite heavy mineral association.

The most prominent base metal anomaly is at SN 1837 3560 (no. 238), where Cu_p is accompanied by anomalous Zn_w, B_s and Ce_p. Pyrite is present, but mineralogical examination failed to identify the mineral phase responsible for the copper. The site lies downstream of a main road and disused railway, but no contamination was recorded. Prominent Pb_s and Pb_p anomalies at SN 1815 3677 (no. 251) and SN 1340 3849 (no. 306) are shown by mineralogical examination to be caused by contaminants, mainly lead glass. High levels of Sn_p are also found at these sites and are probably due mainly to contamination although, at the latter site, rutile bearing tin was noted during the mineralogical examination. The scattered, weak Pb_p anomalies elsewhere in the area are due to monazite nodules. A weak Cu_w anomaly (0.02 ppm) is located at SN 1800 3492 (no. 237) but its cause is uncertain, although this site is downstream of the main A478. A site anomalous for As_s and with a high level of Co_s is located at SN 2116 3513, (no. 181) on the southern slopes of the Freni-fawr. The stream is a first order tributary of the Afon Dulas and the As levels are not high (As_s 55 ppm: As_p below detection limit), suggesting that hydromorphic processes are the most likely cause of the anomaly.

Eastern Cleddau, Afon Cewgyll and Afon Wern

Many anomalies in this catchment are the result of hydrous oxide precipitation. Relatively high Fe_s and Mn_s values occur over the area (Appendix 2). Locally high and anomalous levels of Co_s, As_s, Zn_{sp}, Ni_p, Cu_w and Zn_w are also recorded, e.g. at SN 1378 3177 (no. 234). These are most prominently developed in the first order streams which drain the dolerite intrusions.

The U high at SN 1404 3086 (no. 235) is due to the presence of monazite. The weak Ba_p anomaly (888 ppm) at SN 1530 3041 (no. 402) is in an area of high Ba_p results and is probably derived from feldspathic ashy mudstones of Ashgill age on Foel Drych (Evans, 1945). Large Cu_{sp}, Pb_{sp} and Zn_p anomalies are caused by

Lead in Stream Sediment.

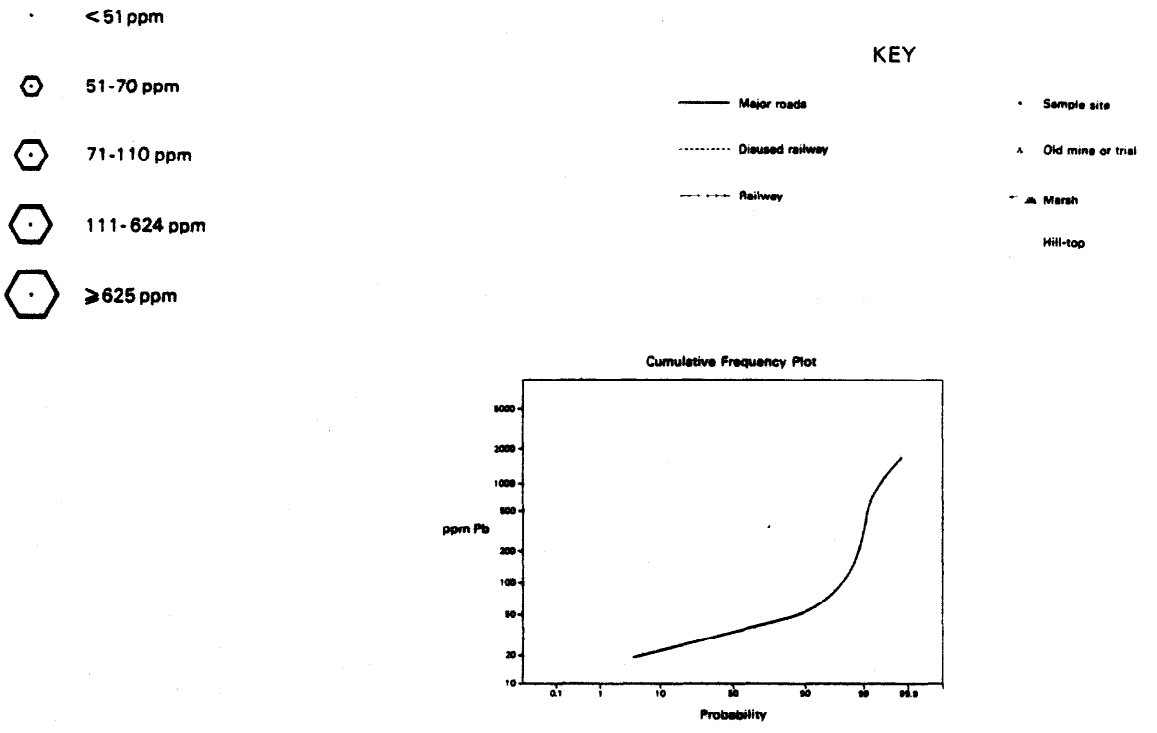


Figure 6 Lead in stream sediment

Lead in Panned Concentrate.

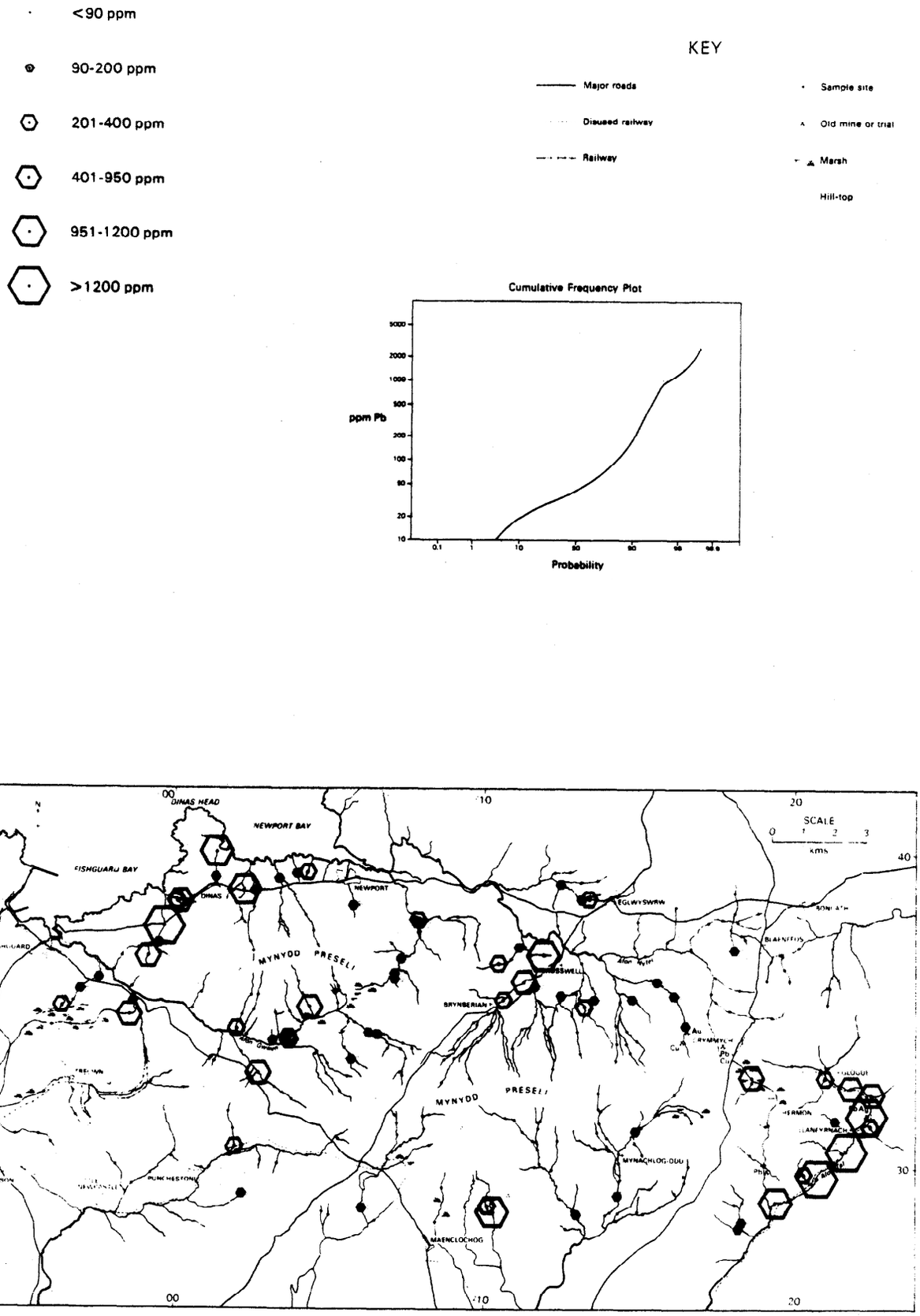


Figure 7 Lead in panned concentrate

contamination, e.g. at SN 1441 2842 (no. 362), SN 1034 2853 (no. 363) and SN 1018 2862 (no. 364). Weak Pb_s anomalies, for example 70 ppm at SN 1445 3036 (no. 260), are possibly the result of hydromorphic processes, where Pb is fixed by organic matter. Isolated high values of V_s (242 ppm; SN 1254 2891 (no. 242)) and B_s (Figure 12) also occur in these catchments but no obvious source, other than the shales, can be identified.

The streams to the north of Maenclochog have only artificial anomalies, Cu_{sp}, Pb_{sp} and Sb_p, all being ascribed to observed contamination.

Mynnydd Cilciffeth, Gwaun Valley and Carningli

Sediment geochemistry in this area is dominated by high levels of transition metals derived from dolerite intrusions. Very high levels of Mn, Fe and Ti in panned concentrate were shown by mineralogical examination to be caused by abundant ilmenite and magnetite. Locally associated high levels of Mo_p, Ni_p and Ca_p are derived from the same lithology. High Mo, in particular, is associated with the intrusion at Mynnydd Cilciffeth, molybdenum probably being present in magnetite. Some of the most anomalous sites are:

SN 0132 3328 (no. 420), Ti 22%, Mn 1.8%;

SN 0254 3275 (no. 399), Ti 24%, Fe 16%, Mn 1.8%, Mo 11 ppm;

SN 0254 3541 (no. 408), Ti 11%, Fe 23%;

SN 0247 3283 (no. 398), Ti 14%, Fe 13%;

SN 0122 3335 (no. 422), Ti 21%, Fe 16%;

It is unlikely that these values reflect metalliferous concentrations of importance, particularly as levels of the more valuable metals are generally low (Ni_p <100 ppm, Cr_s <150 ppm, V_s <200 ppm).

Hydormorphic processes contribute to or cause some Zn_s and Fe_s anomalies over high ground e.g. SN 0744 3290 (No. 273). The highest Mn_s levels are located on lower ground, e.g. SN 0410 3452 (no. 340) and SN 0222 3358 (no. 419). Ni_s, Cr_s and V_s show iregular distribution patterns (Appendix 2) with locally high values, for example Cr_s at SN 0588 3454 (no. 288) and high levels of Ni_s, influenced by secondary processes, accompanying Mn_s at SN 0410 3452 (no. 340). A very prominent zone of high Cu_w and Zn_w results characterises sites draining the southern slopes of Carningli, for example at SN 0518 3606 (no. 436), where Zn_w and Cu_w values of 0.08 ppm and 0.03 ppm, respectively, were recorded. The source of the high values is unknown, dolerite intrusions on high ground elsewhere failing to generate such anomalies. There may be a relationship with some other related factor such as the presence of sulphides in or marginal to the intrusions.

Many base-metal anomalies are caused by contamination due to the proximity of farm buildings and roads to the sample sites. Lead glass, found in samples at SN 0218 3430 (no. 426) and SN 0660 3416 (no. 265) is the commonest cause of Pb_p anomalies. Contamination was noted at SN 0629 3422 (no. 266) and SN 0577 3338 (no. 285) but the source for the Pb_p at SN 0444 3499 (no. 327) remains in doubt; mineralogical examination identified lead secondary minerals of uncertain origin and no contamination was recorded at site. No contamination was seen at the sites with Sb_p anomalies (SN 0223 3479 no. 406 and SN 0218 3430 no. 426) but it is likely that they are also derived from unseen contaminants. Pb_s anomalies are weak (<70 ppm) and are considered to be caused by contamination and organo-metallic complexing.

Most Cu_p anomalies are likely to be caused by small amounts of Cu in ilmenite and magnetite, as they show a strong correlation with Fe_p and Ti_p. The source of the anomaly at SN 0322 3397 (no. 437) was not identified but is most probably contamination. High and anomalous Zn_p values have a similar source.

Prominent As_p anomalies at SN 0262 3492 (no. 407), SN 0254 3541 (no. 408) and SN 0226 3424 (no. 427) are associated with high Cu_p and, additionally, high Cu_w and Zn_w at no. 407 and Zn_p at no. 408. From element associations, it appears that Cu_p and Zn_p anomalies are caused by the abundant Fe-Ti oxides, but the presence of the other metal anomalies suggests that sulphide mineralisation, perhaps associated with the margins of the dolerite intrusions, may also be present in the vicinity.

B_s anomalies (Figure 12) could not be clearly related to any particular feature.

Mynydd Dinas and Newport

Drainage in this drift-covered area is composed of fairly short, northward-flowing streams which cut across the lithology at right angles. The area is subject to contamination effects from the farms and roads, resulting in confused geochemical patterns.

All Pb and most Cu and Zn anomalies are caused by contamination, perhaps enhanced by abundant ilmenite and magnetite derived from the dolerites. Contaminants include:

copper wire at SN 0342 3905 (no.376), SN 0140 3997 (no.403);

lead glass at SN 0140 3997 (no.403), SM 9922 3666 (no.412), SN 0230 3875 (no.379);

various metals at SN 0024 3844 (no.396), SM 9972 3763 (no.430), SN 0140 3997 (no.403).

Sb_p anomalies are attributed to contamination, except for that at SN 0228 3792 (no. 393), for which there is no obvious cause, unless the abundant ilmenite contains minor Sb.

Mineralogical examination found evidence of mineralisation as well as contamination in two samples from the catchment of the stream between Carn Slanney and Mynydd Dinas. At SM 9972 3763 (no. 430), a little pyrite and a gold flake accompanied heavy contamination. Composition of the gold, which XRF analysis found to contain Ag but not Cu, Pb or Zn, suggests that a natural origin is possible. Upstream at SM 9922 3666 (no. 412), a grain of chalcopyrite was identified among the contaminants, Acid volcanics and dolerites form the bedrock lithologies in this catchment. Pyrite was found in several concentrates, for example SN 0140 3997 (no. 403), but may simply derive from the small amounts found in most rocks of this area.

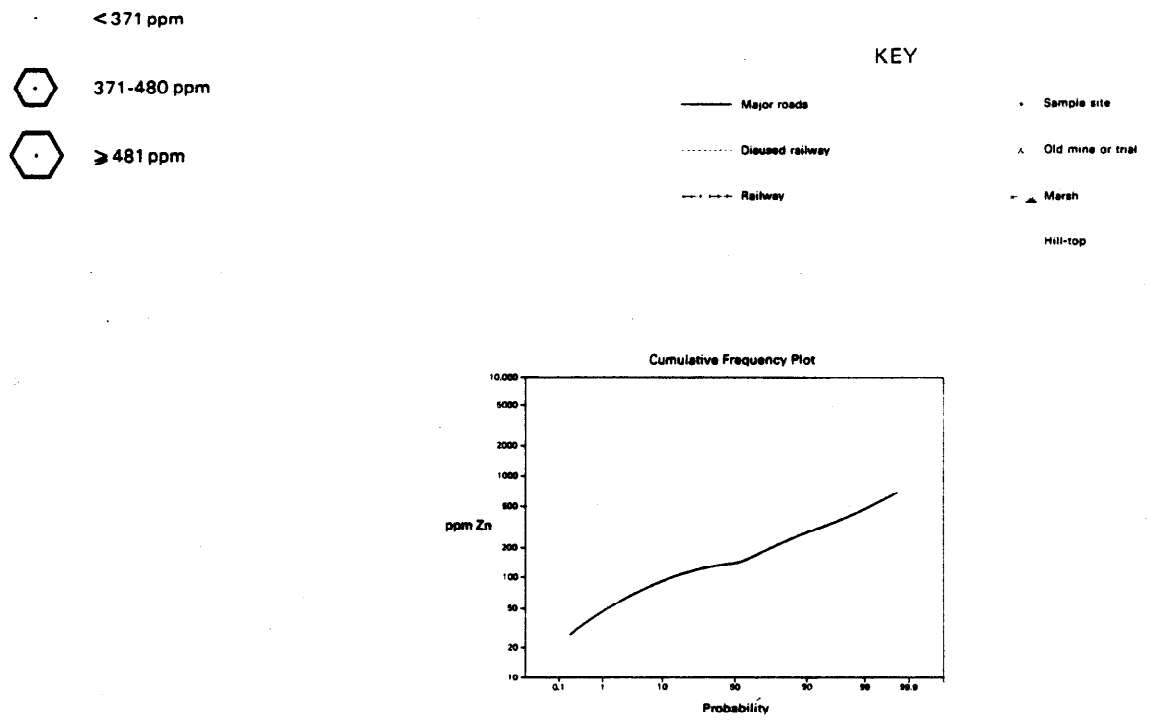
Bedrock generates anomalies locally, high levels of Zr deriving from acid volcanics, for example SN 0220 3811 (no. 410) and SN 0222 3786 (no. 411). Anomalous Ba_s (1290 ppm) at SN 0024 3844 (no. 396) is also ascribed to this source. Dolerite intrusions generate high and anomalous levels of Ti_p, Mn_p, Ca_p, Fe_p Mo_p and other elements found in ilmenite and magnetite. The most anomalous sites are: SN 0374 3734 (no. 385), Ti_p 12%, Fe_p 11%, Mo_p 5 ppm, Ca_p 2.5%; and SN 0349 3772 (no.3 69), Ti_p 9%, Ca_p 2.6%, Sr_p 190 ppm, Mo_p 4 ppm.

Locally, hydrous oxide precipitates produce weakly elevated levels of several elements derived from the same source, e.g. SN 0430 3796 (no. 384) Co_s 47 ppm, Fe_s 6.9%. At SN 0140 3997 (no.403), high Cr_s, V_s, Ca_p and Mo_p levels are derived from Llandovery sedimentary rocks, intruded by dolerite.

Afon Clydach to Brynberian

This area is dominated by outcrops of the Fishguard Volcanic Group, which give rise to prominent geochemical features on the spatial distribution plots (Appendix 2). The most notable is that Zr levels are high over the acid volcanic rocks (zircon was noted in the concentrate at SN 0983 3705 (no. 300)). Other features related to the volcanics include low levels of B_s, Ti_p and Ni_p. In strong contrast, dolerite intrusions are

Zinc in Stream Sediment.



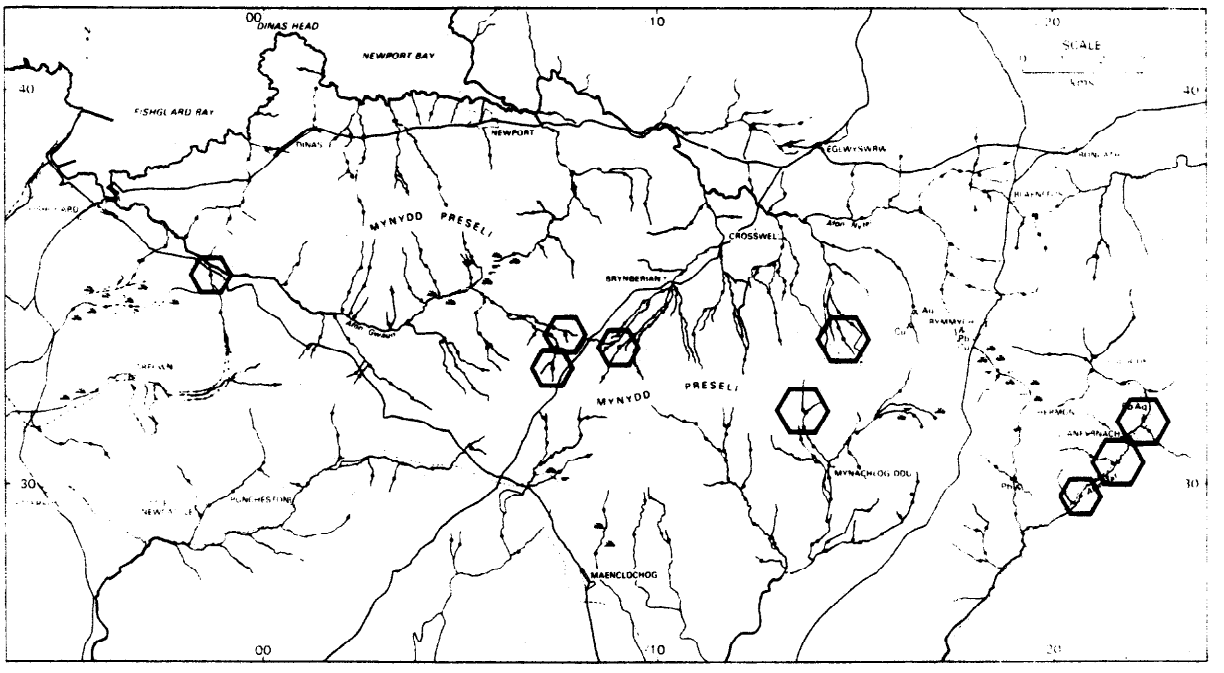


Figure 8 Zinc in stream sediment

Zinc in Panned Concentrate.

< 250 ppm

250-301 ppm

302-440 ppm

441-614 ppm

⩾615 ppm

KEY

Major roads

Disused railway

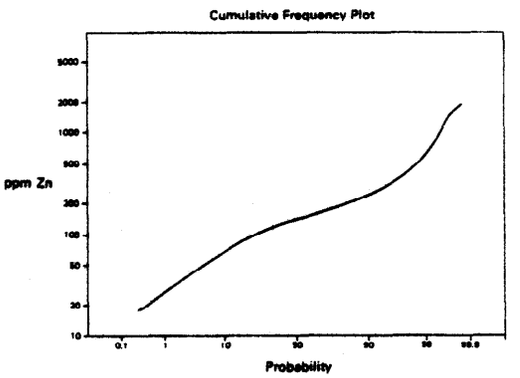
Railway

Sample site

Old mine or trial

Marsh

Hill-top



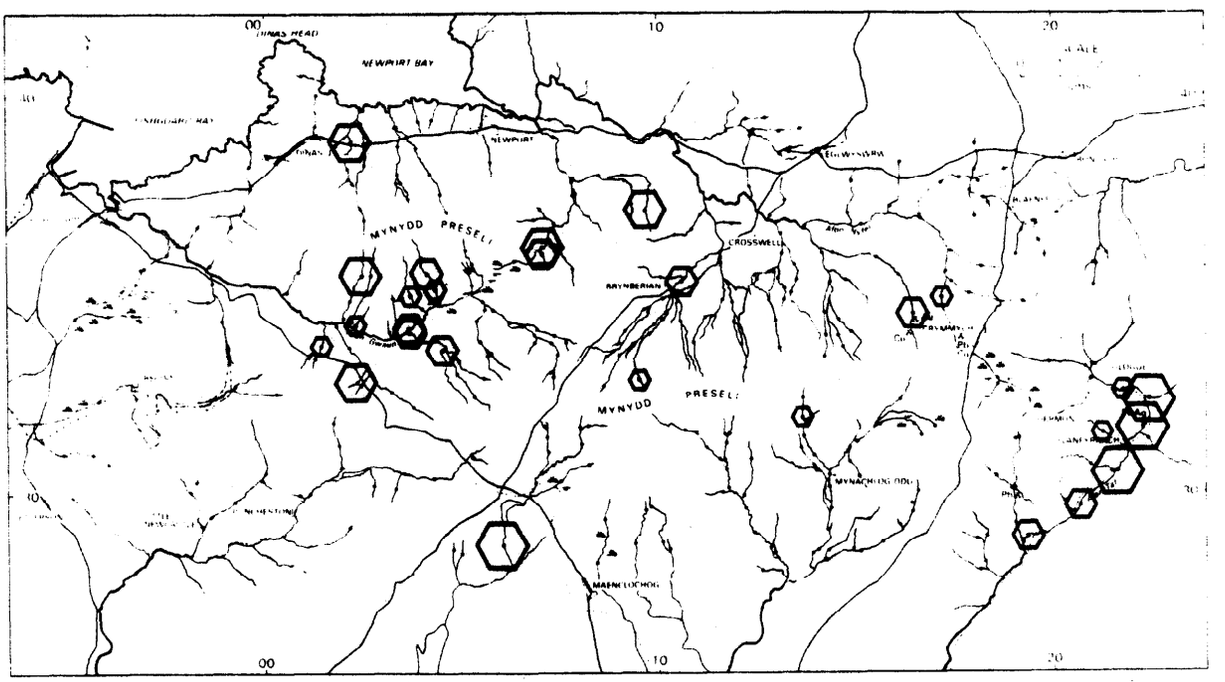


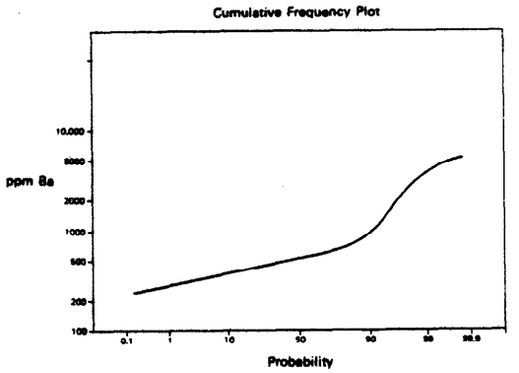
Figure 9 Zinc in panned concentrate

Barium in Stream Sediment.

- ≤ 900 ppm
- 901-1399 ppm
- 1400-3099 ppm
- 3100-3499 ppm
- ≥3500 ppm

KEY

- Major roads
- Disused railway
- Railway
- Sample site
- Old mine or trial
- Marsh
- Hill-top



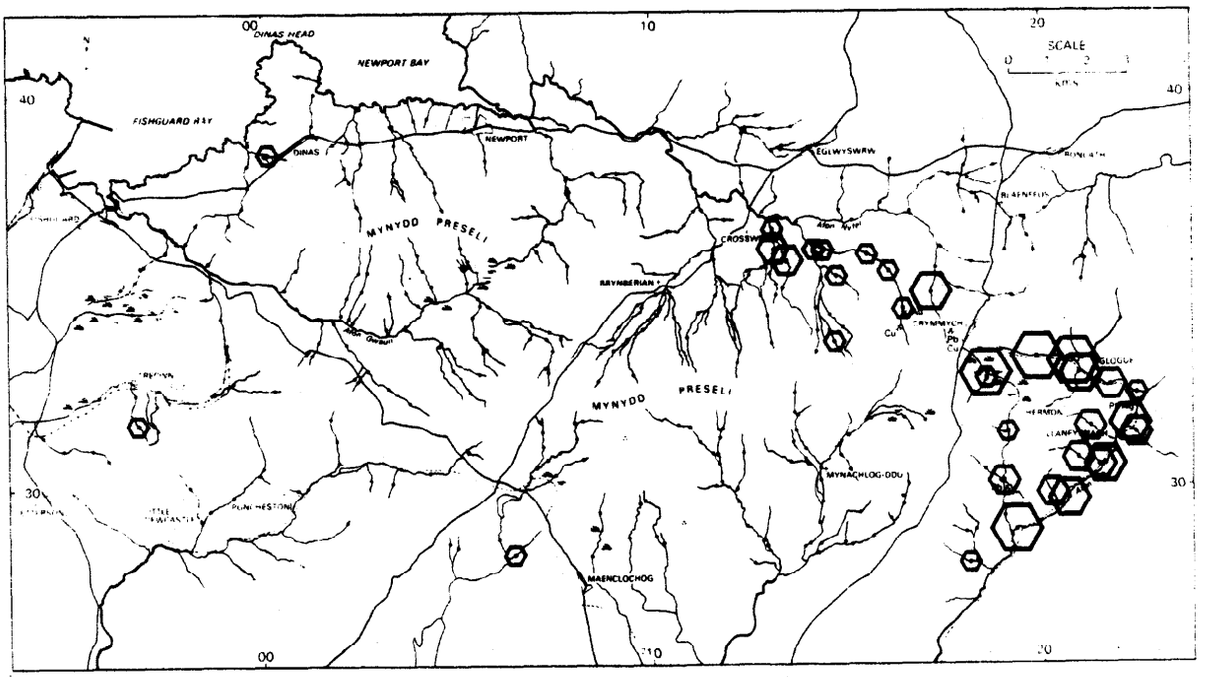


Figure 10 Barium in stream sediment

Tin in Panned Concentrate.

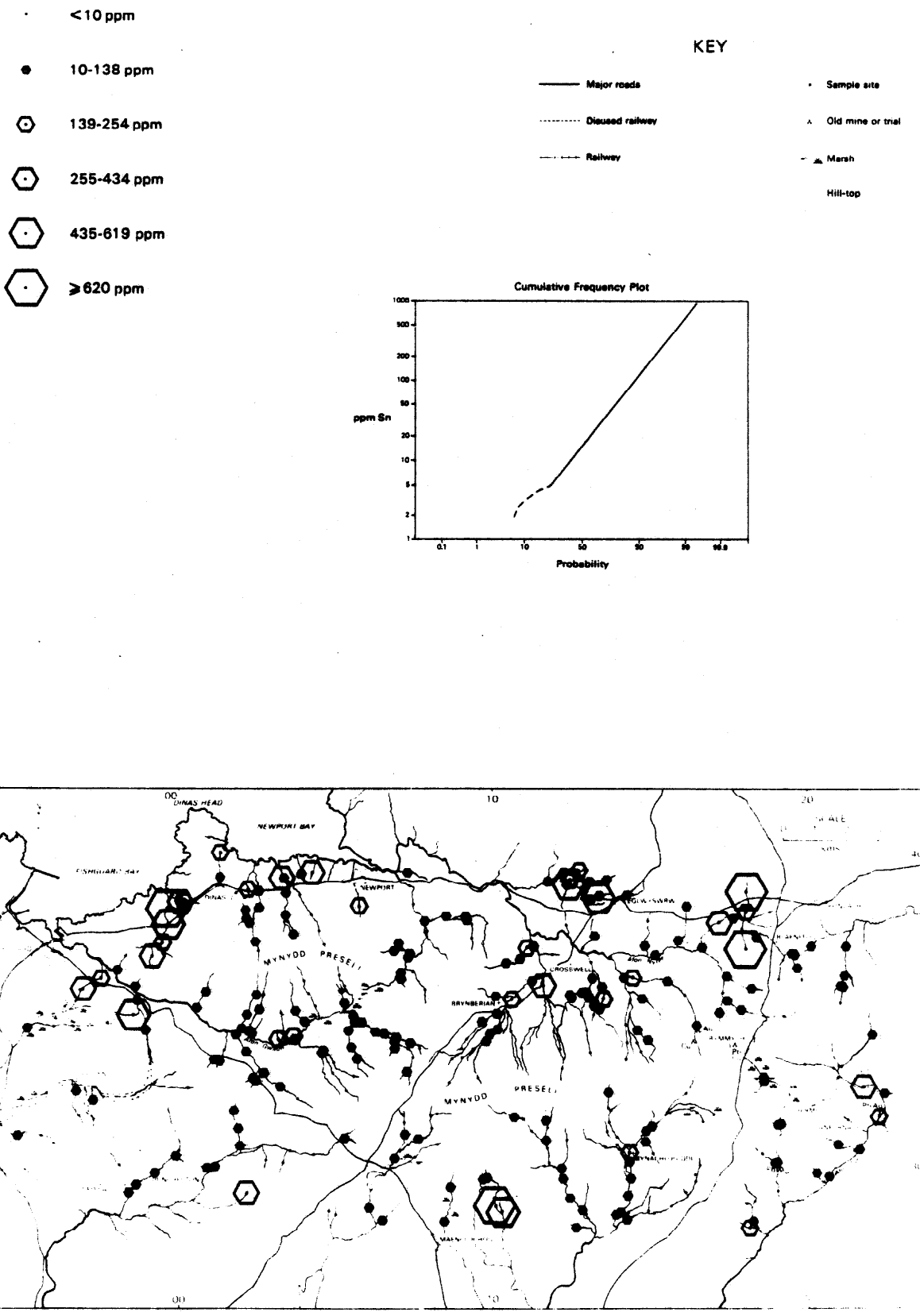


Figure 11 Tin in panned concentrate

Boron in Stream Sediment.

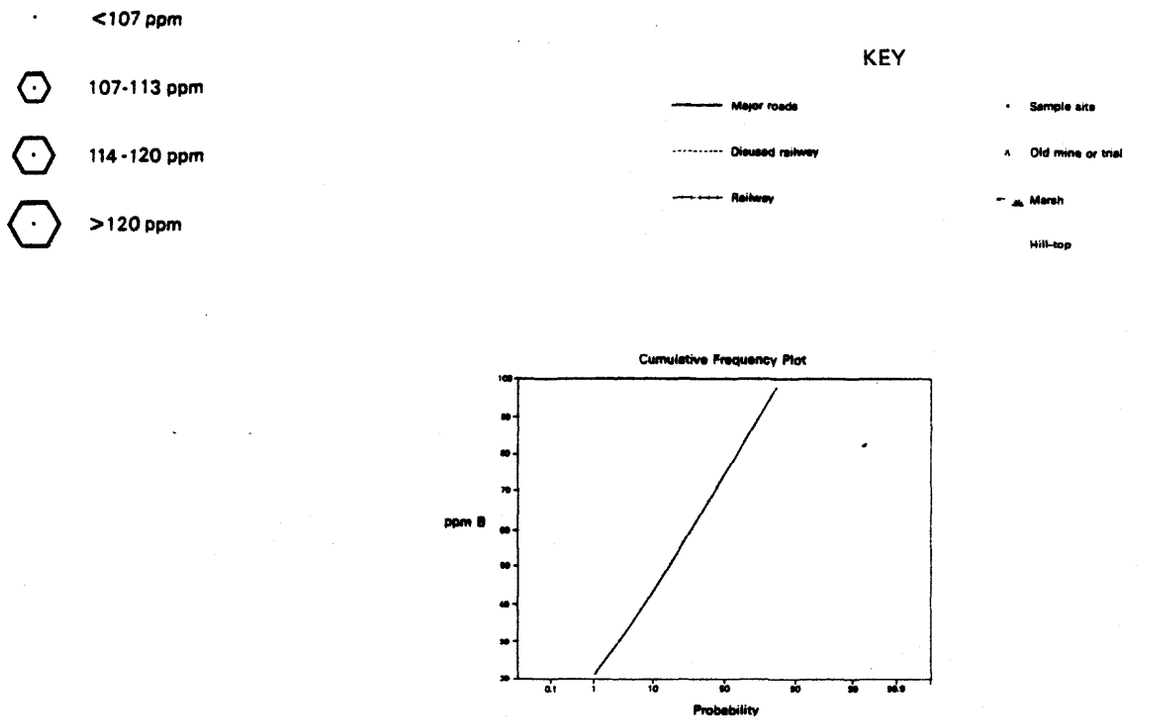


Figure 12 Boron in stream sediment

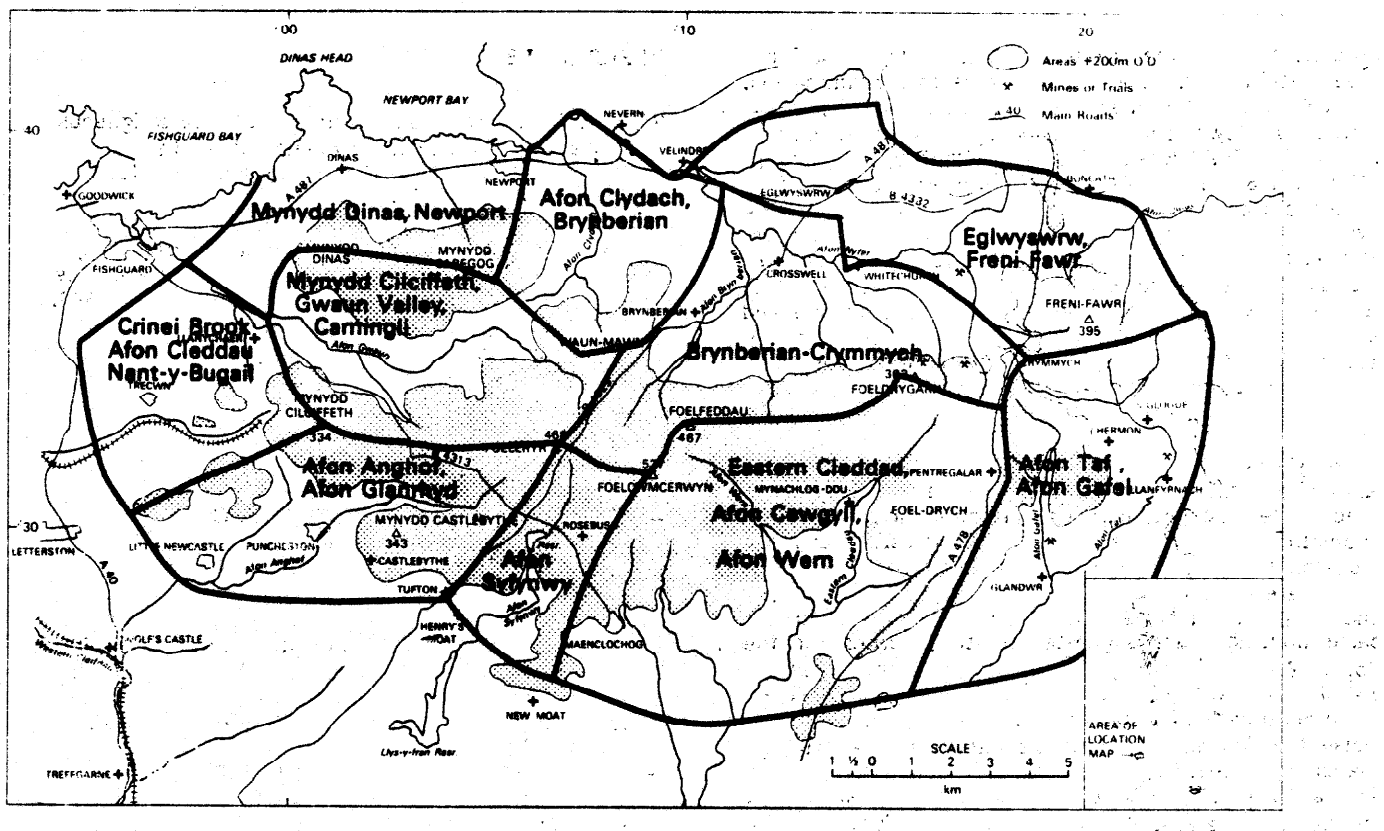


Figure 13 Anomalous areas described in the text

responsible for the anomalies in the extreme south-west of the area, where geochemical patterns reflect the lithology and are similar to those of the Gwaun area. High Zn_p derived from ilmenite is found at SN 0714 3595 (no.331) and SN 0712 3610 (no. 332), whilst an Mn_p high at SN 0791 3555 (no. 298) is probably derived from a similar source.

Pb_p and Sb_p anomalies, for example at SN 1122 3697 (no. 324) and SN 1056 3642 (no. 350), are caused by contamination; lead glass and various metals being the main causes. The Zn_p anomaly at SN 0983 3705 (no.300) is also caused by metallic contaminants though Fe-Ti oxides may also contribute.

The only evidence of mineralisation in this area came from grains observed during field examinations of panned concentrates: a flake of gold found in the panned concentrate at SN 0983 3705 (no. 300), near the Neolithic cromlech of Pentre Ifan, and a possible grain of chalcopyrite noted the pan concentrate at SN 0752 3836 (no. 381). A recent gravity surveys have reported the presence of a negative anomaly in this area, which might be related to a buried intrusion, a vent, or thickening of the volcanic pile (Cornwell and Cave, in preparation). No evidence was found from the drainage survey to suggest that if a vent or intrusion is present it has any mineralisation associated with it.

Crinei Brook, Afon Cleddau, Nant-y-bugail

The streams of this area flow in large, deep channels, which have been cut sub-glacially and range in size from the marshy ditches which are the headwaters of the Cleddau to deep, fast-flowing streams such the Nant-y-bugail. Where not well drained, the 'bottom' land is wet and marshy. In the gorge of the upper Nant-y-bugail and River Aer, much excavation and infilling has taken place to accomodate the Royal Naval Armament Depot, Trecwn. At site SM 9899 3424 (no. 490), in the depot, many elements are anomalous; Fe_p, Ti_p, Mn_p, Mo_p, Cu_s, Pb_s, Ni_s and Mn_s. These could be partly related to Fe-Ti oxides derived from the basic intrusion at Mynnydd Cilciffeth or from contamination. Mn_p at SM 9946 3274 (no. 491), may similarily relate to the basic intrusion and Co_s and Ni_s anomalies could be caused by hydrous oxide precipitates from the same source. Anomalous levels of barium in sediment and panned concentrate at SM 9696 3140 (no. 463) and barium in panned concentrate at SM 9732 3215 (no. 465) were recorded. In both cases, Ba_p values are higher than Ba_s values and baryte could be present. An alternative source could be in the Arenig mudstones, intruded by dolerites, in the catchment. A tin in sediment anomaly at the latter site is probably the result of contamination. Pb_s anomalies may be due to hydromorphic processes, e.g. at SM 9696 3140 (no. 463), but contaminants are a more likely source. Pb_p and Sn_p anomalies are also mainly caused by contamination, though possible cassiterite was recorded at SM 9859 3476 (no. 449).

Pyrite is recorded at SM 9695 3554 (no. 446), although the Cu_p anomaly is thought to be derived primarily from metallic contaminants.

There is little positive evidence for mineralisation in this area, but drift cover, low sample density and contamination would have made it difficult to detect.

Afon Anghor and Afon Glanrhyd

The majority of anomalies in these catchments are caused by basic intrusions in the Arenig and Llanvirn shales and mudstones. Sites at SN 0181 3170 (no. 476) and SN 0177 3168 (no. 477) have Mn_p and Ti_p anomalies derived from the Mynydd Cilciffeth dolerite. The Mn_p and Ni_p anomaly at SN 0221 2904 (no. 489) is similarily related to basic intrusions; tin in contaminants as well as cassiterite was noted in the concentrate from this site. The Pb_p anomaly here is caused by contamination from Pb metal and lead glass, whilst Cu_p may be derived from contaminants or Fe-Ti oxides, whose source lies in the dolerites.

High and anomalous levels of Cu_s, As_s and Co_s at SN 0340 3010 (no. 478) and Mn_s and Cos at SM 9845 2907 (no. 468) are probably caused by hydrous oxide

precipitation and the presence of basic intrusions. Other base metal anomalies are attributable to contamination, e.g. SN 0202 3060 (no. 474), anomalous for Pb_{sp} and Sb_p, which lies downstream of a road and disused railway trackbed. The weak Cu_p anomaly (61 ppm) at SN 0117 2989 (no. 473) is further downstream and is accompanied by a moderate Sn_p level of 65 ppm; possible pyrite was noted in the concentrate at site. The mineral responsible for the Cu_p anomaly at SM 9932 2977 (no. 469) was not represented in the dense (SG >3.3) fraction, examined mineralogically. Contaminants and abundant ilmenite are both present in the concentrate. The source of the B_s anomaly at SN 0284 3014 (no. 484) is not known.

Afon Syfynwy

Anomalies in the headwaters of the Syfynwy show precipitate associations, but the main source of the anomalies appears to be the basic intrusives and the mudstones which crop out in the catchment. High levels of Cr_s are derived from these lithologies, as are V_s, Fe_s and Mn_s anomalies. Ilmenite and magnetite from the basic intrusions are suggested as the sources for the Pb_{sp}, Zn_p and partly for the Cu_p anomalies at SN 0614 2860 (no. 482), although much of the Cu is likely to be contained in contaminants. Contaminants may also cause the Sn_p anomalies in the catchment. Arenig age shales and Sealyham Volcanics probably cause the anomalies at SN 0830 3160 (no. 282) and SN 0825 3061 (no. 284), where Pb_s, Cr_s, Mn_s and As_s are high.

The source of the Ba_s anomaly at SN 0659 2822 (no. 481) is not known but it could derive from the Arenig shales of the locality.

CONCLUSIONS AND RECOMMENDATIONS

Most of the significant geochemical variation could be related to bedrock lithology (particularly dolerite and mudstones), to contaminanation, known mineralisation and to hydrous oxide precipitation and scavenging.

Two areas where anomalies suggested some mineral potential are considered worthy of more detailed study:

1. Ba, Cu, Pb and Zn anomalies in catchments draining the Fishguard Volcanic Group and overlying D. Murchisoni Beds in the Crosswell-Crymmych area. The presence locally of As enrichments, old trials and records of possible gold mineralisation also suggests some potential for gold mineralisation associated with the dark mudstones. Volcanogenic massive sulphides, gold, and vein sulphides are considered to be the most likely styles of mineralisation. Further work to investigate these possibilities is in progress.

2. Pb, Zn and Ba anomalies in the Hendre and Mydrim shales of the Taf Valley. An extension of the drainage survey is required to delineate the boundaries of the anomalous area, and more detailed geological, geophysical and geochemical studies are needed to locate the source of the anomalies and styles of mineralisation present.

   In addition, the following are tenuous indications of mineralisation:

   a Grains of chalcopyrite and gold in streams draining Fishguard Volcanic Group rocks and dolerite, near Dinas and Pentre Efan.

   b Scattered occurences of cassiterite grains, always only one or two and bearing no obvious relationship to the geology.

ACKNOWLEDGEMENTS

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REFERENCES

BEVINS, R. E. 1978. Pumpellyite-bearing basic igneous rocks from the Lower Ordovician of North Pembrokeshire, Wales. **Mineral. Mag.**, Vol. 42, pp. 81-83.

— and ROACH, R. A. 1979a. Early Ordovician volcanism in Dyfed, South Wales. in Harris, A. L., Holland, C. H.., Leake, B. E. (eds). The Caledonides of the British Isles. **Geol. Soc. London.** pp. 603-609.

— 1979b. Pillow lava and isolated pillow breccia of Rhyodacitic composition from the Fishguard Volcanic Group, Lower Ordovician, SW Wales, United Kingdom. **Journal of Geology**, Vol. 87, pp. 193-201.

BRADLEY, R. I. 1976. Soils in Dyfed III: sheet SN 13 (Eglwyswrw). **Soil Surv. Rep.**, 38.

—, RUDEFORTH, C. C. and WILKINS, C. 1977. Distribution of some chemical elements in the soils of North West Pembrokeshire. **J. Soil Sci.** Vol. 29, pp. 258-270.

CHARLESWORTH, J. K. 1929. The South Wales End Moraine. **Q. Jl. Geol. Soc. Lond.** Vol. 85 pp. 335-338.

COOPER, D. C., NUTT, M. J. C. and MORGAN, D. J. 1982. A reconnaissance geochemical survey of Anglesey. **Mineral Reconnaissance Programme Rept. Inst. Geol. Sci.** No. 51.

—, BASHAM, I. R. and SMITH, T. K. 1983. On the occurrence of an unusual form of monazite in panned stream sediments in Wales. **Geol. J.**, Vol, 18, pp. 121-127.

COOPER, D. C., CAMERON, D. G., JACKSON, AUDREY A., ALLEN, P. M. and PARKER, M. E. 1983. Exploration for volcanogenic sulphides at Benglog, North Wales. **Mineral Reconnaissance Programme Rept. Inst. Geol. Sci.** No. 63.

CORNWELL, J. C. and CAVE R. in preparation. An Airborne Geophysical Survey of part of Dyfed Mineral Reconnaissance Programme Rept. **Inst. Geol. Sci.,**

COWPER REED, F. R. 1885. The geology of the country around Fishguard, Pembrokeshire. **Q. J. Geol. Soc. London,** Vol. 51, pp. 149-195.

COX, A. H. 1930. Preliminary note on the geological structure of Pen Caer and Strumble Head, Pembrokeshire. **Proc. Geol. Assoc.** Vol. 41, pp. 274-289.

ELSDEN, J. V. 1905. On the igneous rocks occurring between St. David's Head and Strumble Head, Pembrokeshire. **Q.J. Geol. Soc. Lond.** Vol. 61, pp. 579-607.

EVANS, D. C. 1906. The Ordovician rocks of Western Carmarthenshire. **Q. J. Geol. Soc. Lond.** Vol. 62, pp. 597-643.

EVANS, W. D. 1938. The Arenig, Llanvirn and Lower Llandeilo rocks of the Eastern Prescelly Hills, Pembrokeshire and the eastward termination of the Fishguard Newport Volcanic group. **Ph.D thesis. Univ. Wales.** (unpublished).

— 1940. The geology of the Prescelly Hills and adjoining areas in North Pembrokeshire and Carmarthenshire. **Ph.D thesis, Univ. London.** (unpublished).

— 1945 The Geology of the Prescelly Hills, North Pembrokeshire. **Q. J. Geol. Soc. London.** Vol. 101, pp. 89-107.

FOSTER-SMITH, J. R. 1981. The Non-Ferrous Metal Mines of the South Wales Area. **British Mining.** Vol. 18.

Imperial College of Science and Technolgy, Applied Geochemistry Research Group 1978. **The Woolfson Geochemical Atals of England and Wales.** (Oxford. Clarendon Press) 69p.

HALL, G. W. 1971. Metal Mines of Southern Wales. (**Gloucester:** John Jennings Ltd).

JOHN, B. S. 1965. A Possible Main Wurm Glaciation in West Pembrokeshire. **Nature.** Vol. 207, pp. 622-623.
— 1967. Further Evidence for a Middle Wiirm Insterstadial and a Main Wiirm Glaciation of South-West Wales. **Geol. Mag.** Vol. 104, pp. 630-633.
— 1970. Pembrokeshire. In C. A. LEWIS (ed), **The Glaciations of Wales and the Adjoining Regions.** (London: Longmans). pp. 229-265.
— 1972. The Fishguard-Pembrokeshire Area: a description of the O.S. one inch sheets 138/151: Fishguard and Pembroke. **British Landscapes Through Maps.** Vol. 16.
JONES, O. T. 1912. The Geological structure of Central Wales and the adjoining regions. **Q. J. Geol. Soc. London.** Vol. 98, pp. 328
— 1965. The glacial and postglacial history of the Lower Teifi valley. **Q. J. Geol. Soc. London.** Vol. 121, pp. 247-281.
LEPELTIER, C. 1969. A simplified statistical treatment of geochemical data by graphical representation. **Econ. Geol.** Vol. 64, pp. 538-550.
LOWMAN, R. D. W. 1977. The geology, petrology and geochemistry of an area of Lower Palaeozoic rocks east of Fishguard, northern Pembrokeshire. **Ph.D. thesis, Univ. Wales.** (unpublished).
— and BLOXHAM, T. W. 1981. The petrology of the Lower Palaeozoic Fishguard Volcanic Group and associated rocks east of Fishguard, N. Pembrokeshire, (Dyfed), South Wales. **J. Geol. Soc. London.** Vol. 138, pp. 47-68.
NOWLAN, G. 1976. Concretionary manganese-iron oxides in streams and their usefulness as a sample medium for geochemical prospecting. **Jl. Geochem. Explor.** Vol. 6, pp. 193-210.
PARSLOW, G. R. 1974. Determination of background and threshold in exploration geochemistry. **Jl. Geochem. Explor.** Vol. 3, pp. 319-336.
PART, G. M. 1922. Notes on the Ordovician Lavas Of the Mynydd Prescelly, North Pembs. **Geol. Mag.** Vol. 54, pp. 310-323.
READ, D. Rare earth element behaviour during subaerial weathering. **Ph.D thesis Univ. London.** (unpublished).
REEDMAN, J. H. 1979. Techniques in mineral exploration. (London: Applied Science), pp 533.
SINCLAIR, A. J. 1976. Applications of probability graphs in mineral exploration. **Assoc. Explor. Geochemists Spec.** Vol. 4, (Canada. Richmond Printers, B.C.) 95p.
THOMAS, G. E. and THOMAS, T. M. 1956. The volcanic rocks of the area between Fishguard and Strumble Head, Pembrokeshire. **Q. J. Geol. Soc. London.** Vol. 112, pp. 291-314.
THOMAS, H. H. and COX, A. H. 1924. The volcanic series of Trefgarn, Roch and Ambleston, (Pembrokeshire). **Q. J. Geol. Soc. London.** Vol. 80, pp. 520-548.
URQUIDDI-BARRAU, F. 1973. Regional Geochemical Variations related to base metal mineralisation in Wales. **Ph.D. Thesis, Univ. London.**
WILLIAMS, T. G. 1933. The Precambrian and Lower Palaeozoic rocks of the eastern end of the St. David's Precambrian area, Pembrokeshire. **Q. J. Geol. Soc. London.** Vol. 90, pp. 32-75.

SAMPNUMB	SNP XRF	ASP XRF	CAP XRF	CEP XRF	SBP XRF	SRP XRF	ZAP XRF	UP XRF	MOP XRF
101.	356.00	2.00	740.00	67000.00	4.00	130.00	250.00	80.00	1.00
102.	4.50	2.00	660.00	25500.00	4.00	90.00	220.00	30.00	1.00
103.	215.00	1.00	1120.00	29000.00	4.00	70.00	220.00	40.00	1.00
104.	4.50	1.00	650.00	4400.00	4.00	70.00	170.00	10.00	1.00
105.	18.00	1.00	640.00	6153.00	4.00	80.00	200.00	10.00	1.00
106.	16.00	2.00	1450.00	8686.00	4.00	80.00	200.00	20.00	1.00
107.	44.00	6.00	1190.00	21000.00	4.00	80.00	160.00	30.00	1.00
108.	19.00	15.00	740.00	14500.00	4.00	100.00	200.00	20.00	1.00
109.	25.00	1.00	1140.00	37600.00	4.00	130.00	250.00	40.00	1.00
110.	29.00	27.00	1700.00	1402.00	4.00	90.00	310.00	10.00	5.00
111.	9.00	1.00	300.00	61300.00	4.00	160.00	220.00	80.00	1.00
112.	4.50	6.00	610.00	46700.00	4.00	140.00	250.00	50.00	1.00
113.	20.00	4.00	740.00	19200.00	4.00	110.00	250.00	30.00	1.00
114.	138.00	6.00	2090.00	11700.00	4.00	110.00	1550.00	20.00	1.00
115.	9.00	4.00	330.00	37400.00	4.00	130.00	230.00	50.00	1.00
116.	4.50	42.00	490.00	937.00	4.00	90.00	140.00	10.00	19.00
117.	36.00	1.00	1860.00	1181.00	4.00	70.00	490.00	1.10	1.00
118.	18.00	3.00	2980.00	466.00	4.00	80.00	210.00	1.10	1.00
119.	59.00	19.00	1420.00	65700.00	4.00	170.00	370.00	70.00	3.00
120.	182.00	26.00	2340.00	2722.00	111.00	140.00	210.00	30.00	12.00
121.	89.00	3.00	550.00	51500.00	4.00	140.00	200.00	70.00	1.00
122.	10.00	3.00	740.00	7996.00	4.00	90.00	270.00	10.00	1.00
123.	18.00	2.00	390.00	3978.00	4.00	100.00	250.00	10.00	1.00
124.	10.00	31.00	430.00	2486.00	4.00	110.00	170.00	1.10	14.00
125.	9.00	8.00	2430.00	776.00	4.00	110.00	430.00	1.10	1.00
126.	17.00	1.00	13440.00	582.00	4.00	150.00	250.00	1.10	2.00
127.	16.00	4.00	2340.00	531.00	4.00	70.00	280.00	1.10	1.00
128.	4.50	3.00	5230.00	167.00	4.00	100.00	260.00	1.10	1.00
129.	84.00	8.00	890.00	12000.00	9.00	120.00	190.00	10.00	1.00
130.	4.50	10.00	3230.00	3895.00	4.00	210.00	2240.00	10.00	1.00
131.	9.00	7.00	570.00	54000.00	4.00	160.00	200.00	60.00	1.00
132.	17.00	11.00	950.00	1689.00	4.00	170.00	4270.00	1.10	1.00
133.	61.00	15.00	1720.00	66200.00	4.00	170.00	280.00	70.00	2.00
134.	94.00	4.00	690.00	1774.00	4.00	60.00	890.00	10.00	1.00
135.	72.00	9.00	2000.00	18000.00	4.00	110.00	940.00	30.00	1.00
136.	4.50	1.00	2820.00	298.00	4.00	90.00	420.00	1.10	1.00
137.	172.00	4.00	2180.00	28100.00	4.00	120.00	1060.00	30.00	1.00
138.	27.00	4.00	11290.00	5624.00	4.00	180.00	430.00	1.10	1.00
139.	4.50	2.00	9530.00	31900.00	4.00	130.00	270.00	30.00	1.00
140.	4.50	4.00	4560.00	1457.00	4.00	110.00	250.00	10.00	1.00
141.	99.00	14.00	1480.00	22000.00	4.00	150.00	440.00	20.00	6.00
142.	30.00	10.00	2710.00	1787.00	4.00	130.00	1110.00	10.00	1.00
143.	19.00	8.00	5080.00	209.00	4.00	110.00	560.00	1.10	1.00
144.	190.00	6.00	4220.00	194.00	4.00	90.00	1680.00	1.10	1.00
145.	4.50	5.00	13160.00	59.00	4.00	190.00	400.00	10.00	1.00
146.	4.50	7.00	6780.00	123.00	4.00	120.00	250.00	1.10	1.00
147.	15.00	4.00	13350.00	575.00	4.00	170.00	360.00	1.10	1.00
148.	38.00	7.00	2150.00	6213.00	4.00	90.00	1820.00	10.00	2.00
149.	24.00	2.00	650.00	28300.00	4.00	110.00	300.00	40.00	1.00
150.	12.00	1.00	6190.00	157.00	4.00	140.00	1070.00	1.10	1.00
151.	67.00	7.00	960.00	3620.00	4.00	70.00	1080.00	10.00	1.00
152.	28.00	8.00	1650.00	374.00	4.00	90.00	2250.00	1.10	4.00
153.	62.00	1.00	5080.00	584.00	4.00	100.00	550.00	1.10	1.00
161	4.50	1.00	16790.00	588.00	4.00	180.00	660.00	1.10	1.00
162.	4.50	4.00	640.00	9133.00	4.00	90.00	200.00	20.00	1.00
164.	4.50	12.60	3840.00	842.00	4.00	80.00	250.00	1.10	2.00

SAMPNUMB	ZNW AAS	CUP XRF	PBP XRF	ZNP XRF	BAP XRF	FEP XRF	MNP XRF	TIP XRF	NIP XRF
101.	0.00	6.00	70.00	66.00	13.50	21690.00	750.00	3820.00	73.00
102.	0.00	8.00	6.50	90.00	13.50	40170.00	520.00	4740.00	43.00
103.	0.00	11.00	85.00	83.00	13.50	38350.00	500.00	4050.00	46.00
104.	0.00	6.00	6.50	82.00	79.00	43800.00	330.00	4520.00	28.00
105.	0.00	11.00	31.00	92.00	13.50	53650.00	360.00	1880.00	33.00
106.	0.00	11.00	51.00	94.00	13.50	50000.00	420.00	4770.00	35.00
107.	0.00	9.00	6.50	68.00	13.50	30910.00	400.00	3540.00	33.00
108.	0.00	20.00	66.00	138.00	13.50	60150.00	540.00	6090.00	49.00
109.	0.00	14.00	6.50	121.00	13.50	42240.00	610.00	5290.00	60.00
110.	0.00	42.00	44.00	252.00	2153.00	104780.00	880.00	9890.00	63.00
111.	0.00	17.00	6.50	106.00	13.50	32140.00	540.00	5290.00	89.00
112.	0.00	15.00	6.50	133.00	13.50	46650.00	720.00	6010.00	75.00
113.	0.00	17.00	26.00	120.00	13.50	53920.00	550.00	5710.00	51.00
114.	0.00	28.00	253.00	194.00	741.00	59520.00	640.00	22000.00	48.00
115.	0.00	100.00	29.00	121.00	13.50	44990.00	700.00	5230.00	64.00
116.	0.00	53.00	50.00	194.00	2874.00	83290.00	810.00	6030.00	49.00
117.	0.00	10.00	61.00	105.00	464.00	41770.00	390.00	13390.00	22.00
118.	0.00	25.00	83.00	246.00	544.00	72420.00	850.00	19970.00	52.00
119.	0.00	44.00	1073.00	415.00	13.50	52890.00	850.00	6500.00	92.00
120.	0.01	427.00	21884.00	9915.00	2229.00	94110.00	1630.00	5240.00	97.00
121.	0.00	17.00	87.00	127.00	13.50	41940.00	710.00	5200.00	80.00
122.	0.00	11.00	55.00	130.00	13.50	58490.00	470.00	5380.00	39.00
123.	0.00	14.00	73.00	135.00	299.00	62160.00	550.00	6380.00	41.00
124.	0.00	35.00	38.00	167.00	2368.00	77550.00	450.00	7100.00	46.00
125.	0.00	19.00	92.00	282.00	653.00	67080.00	740.00	24650.00	36.00
126.	0.00	20.00	59.00	158.00	225.00	79840.00	1340.00	30170.00	52.00
127.	0.00	9.00	64.00	173.00	525.00	57860.00	740.00	15880.00	31.00
128.	0.00	18.00	60.00	158.00	470.00	69690.00	750.00	20070.00	41.00
129.	0.00	69.00	840.00	688.00	633.00	68780.00	1010.00	5940.00	54.00
130.	0.00	18.00	54.00	154.00	14200.00	58030.00	420.00	19720.00	30.00
131.	0.00	126.00	246.00	218.00	13.50	52080.00	930.00	5410.00	82.00
132.	0.00	16.00	215.00	175.00	2516.00	35030.00	370.00	21930.00	31.00
133.	0.00	42.00	1764.00	437.00	13.50	50360.00	810.00	6580.00	91.00
134.	0.00	3.00	63.00	100.00	385.00	53090.00	380.00	11190.00	25.00
135.	0.00	10.00	591.00	172.00	405.00	54120.00	730.00	9590.00	53.00
136.	0.00	3.00	33.00	153.00	254.00	61360.00	780.00	9790.00	13.00
137.	0.00	19.00	85.00	169.00	13.50	52960.00	780.00	9420.00	57.00
138.	0.00	7.00	45.00	79.00	13.50	47990.00	550.00	10460.00	23.00
139.	0.00	10.00	6.50	137.00	13.50	49730.00	1120.00	12090.00	62.00
140.	0.00	8.00	38.00	135.00	362.00	65500.00	970.00	16190.00	33.00
141.	0.01	44.00	2794.00	1116.00	2436.00	64870.00	750.00	9490.00	58.00
142.	0.00	23.00	77.00	205.00	1090.00	68350.00	450.00	20860.00	34.00
143.	0.00	25.00	96.00	135.00	629.00	74940.00	620.00	23050.00	36.00
144.	0.00	77.00	169.00	203.00	1129.00	73830.00	670.00	18920.00	33.00
145.	0.00	7.00	34.00	114.00	259.00	62380.00	820.00	21080.00	24.00
146.	0.00	3.00	43.00	160.00	355.00	69390.00	920.00	15440.00	26.00
147.	0.00	12.00	42.00	145.00	367.00	71390.00	790.00	16000.00	37.00
148.	0.00	22.00	143.00	179.00	488.00	64920.00	710.00	10390.00	40.00
149.	0.00	12.00	18.00	120.00	13.50	46190.00	640.00	5550.00	55.00
150.	0.00	10.00	39.00	184.00	363.00	69550.00	670.00	11220.00	17.00
151.	0.00	16.00	135.00	117.00	662.00	60570.00	560.00	8630.00	26.00
152.	0.00	27.00	194.00	317.00	2185.00	86440.00	640.00	7670.00	28.00
153.	0.00	3.00	72.00	92.00	185.00	47880.00	500.00	10680.00	10.00
161.	0.00	7.00	27.00	73.00	131.00	45940.00	910.00	21170.00	13.00
162.	0.00	11.00	30.00	120.00	121.00	55310.00	620.00	5410.00	42.00
164.	0.00	47.00	56.00	254.00	352.00	101980.00	3470.00	32320.00	79.00

SAMPNUMB	ZNW AAS	CUP XRF	PBP XRF	ZNP XRF	BAP XRF	FEP XRF	MNP XRF	TIP XRF	NIP XRF
283.	0.00	40.00	33.00	204.00	417.00	101300.00	2830.00	22940.00	60.00
284.	0.00	34.00	47.00	175.00	540.00	92220.00	2360.00	8970.00	47.00
285.	0.00	35.00	97.00	207.00	400.00	97070.00	2400.00	32690.00	62.00
286.	0.00	28.00	43.00	155.00	254.00	87040.00	2790.00	43130.00	61.00
287.	0.00	17.00	73.00	189.00	13.50	102390.00	8190.00	71000.00	58.00
288.	0.00	16.00	71.00	224.00	13.50	119720.00	13840.00	129900.00	43.00
289.	0.00	8.00	13.00	112.00	168.00	58410.00	380.00	5160.00	39.00
290.	0.00	12.00	29.00	59.00	13.50	41280.00	570.00	3750.00	26.00
292.	0.01	21.00	130.00	68.00	79.00	39740.00	370.00	3660.00	24.00
294.	0.02	126.00	213.00	305.00	441.00	101053.00	1730.00	25350.00	35.00
295.	0.01	3.00	13.00	28.00	31.00	20210.00	610.00	12070.00	7.00
296.	0.01	108.00	6.50	24.00	65.00	14890.00	290.00	4640.00	2.50
297.	0.01	23.00	70.00	189.00	446.00	91040.00	2530.00	36900.00	40.00
298.	0.01	30.00	53.00	223.00	251.00	113170.00	7180.00	89600.00	48.00
299.	0.04	26.00	44.00	153.00	429.00	81250.00	1240.00	29390.00	45.00
300.	0.02	3.00	30.00	611.00	164.00	13690.00	210.00	3090.00	6.00
301.	0.01	24.00	39.00	76.00	51.00	37900.00	380.00	3290.00	16.00
302.	0.00	35.00	169.00	102.00	13.50	44020.00	1180.00	4050.00	45.00
303.	0.00	6.00	13.00	57.00	13.50	32510.00	480.00	3460.00	20.00
304.	0.00	17.00	18.00	105.00	403.00	58730.00	720.00	5150.00	32.00
305.	0.00	6.00	29.00	64.00	63.00	37130.00	530.00	3590.00	21.00
306.	0.00	38.00	220.00	98.00	13.50	58870.00	640.00	4380.00	32.00
307.	0.01	10.00	54.00	64.00	13.50	52940.00	1030.00	19920.00	21.00
308.	0.02	11.00	56.00	92.00	203.00	36730.00	410.00	10270.00	16.00
309.	0.01	15.00	107.00	235.00	128.00	112460.00	9383.00	116800.00	34.00
310.	0.00	25.00	66.00	161.00	396.00	98190.00	4890.00	36800.00	50.00
311.	0.00	32.00	30.00	155.00	258.00	94280.00	2740.00	33960.00	73.00
312.	0.00	26.00	51.00	153.00	235.00	85350.00	3120.00	44390.00	59.00
313.	0.00	28.00	54.00	155.00	217.00	90010.00	3560.00	44270.00	58.00
314.	0.00	12.00	26.00	121.00	270.00	61610.00	420.00	6670.00	41.00
315.	0.00	12.00	6.50	117.00	13.50	46200.00	460.00	5770.00	65.00
316.	0.00	19.00	35.00	97.00	176.00	67890.00	740.00	5240.00	37.00
317.	0.00	26.00	546.00	238.00	720.00	84310.00	1160.00	9620.00	34.00
318.	0.01	16.00	110.00	219.00	408.00	77650.00	1510.00	28520.00	34.00
319.	0.00	11.00	15.00	119.00	310.00	58090.00	350.00	6550.00	38.00
320.	0.00	6.00	6.50	57.00	41.00	31930.00	410.00	3390.00	19.00
321.	0.00	3.00	45.00	50.00	13.50	30670.00	410.00	2990.00	18.00
322.	0.01	3.00	6.50	42.00	95.00	25500.00	270.00	2310.00	12.00
323.	0.01	6.00	307.00	70.00	182.00	41580.00	380.00	7010.00	15.00
324.	0.01	12.00	198.00	63.00	153.00	46180.00	360.00	3540.00	9.00
325.	0.01	23.00	63.00	233.00	706.00	89520.00	1700.00	7940.00	33.00
326.	0.01	73.00	97.00	137.00	308.00	92520.00	890.00	7840.00	31.00
327.	0.02	29.00	930.00	268.00	528.00	106420.00	2360.00	13750.00	59.00
328.	0.09	35.00	51.00	317.00	190.00	221690.00	3580.00	35980.00	50.00
329.	0.01	18.00	27.00	149.00	13.50	111060.00	5830.00	76800.00	42.00
330.	0.01	8.00	31.00	45.00	82.00	37360.00	850.00	22010.00	10.00
331.	0.01	32.00	98.00	440.00	334.00	102560.00	2910.00	34780.00	52.00
332.	0.01	17.00	123.00	603.00	13.50	93700.00	6630.00	72500.00	45.00
333.	0.01	39.00	41.00	234.00	190.00	104730.00	4450.00	47800.00	46.00
334.	0.01	13.00	47.00	140.00	178.00	71500.00	2410.00	33000.00	53.00
335.	0.01	18.00	30.00	176.00	138.00	115140.00	4590.00	85480.00	22.00
336.	0.00	109.00	64.00	171.00	13.50	102590.00	7650.00	107600.00	42.00
337.	0.01	17.00	31.00	147.00	76.00	97870.00	5600.00	77000.00	38.00
338.	0.01	22.00	28.00	139.00	346.00	83770.00	2070.00	45780.00	46.00
339.	0.04	22.00	47.00	210.00	292.00	98540.00	4400.00	36100.00	48.00
340.	0.00	21.00	34.00	203.00	329.00	73250.00	5380.00	88700.00	71.00

SAMPNUMB	SNP XRF	ASP XRF	CAP XRF	CEP XRF	SBP XRF	SRP XRF	ZRP XRF	UP XRF	MOP XRF
283.	4.50	7.00	2410.00	294.00	4.00	70.00	210.00	1.10	3.00
284.	4.50	10.00	400.00	121.00	4.00	70.00	170.00	1.10	1.00
285.	42.00	9.00	7030.00	176.00	4.00	90.00	280.00	1.10	1.00
286.	19.00	11.00	9420.00	1632.00	4.00	110.00	340.00	1.10	1.00
287.	70.00	3.00	8500.00	14700.00	4.00	160.00	540.00	20.00	4.00
288.	35.00	4.00	9990.00	12700.00	4.00	80.00	770.00	10.00	5.00
289.	4.50	.00	285.00	4620.00	4.00	85.00	340.00	10.00	1.00
290.	21.00	11.00	1210.00	8226.00	4.00	50.00	300.00	10.00	1.00
292.	84.00	8.00	950.00	2894.00	4.00	50.00	190.00	1.10	1.00
294.	253.00	9.00	4790.00	510.00	4.00	90.00	510.00	1.10	3.00
295.	4.50	7.00	2530.00	799.00	4.00	30.00	460.00	1.10	1.00
296.	4.50	1.00	1800.00	322.00	4.00	30.00	240.00	1.10	1.00
297.	4.50	4.00	7400.00	109.00	4.00	100.00	550.00	1.10	2.00
298.	4.50	5.00	6960.00	204.00	4.00	80.00	649.00	1.10	6.00
299.	4.50	1.00	10390.00	108.00	4.00	120.00	251.00	1.10	2.00
300.	4.50	11.00	860.00	445.00	4.00	30.00	950.00	1.10	1.00
301.	23.00	17.00	1280.00	2015.00	4.00	30.00	390.00	10.00	1.00
302.	536.00	13.00	1620.00	21800.00	4.00	70.00	250.00	30.00	1.00
303.	10.00	8.00	1150.00	5600.00	14.00	50.00	230.00	10.00	1.00
304.	4.50	4.00	720.00	1220.00	4.00	70.00	210.00	1.10	1.00
305.	27.00	5.00	1070.00	2050.00	4.00	50.00	273.00	1.10	1.00
306.	615.00	13.00	2140.00	7597.00	4.00	60.00	330.00	10.00	1.00
307.	41.00	15.00	1777.00	7421.00	4.00	40.00	2230.00	10.00	2.00
308.	20.00	8.00	7880.00	375.00	4.00	100.00	1520.00	1.10	1.00
309.	46.00	7.00	13380.00	701.00	4.00	100.00	740.00	10.00	5.00
310.	47.00	7.00	3550.00	1120.00	4.00	90.00	390.00	1.10	1.00
311.	4.50	8.00	5540.00	2453.00	4.00	100.00	300.00	1.10	1.00
312.	34.00	10.00	10530.00	2486.00	4.00	120.00	350.00	1.10	1.00
313.	54.00	11.00	8220.00	4903.00	4.00	120.00	360.00	10.00	1.00
314.	32.00	1.00	390.00	3304.00	4.00	90.00	350.00	10.00	1.00
315.	4.50	1.00	340.00	37200.00	4.00	130.00	310.00	50.00	1.00
316.	71.00	20.00	1190.00	5656.00	4.00	80.00	160.00	10.00	1.00
317.	114.00	14.00	3800.00	79.00	4.00	90.00	380.00	1.10	1.00
318.	31.00	3.00	5120.00	247.00	4.00	90.00	270.00	1.10	3.00
319.	4.50	1.00	210.00	3160.00	4.00	90.00	320.00	1.10	1.00
320.	14.00	7.00	980.00	3011.00	4.00	50.00	210.00	1.10	1.00
321.	39.00	9.00	1280.00	3633.00	4.00	40.00	140.00	10.00	1.00
322.	4.50	9.00	780.00	603.00	4.00	30.00	130.00	1.10	1.00
323.	4.50	5.00	2470.00	185.00	4.00	50.00	180.00	1.10	2.00
324.	204.00	7.00	1420.00	468.00	13.00	40.00	330.00	10.00	1.00
325.	56.00	20.00	3690.00	170.00	4.00	100.00	300.00	10.00	1.00
326.	432.00	8.00	7380.00	1589.00	17.00	100.00	210.00	1.10	1.00
327.	4.50	7.00	2610.00	233.00	4.00	90.00	200.00	1.10	1.00
328.	4.50	66.00	9790.00	2043.00	4.00	80.00	190.00	1.10	4.00
329.	4.50	2.00	44840.00	1258.00	4.00	230.00	410.00	1.10	3.00
330.	15.00	1.00	7420.00	1199.00	4.00	90.00	340.00	1.10	1.00
331.	18.00	4.00	5120.00	405.00	4.00	90.00	280.00	1.10	2.00
332.	31.00	9.00	13670.00	4040.00	4.00	110.00	640.00	10.00	4.00
333.	25.00	2.00	13820.00	1674.00	4.00	140.00	400.00	1.10	3.00
334.	4.50	1.00	24010.00	1258.00	4.00	140.00	270.00	1.10	3.00
335.	4.50	2.00	22630.00	1303.00	4.00	170.00	490.00	1.10	4.00
336.	4.50	1.00	28720.00	4486.00	4.00	170.00	670.00	1.10	3.00
337.	4.50	2.00	33000.00	1545.00	4.00	220.00	510.00	1.10	3.00
338.	4.50	1.00	9730.00	573.00	4.00	150.00	330.00	1.10	3.00
339.	94.00	7.00	3240.00	1478.00	4.00	60.00	350.00	1.10	1.00
340.	42.00	7.00	1050.00	14200.00	4.00	120.00	190.00	20.00	1.00

SAMPNUMB	ZNW AAS	CUP XRF	PBP XRF	ZNP XRF	BAP XRF	FEP XRF	MNP XRF	TIP XRF	NIP XRF
469.	0.01	167.00	39.00	76.00	13.50	58780.00	2720.00	46580.00	26.00
470.	0.00	8.00	16.00	77.00	301.00	54060.00	2110.00	25390.00	22.00
471.	0.00	11.00	27.00	87.00	13.50	58400.00	3570.00	34200.00	37.00
472.	0.01	14.00	21.00	90.00	13.50	64400.00	1790.00	27960.00	30.00
473.	0.00	61.00	28.00	130.00	13.50	85280.00	6260.00	74000.00	28.00
474.	0.00	34.00	283.00	141.00	240.00	110000.00	5000.00	48200.00	33.00
475.	0.00	17.00	16.00	124.00	119.00	103690.00	6330.00	75500.00	25.00
476.	0.00	14.00	27.00	145.00	33.00	116500.00	10640.00	135300.00	17.00
477.	0.01	17.00	41.00	135.00	245.00	115980.00	9060.00	106600.00	27.00
478.	0.00	19.00	16.00	90.00	13.50	60150.00	1220.00	19270.00	35.00
479.	0.01	16.00	37.00	182.00	99.00	90610.00	5770.00	49400.00	44.00
481.	0.00	17.00	83.00	138.00	637.00	69530.00	1810.00	22170.00	29.00
482.	0.00	163.00	196.00	1669.00	481.00	80570.00	3530.00	39120.00	42.00
483.	0.01	18.00	31.00	158.00	555.00	84650.00	2580.00	18470.00	43.00
484.	0.01	29.00	27.00	106.00	13.50	69260.00	1000.00	7920.00	45.00
486.	0.01	11.00	33.00	158.00	222.00	120620.00	7420.00	89800.00	23.00
487.	0.00	3.00	16.00	53.00	59.00	40530.00	1130.00	24520.00	15.00
488.	0.00	25.00	78.00	87.00	275.00	82470.00	1180.00	14220.00	34.00
489.	0.00	55.00	174.00	160.00	13.50	104740.00	7450.00	60300.00	73.00
490.	0.00	13.00	64.00	207.00	118.00	141570.00	16150.00	157100.00	27.00
491.	0.00	24.00	34.00	198.00	242.00	119490.00	7220.00	54000.00	34.00
-1.	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00

SAMPNUMB	SNP XRF	ASP XRF	CAP XRF	CEP XRF	SBP XRF	SRP XRF	ZRP XRF	UP XRF	MOP XRF
469.	56.00	2.00	6180.00	7815.00	4.00	180.00	260.00	10.00	4.00
470.	4.50	1.00	4490.00	474.00	4.00	90.00	170.00	1.10	1.00
471.	107.00	7.00	6320.00	19100.00	4.00	160.00	310.00	10.00	1.00
472.	12.00	13.00	1910.00	8093.00	4.00	50.00	170.00	10.00	1.00
473.	65.00	4.00	1990.00	9212.00	4.00	30.00	630.00	10.00	4.00
474.	16.00	8.00	2800.00	686.00	12.00	40.00	310.00	1.10	4.00
475.	10.00	8.00	980.00	844.00	4.00	20.00	420.00	1.10	5.00
476.	4.50	3.00	1090.00	520.00	4.00	10.00	540.00	1.10	6.00
477.	12.00	6.00	790.00	423.00	4.00	40.00	510.00	1.10	6.00
478.	4.50	6.00	350.00	11900.00	4.00	50.00	190.00	20.00	1.00
479.	4.50	7.00	2680.00	6813.00	4.00	70.00	400.00	1.10	3.00
481.	32.00	6.00	1950.00	2540.00	4.00	70.00	180.00	1.10	1.00
482.	48.00	19.00	5640.00	418.00	8.00	90.00	290.00	1.10	3.00
483.	4.50	7.00	1440.00	325.00	4.00	80.00	210.00	1.10	5.00
484.	4.50	5.00	270.00	12600.00	4.00	120.00	190.00	10.00	1.00
485.	4.50	6.00	4160.00	881.00	4.00	60.00	390.00	1.10	4.00
487.	4.50	7.00	5470.00	3346.00	4.00	90.00	180.00	1.10	2.00
488.	4.50	11.00	3290.00	1655.00	4.00	110.00	160.00	1.10	2.00
489.	300.00	8.00	5060.00	16400.00	4.00	80.00	490.00	10.00	2.00
490.	38.00	4.00	2810.00	609.00	4.00	30.00	610.00	1.10	7.00
491.	4.50	5.00	9730.00	411.00	4.00	90.00	290.00	1.10	3.00
-1.	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00

SAMPNUMB	EASTING	NORTHING	CUC AAS	PBC AAS	ZNC AAS	BAC OES	FEC OES	MNC OES	COC OES
165.	20871.	23263.	25.00	40.00	350.00	576.00	75900.00	8820.00	261.00
166.	20912.	23336.	25.00	50.00	470.00	509.00	76400.00	11200.00	232.00
167.	22124.	23570.	15.00	40.00	140.00	508.00	45800.00	1970.00	207.00
168.	22120.	23573.	5.00	20.00	50.00	348.00	34200.00	643.00	21.00
169.	22134.	23697.	15.00	40.00	120.00	387.00	38200.00	1420.00	30.00
170.	20884.	23338.	15.00	40.00	150.00	664.00	46900.00	1090.00	42.00
171.	20910.	23371.	15.00	30.00	140.00	375.00	43600.00	771.00	22.00
172.	20949.	23369.	20.00	40.00	290.00	522.00	73900.00	6630.00	126.00
173.	21000.	23415.	20.00	40.00	270.00	558.00	63900.00	3090.00	63.00
174.	20990.	23448.	20.00	30.00	140.00	509.00	47100.00	833.00	24.00
175.	20976.	23454.	25.00	50.00	210.00	788.00	48700.00	1510.00	59.00
176.	21023.	23482.	20.00	40.00	220.00	585.00	44200.00	1290.00	38.00
177.	20987.	23392.	20.00	40.00	290.00	517.00	61300.00	3440.00	46.00
178.	21018.	23428.	20.00	40.00	180.00	374.00	63200.00	1410.00	38.00
179.	21088.	23315.	20.00	40.00	370.00	630.00	66800.00	8770.00	109.00
180.	22129.	23603.	15.00	40.00	100.00	394.00	39900.00	1320.00	34.00
181.	22116.	23513.	15.00	50.00	100.00	297.00	54700.00	3630.00	101.00
182.	22151.	23599.	15.00	30.00	90.00	387.00	37500.00	961.00	13.00
183.	22218.	23416.	20.00	50.00	160.00	353.00	39200.00	965.00	34.00
184.	22196.	23250.	35.00	90.00	240.00	2980.00	47000.00	1130.00	23.00
185.	21360.	23528.	10.00	40.00	170.00	409.00	41200.00	1240.00	17.00
186.	21331.	23501.	15.00	40.00	180.00	459.00	52300.00	1070.00	18.00
187.	21324.	23594.	10.00	30.00	130.00	1480.00	38200.00	612.00	10.00
188.	21377.	23230.	10.00	40.00	200.00	719.00	68900.00	4880.00	90.00
189.	21378.	23134.	15.00	40.00	370.00	510.00	50000.00	5980.00	53.00
190.	21066.	23423.	10.00	30.00	220.00	574.00	64300.00	4070.00	56.00
191.	21054.	23486.	10.00	30.00	230.00	522.00	55300.00	5170.00	60.00
192.	21318.	23356.	5.00	30.00	150.00	753.00	36100.00	1060.00	30.00
193.	21306.	23430.	10.00	30.00	220.00	809.00	47200.00	1970.00	33.00
194.	21220.	23364.	15.00	40.00	360.00	634.00	69300.00	8550.00	92.00
195.	21203.	23420.	15.00	40.00	280.00	599.00	52300.00	5130.00	60.00
196.	21293.	23475.	15.00	40.00	210.00	543.00	45100.00	760.00	14.00
197.	21189.	23004.	25.00	40.00	150.00	435.00	39700.00	907.00	23.00
198.	21181.	23053.	20.00	40.00	140.00	399.00	43900.00	1950.00	35.00
200.	21374.	23106.	15.00	60.00	280.00	552.00	75800.00	3080.00	29.00
201.	21404.	23060.	15.00	40.00	360.00	409.00	59800.00	7210.00	30.00
202.	21295.	23550.	10.00	40.00	200.00	618.00	35600.00	1350.00	5.00
203.	21304.	23548.	10.00	30.00	140.00	512.00	35900.00	803.00	10.00
204.	21832.	23736.	20.00	40.00	100.00	490.00	41900.00	501.00	12.00
207.	21848.	23722.	15.00	30.00	100.00	452.00	42800.00	589.00	20.00
208.	21772.	23787.	15.00	40.00	120.00	486.00	44600.00	900.00	20.00
209.	20827.	23780.	10.00	30.00	100.00	617.00	31100.00	544.00	47.00
210.	21228.	23309.	10.00	30.00	280.00	480.00	91900.00	2780.00	74.00
211.	21456.	23390.	10.00	40.00	200.00	580.00	41700.00	2180.00	19.00
212.	21419.	23358.	15.00	40.00	510.00	1040.00	67900.00	6670.00	58.00
213.	21502.	23402.	10.00	40.00	100.00	720.00	30900.00	1020.00	16.00
214.	21182.	23422.	15.00	40.00	210.00	643.00	51900.00	4190.00	78.00
215.	21178.	23076.	15.00	40.00	160.00	674.00	52000.00	1780.00	74.00
216.	21370.	23052.	15.00	40.00	200.00	592.00	45100.00	919.00	34.00
217.	21104.	23144.	25.00	40.00	170.00	329.00	50400.00	3550.00	55.00
218.	21080.	23149.	20.00	40.00	120.00	535.00	45200.00	4050.00	58.00
219.	21400.	22844.	20.00	40.00	250.00	652.00	48600.00	2620.00	36.00
220.	21098.	23369.	5.00	30.00	30.00	486.00	46000.00	124.00	5.00
221.	21124.	23433.	15.00	40.00	240.00	644.00	61300.00	2910.00	55.00
222.	21434.	23334.	10.00	40.00	340.00	445.00	57600.00	4220.00	47.00
223.	21434.	23387.	10.00	40.00	110.00	470.00	56400.00	1120.00	23.00

SAMPNUMB	NIC OES	VC OES	CRC OES	BC GES	ZRC OES	ASC XRF	MOC OES	SNC OES	CUW AAS
165.	128.00	138.00	120.00	99.00	217.00	51.00	3.10	2.50	0.00
166.	110.00	153.00	136.00	92.00	213.00	31.00	0.50	2.50	0.00
167.	99.00	141.00	39.00	112.00	387.00	27.00	1.10	2.50	0.00
168.	34.00	101.00	89.00	101.00	454.00	19.00	2.30	2.50	0.00
169.	41.00	113.00	105.00	97.00	440.00	16.00	0.50	2.50	0.00
170.	63.00	149.00	159.00	92.00	202.00	14.00	2.00	2.50	0.00
171.	57.00	116.00	139.00	67.00	317.00	13.00	1.70	2.50	0.00
172.	81.00	147.00	117.00	91.00	221.00	28.00	1.40	2.50	0.00
173.	67.00	147.00	133.00	79.00	241.00	22.00	1.50	2.50	0.00
174.	57.00	149.00	114.00	69.00	303.00	12.00	1.30	2.50	0.01
175.	58.00	136.00	125.00	66.00	325.00	12.00	1.80	2.50	0.01
176.	43.00	115.00	77.00	43.00	354.00	11.00	0.50	6.00	0.01
177.	62.00	153.00	107.00	63.00	190.00	26.00	0.50	2.50	0.00
178.	56.00	163.00	63.00	37.00	245.00	23.00	0.50	2.50	0.01
179.	97.00	117.00	92.00	73.00	191.00	21.00	0.50	2.50	0.01
180.	36.00	113.00	72.00	80.00	355.00	20.00	1.20	2.50	0.01
181.	39.00	107.00	61.00	76.00	301.00	55.00	2.30	2.50	0.01
182.	35.00	111.00	77.00	76.00	381.00	16.00	0.50	2.50	0.01
183.	34.00	99.00	87.00	86.00	412.00	19.00	1.80	2.50	0.01
184.	40.00	154.00	75.00	85.00	394.00	29.00	7.10	15.00	0.01
185.	14.00	85.00	53.00	42.00	417.00	7.00	1.70	2.50	0.08
186.	16.00	82.00	65.00	31.00	683.00	8.00	1.20	2.50	0.01
187.	13.00	94.00	75.00	45.00	481.00	12.00	2.90	2.50	0.01
188.	43.00	119.00	88.00	94.00	276.00	81.00	0.50	2.50	0.02
189.	44.00	108.00	98.00	67.00	228.00	29.00	0.50	2.50	0.01
190.	37.00	108.00	85.00	74.00	197.00	20.00	0.50	2.50	0.01
191.	37.00	112.00	102.00	62.00	267.00	18.00	2.20	2.50	0.01
192.	43.00	107.00	118.00	101.00	223.00	13.00	1.40	2.50	0.01
193.	37.00	100.00	86.00	97.00	208.00	18.00	1.20	2.50	0.01
194.	54.00	123.00	97.00	72.00	272.00	35.00	1.10	2.50	0.01
195.	43.00	115.00	92.00	65.00	263.00	20.00	1.90	2.50	0.01
196.	23.00	111.00	104.00	58.00	318.00	12.00	1.40	2.50	0.00
197.	35.00	117.00	84.00	66.00	335.00	20.00	2.00	18.00	0.01
198.	34.00	105.00	60.00	58.00	251.00	15.00	1.80	2.50	0.00
200.	41.00	117.00	116.00	60.00	182.00	41.00	1.30	2.50	0.01
201.	51.00	121.00	115.00	44.00	206.00	28.00	1.40	2.50	0.01
202.	5.00	14.00	21.00	18.00	620.00	7.00	2.30	2.50	0.01
203.	14.00	54.00	71.00	49.00	571.00	13.00	2.00	2.50	0.01
204.	35.00	148.00	107.00	102.00	329.00	8.00	1.50	2.50	0.01
207.	32.00	147.00	76.00	91.00	353.00	14.00	0.50	2.50	0.01
208.	49.00	130.00	135.00	108.00	448.00	11.00	2.40	6.00	0.01
209.	27.00	76.00	120.00	60.00	827.00	11.00	1.80	18.00	0.01
210.	48.00	93.00	105.00	63.00	183.00	70.00	2.30	6.00	0.01
211.	23.00	89.00	68.00	30.00	532.00	12.00	1.90	8.00	0.01
212.	54.00	120.00	102.00	37.00	331.00	28.00	2.00	5.00	0.01
213.	20.00	51.00	65.00	17.00	521.00	7.00	3.50	2.50	0.01
214.	58.00	135.00	162.00	100.00	231.00	17.00	1.30	2.50	0.01
215.	54.00	121.00	125.00	93.00	257.00	14.00	1.00	2.50	0.00
216.	54.00	125.00	136.00	67.00	281.00	11.00	1.40	2.50	0.01
217.	56.00	125.00	98.00	46.00	276.00	23.00	1.00	2.50	0.00
218.	55.00	93.00	106.00	77.00	202.00	28.00	2.90	2.50	0.01
219.	50.00	123.00	146.00	73.00	249.00	12.00	1.60	5.00	0.01
220.	36.00	124.00	111.00	72.00	270.00	2.00	0.50	2.50	0.00
221.	71.00	124.00	144.00	82.00	169.00	25.00	3.10	2.50	0.01
222.	65.00	157.00	121.00	52.00	225.00	24.00	2.40	2.50	0.00
223.	45.00	128.00	95.00	46.00	246.00	25.00	1.70	2.50	0.01

SAMPNUMB	ZNW AAS	CUP XRF	PBT XRF	ZNP XRF	BAP XRF	FEP XRF	MNP XRF	TIP XRF	NIP XRF
165.	0.01	13.00	23.00	195.00	537.00	80150.00	1550.00	15200.00	47.00
166.	0.00	21.00	26.00	220.00	470.00	83420.00	2020.00	22700.00	48.00
167.	0.00	25.00	26.00	138.00	13.50	54840.00	680.00	6050.00	56.00
168.	0.00	8.00	10.00	124.00	13.50	56310.00	420.00	6180.00	43.00
169.	0.00	16.00	29.00	135.00	13.50	53290.00	770.00	5890.00	53.00
170.	0.00	14.00	41.00	135.00	304.00	95400.00	6400.00	83700.00	48.00
171.	0.00	28.00	32.00	190.00	573.00	91270.00	1450.00	33010.00	58.00
172.	0.00	22.00	30.00	189.00	362.00	92180.00	3560.00	36200.00	47.00
173.	0.00	17.00	27.00	191.00	346.00	92280.00	3200.00	35200.00	47.00
174.	0.00	20.00	36.00	161.00	425.00	89950.00	3650.00	49700.00	53.00
175.	0.00	28.00	94.00	221.00	616.00	91360.00	2370.00	45470.00	40.00
176.	0.00	24.00	73.00	205.00	582.00	83980.00	1630.00	32280.00	37.00
177.	0.00	16.00	49.00	189.00	147.00	101760.00	6070.00	61300.00	45.00
178.	0.01	18.00	39.00	139.00	13.50	116720.00	17650.00	138600.00	35.00
179.	0.00	9.00	61.00	160.00	636.00	71540.00	1160.00	10278.00	46.00
180.	0.00	19.00	29.00	136.00	13.50	50460.00	720.00	6240.00	62.00
181.	0.01	11.00	6.50	123.00	13.50	52030.00	490.00	6470.00	52.00
182.	0.00	14.00	6.50	124.00	13.50	56310.00	600.00	6260.00	51.00
183.	0.00	18.00	47.00	129.00	97.00	63270.00	510.00	6310.00	44.00
184.	0.00	354.00	668.00	301.00	968.00	103610.00	3010.00	6960.00	56.00
185.	0.04	29.00	103.00	107.00	171.00	56690.00	580.00	13420.00	10.00
186.	0.00	94.00	209.00	120.00	149.00	65120.00	920.00	15650.00	21.00
187.	0.22	54.00	73.00	95.00	198.00	45440.00	760.00	17210.00	18.00
188.	0.00	9.00	29.00	125.00	709.00	55290.00	840.00	12230.00	38.00
189.	0.00	11.00	26.00	136.00	734.00	66510.00	1160.00	18000.00	47.00
190.	0.00	10.00	37.00	156.00	100.00	81220.00	2280.00	35090.00	42.00
191.	0.00	9.00	24.00	122.00	150.00	64790.00	1860.00	34970.00	41.00
192.	0.00	3.00	30.00	128.00	606.00	52180.00	930.00	19800.00	34.00
193.	0.00	9.00	24.00	178.00	591.00	64920.00	1040.00	15480.00	34.00
194.	0.00	14.00	39.00	183.00	257.00	68720.00	1400.00	12310.00	47.00
195.	0.00	9.00	17.00	132.00	13.50	53800.00	940.00	12230.00	52.00
196.	0.00	9.00	30.00	116.00	255.00	64830.00	1280.00	35750.00	23.00
197.	0.00	17.00	21.00	140.00	13.50	74640.00	2650.00	33520.00	51.00
198.	0.00	17.00	32.00	150.00	125.00	78370.00	2470.00	25910.00	51.00
200.	0.00	9.00	53.00	155.00	182.00	90450.00	2330.00	48300.00	52.00
201.	0.00	42.00	38.00	131.00	111.00	70150.00	2080.00	49080.00	54.00
202.	0.00	3.00	68.00	71.00	151.00	32740.00	500.00	11300.00	11.00
203.	0.02	6.00	25.00	123.00	457.00	55210.00	680.00	15270.00	14.00
204.	0.00	13.00	6.50	79.00	13.50	41950.00	350.00	4440.00	36.00
207.	0.01	8.00	6.50	67.00	13.50	38880.00	320.00	3570.00	46.00
208.	0.02	9.00	21.00	59.00	13.50	24970.00	420.00	3480.00	43.00
209.	0.01	3.00	6.50	32.00	13.50	25180.00	1260.00	7340.00	22.00
210.	0.01	10.00	37.00	179.00	494.00	87350.00	910.00	12690.00	40.00
211.	0.00	10.00	38.00	184.00	345.00	62620.00	1160.00	19290.00	25.00
212.	0.00	8.00	30.00	158.00	326.00	57290.00	1040.00	18190.00	24.00
213.	0.01	6.00	41.00	130.00	353.00	37350.00	350.00	7560.00	13.00
214.	0.00	22.00	30.00	163.00	428.00	80710.00	1070.00	17900.00	49.00
215.	0.00	19.00	28.00	146.00	434.00	76070.00	1030.00	16560.00	46.00
216.	0.01	11.00	29.00	116.00	214.00	60290.00	1370.00	35660.00	32.00
217.	0.00	42.00	33.00	171.00	146.00	95110.00	10210.00	18000.00	68.00
218.	0.00	16.00	22.00	133.00	455.00	79750.00	3720.00	8960.00	56.00
219.	0.00	18.00	73.00	145.00	332.00	70630.00	1390.00	30240.00	32.00
220.	0.00	10.00	36.00	35.00	243.00	32470.00	690.00	30690.00	24.00
221.	0.00	8.00	42.00	138.00	339.00	75050.00	1180.00	20980.00	43.00
222.	0.00	3.00	49.00	149.00	201.00	59820.00	1490.00	29970.00	21.00
223.	0.00	6.00	26.00	107.00	243.00	68520.00	1070.00	23970.00	21.00

SAMPNUMB	EASTING	NORTHING	CUC AAS	PBC AAS	ZNC AAS	BAC OES	FEC OES	MNC OES	COC OES
341.	20379.	23402.	25.00	20.00	230.00	590.00	55900.00	4970.00	52.00
342.	20372.	23399.	30.00	60.00	290.00	552.00	55600.00	4570.00	27.00
343.	20370.	23403.	25.00	40.00	300.00	526.00	50900.00	7170.00	52.00
344.	20574.	23259.	20.00	20.00	130.00	458.00	49900.00	1790.00	15.00
345.	20554.	23222.	20.00	20.00	220.00	531.00	47900.00	6810.00	38.00
346.	20496.	23293.	25.00	30.00	260.00	508.00	63400.00	9610.00	71.00
347.	20500.	23326.	25.00	20.00	170.00	541.00	49100.00	3820.00	50.00
348.	21306.	22834.	25.00	30.00	180.00	606.00	42600.00	730.00	11.00
349.	21275.	22798.	20.00	20.00	80.00	527.00	38500.00	481.00	5.00
350.	21056.	23642.	5.00	40.00	150.00	416.00	38700.00	1000.00	5.00
351.	21199.	23670.	10.00	50.00	140.00	561.00	25300.00	2360.00	5.00
352.	21316.	23644.	10.00	30.00	110.00	1200.00	41500.00	603.00	5.00
353.	21614.	23546.	20.00	60.00	160.00	1190.00	42500.00	891.00	12.00
354.	21544.	22921.	20.00	20.00	80.00	365.00	36300.00	545.00	15.00
355.	21428.	22852.	20.00	30.00	180.00	580.00	46700.00	1340.00	19.00
356.	21559.	22853.	20.00	30.00	160.00	525.00	52000.00	1480.00	30.00
357.	21625.	22918.	20.00	20.00	90.00	408.00	46200.00	699.00	11.00
358.	21653.	22937.	25.00	40.00	200.00	570.00	58600.00	2620.00	55.00
359.	21667.	23005.	25.00	40.00	170.00	600.00	64100.00	2570.00	41.00
360.	20468.	23354.	30.00	50.00	80.00	447.00	52800.00	4110.00	23.00
362.	21441.	22842.	20.00	30.00	150.00	454.00	43600.00	1200.00	22.00
363.	21034.	22853.	50.00	100.00	130.00	578.00	42300.00	743.00	29.00
364.	21018.	22862.	25.00	40.00	110.00	639.00	40800.00	618.00	14.00
365.	20946.	22859.	25.00	30.00	140.00	363.00	71600.00	3710.00	53.00
366.	20849.	22816.	20.00	40.00	200.00	493.00	45500.00	3530.00	36.00
368.	20348.	23794.	50.00	30.00	130.00	445.00	37400.00	794.00	14.00
369.	20349.	23772.	5.00	20.00	50.00	416.00	22100.00	548.00	5.00
370.	20870.	22928.	20.00	40.00	150.00	508.00	42800.00	6800.00	51.00
371.	20968.	22938.	15.00	30.00	100.00	501.00	41600.00	2160.00	16.00
372.	20989.	22966.	20.00	30.00	130.00	519.00	42400.00	950.00	20.00
373.	20435.	23934.	25.00	50.00	120.00	432.00	37300.00	990.00	12.00
374.	20399.	23936.	20.00	30.00	120.00	392.00	37900.00	755.00	13.00
375.	20344.	23913.	20.00	30.00	110.00	518.00	35700.00	1120.00	13.00
376.	20342.	23905.	25.00	50.00	150.00	516.00	35500.00	2020.00	14.00
377.	20192.	23873.	15.00	30.00	110.00	541.00	24100.00	1090.00	5.00
378.	20262.	23874.	20.00	60.00	120.00	415.00	27600.00	788.00	5.00
379.	20230.	23875.	35.00	110.00	150.00	443.00	35300.00	987.00	11.00
381.	20752.	23836.	15.00	30.00	210.00	414.00	40700.00	1490.00	18.00
382.	20748.	23887.	15.00	30.00	140.00	446.00	34200.00	904.00	12.00
383.	20739.	23928.	15.00	30.00	120.00	571.00	34200.00	2520.00	5.00
384.	20430.	23796.	25.00	20.00	240.00	391.00	69100.00	3260.00	47.00
385.	20374.	23734.	15.00	30.00	210.00	473.00	64400.00	3500.00	54.00
386.	20248.	23715.	15.00	20.00	150.00	439.00	26100.00	819.00	11.00
387.	20264.	23829.	15.00	30.00	120.00	348.00	33600.00	1070.00	10.00
389.	21016.	22875.	20.00	30.00	70.00	858.00	37300.00	508.00	5.00
390.	20355.	23776.	15.00	20.00	100.00	649.00	37400.00	732.00	13.00
391.	20348.	23856.	15.00	30.00	140.00	770.00	33300.00	2380.00	5.00
392.	20394.	23860.	20.00	30.00	160.00	592.00	47200.00	1380.00	15.00
393.	20228.	23792.	20.00	30.00	120.00	330.00	36200.00	846.00	13.00
394.	19972.	23818.	15.00	40.00	110.00	534.00	33500.00	1840.00	12.00
395.	20015.	23837.	30.00	90.00	180.00	474.00	25900.00	953.00	5.00
396.	20024.	23844.	45.00	340.00	280.00	1290.00	40200.00	1300.00	25.00
398.	20247.	23283.	35.00	70.00	270.00	611.00	48200.00	4190.00	67.00
399.	20254.	23275.	10.00	30.00	150.00	554.00	57900.00	5350.00	20.00
400.	21844.	22882.	20.00	30.00	90.00	299.00	38300.00	640.00	12.00
401.	21869.	23032.	25.00	30.00	120.00	493.00	51000.00	1060.00	28.00

SAMPNUM3	ZNW AAS	CUP XRF	PBP XRF	ZNP XRF	BAP XRF	FEP XRF	MNP XRF	TIP XRF	NIP XRF
341.	0.14	33.00	49.00	263.00	13.50	78560.00	2300.00	16810.00	64.00
342.	0.00	23.00	277.00	512.00	475.00	97770.00	3310.00	27520.00	46.00
343.	0.00	48.00	279.00	322.00	434.00	102430.00	4680.00	36500.00	57.00
344.	0.01	21.00	34.00	148.00	384.00	95690.00	2360.00	16680.00	59.00
345.	0.01	21.00	44.00	188.00	545.00	86300.00	2970.00	32140.00	54.00
346.	0.02	19.00	30.00	206.00	556.00	89250.00	3960.00	22690.00	56.00
347.	0.01	29.00	42.00	170.00	459.00	90360.00	2470.00	20530.00	52.00
348.	0.01	17.00	93.00	149.00	357.00	67110.00	1160.00	37250.00	35.00
349.	0.02	31.00	52.00	152.00	408.00	66300.00	620.00	14590.00	23.00
350.	0.00	38.00	291.00	191.00	119.00	74440.00	700.00	6460.00	23.00
351.	0.03	3.00	1163.00	141.00	501.00	46290.00	610.00	3240.00	8.00
352.	0.02	3.00	42.00	95.00	351.00	53610.00	420.00	10650.00	13.00
353.	0.01	21.00	116.00	197.00	896.00	72830.00	580.00	9700.00	35.00
354.	0.01	30.00	19.00	147.00	528.00	91840.00	730.00	11510.00	58.00
355.	0.01	19.00	78.00	146.00	390.00	73950.00	980.00	21850.00	34.00
356.	0.05	21.00	36.00	156.00	456.00	83130.00	1060.00	18830.00	38.00
357.	0.01	20.00	42.00	128.00	728.00	77480.00	580.00	10450.00	38.00
358.	0.01	23.00	39.00	184.00	694.00	87230.00	930.00	11150.00	42.00
359.	0.01	53.00	61.00	240.00	702.00	114220.00	970.00	10970.00	57.00
360.	0.01	26.00	75.00	327.00	321.00	101160.00	3260.00	43530.00	52.00
362.	0.01	110.00	52.00	161.00	378.00	77290.00	1540.00	39030.00	39.00
363.	0.01	91.00	1021.00	135.00	433.00	104770.00	1040.00	15330.00	36.00
364.	0.01	311.00	297.00	178.00	246.00	95450.00	3320.00	50400.00	39.00
365.	0.01	16.00	30.00	116.00	63.00	86740.00	5710.00	88400.00	25.00
366.	0.01	8.00	58.00	114.00	13.50	71140.00	3780.00	52200.00	27.00
368.	0.00	27.00	37.00	135.00	87.00	97430.00	4460.00	65600.00	27.00
369.	0.00	9.00	31.00	105.00	13.50	86430.00	6090.00	93400.00	22.00
370.	0.00	26.00	49.00	141.00	597.00	82710.00	1940.00	7590.00	42.00
371.	0.00	12.00	38.00	155.00	128.00	96380.00	4980.00	58900.00	34.00
372.	0.01	34.00	43.00	186.00	549.00	93170.00	1280.00	33210.00	53.00
373.	0.00	13.00	267.00	39.00	28.00	59560.00	480.00	4570.00	15.00
374.	0.01	9.00	119.00	32.00	55.00	36020.00	580.00	6360.00	10.00
375.	0.01	12.00	37.00	85.00	87.00	74010.00	2620.00	41800.00	16.00
376.	0.00	243.00	116.00	64.00	55.00	61650.00	920.00	13260.00	14.00
377.	0.00	3.00	30.00	34.00	13.50	26790.00	780.00	9450.00	10.00
378.	0.00	15.00	119.00	89.00	75.00	50730.00	1580.00	34150.00	16.00
379.	0.03	72.00	1000.00	529.00	98.00	85100.00	1240.00	7040.00	28.00
381.	0.00	6.00	17.00	101.00	204.00	44840.00	540.00	8560.00	17.00
382.	0.02	9.00	51.00	101.00	169.00	51260.00	740.00	10610.00	22.00
383.	0.00	7.00	26.00	45.00	13.50	28420.00	770.00	3660.00	13.00
384.	0.01	31.00	58.00	193.00	577.00	118560.00	1310.00	16600.00	39.00
385.	0.00	14.00	32.00	174.00	13.50	114180.00	8970.00	120700.00	31.00
386.	0.00	15.00	40.00	184.00	13.50	92360.00	6930.00	92100.00	39.00
387.	0.01	12.00	23.00	100.00	254.00	51970.00	690.00	14870.00	22.00
389.	0.01	48.00	46.00	134.00	706.00	105220.00	480.00	10560.00	35.00
390.	0.00	17.00	37.00	166.00	42.00	116280.00	6770.00	92700.00	31.00
391.	0.01	6.00	23.00	77.00	55.00	51110.00	2320.00	35400.00	17.00
392.	0.01	16.00	35.00	116.00	154.00	93100.00	2970.00	45600.00	22.00
393.	0.00	14.00	23.00	106.00	123.00	67130.00	920.00	19660.00	26.00
394.	0.00	8.00	76.00	52.00	31.00	66430.00	1050.00	14910.00	14.00
395.	0.01	13.00	349.00	94.00	152.00	56030.00	650.00	8520.00	16.00
396.	0.00	361.00	467.00	141.00	273.00	104580.00	1130.00	5570.00	30.00
398.	0.00	38.00	63.00	470.00	177.00	132700.00	13510.00	140000.00	48.00
399.	0.01	3.00	25.00	174.00	13.50	163400.00	18840.00	241000.00	5.00
400.	0.00	28.00	36.00	139.00	737.00	85170.00	620.00	11070.00	41.00
401.	0.01	27.00	36.00	149.00	591.00	92210.00	800.00	13490.00	45.00

SAMPNUMB	NIC OES	VC OES	CRC OES	BC OES	ZRC OES	ASC XRF	MOC OES	SNC OES	CUW AAS
341.	72.00	112.00	99.00	120.00	182.00	14.00	0.50	7.00	0.01
342.	54.00	132.00	76.00	71.00	181.00	15.00	0.50	14.00	0.00
343.	66.00	111.00	76.00	72.00	177.00	19.00	0.50	7.00	0.00
344.	55.00	119.00	133.00	69.00	168.00	10.00	0.50	7.00	0.01
345.	68.00	125.00	76.00	72.00	244.00	21.00	0.50	2.50	0.01
346.	80.00	145.00	71.00	65.00	223.00	23.00	0.50	5.00	0.01
347.	60.00	117.00	102.00	75.00	234.00	14.00	0.50	2.50	0.00
348.	39.00	126.00	103.00	84.00	201.00	6.00	0.50	2.50	0.01
349.	26.00	95.00	91.00	76.00	379.00	6.00	0.50	2.50	.01
350.	5.00	28.00	25.00	13.00	415.00	7.00	0.50	13.00	.00
351.	10.00	31.00	39.00	45.00	805.00	11.00	0.50	12.00	0.01
352.	15.00	87.00	62.00	62.00	338.00	20.00	2.00	11.00	0.00
353.	28.00	125.00	61.00	60.00	331.00	12.00	1.60	9.00	0.00
354.	46.00	119.00	191.00	47.00	623.00	4.00	0.50	2.50	0.01
355.	27.00	137.00	87.00	52.00	296.00	11.00	0.50	9.00	0.00
356.	48.00	154.00	102.00	66.00	274.00	9.00	0.50	2.50	0.00
357.	40.00	140.00	84.00	61.00	226.00	5.00	0.50	2.50	0.01
358.	49.00	153.00	96.00	63.00	264.00	22.00	0.50	2.50	0.01
359.	64.00	207.00	167.00	57.00	300.00	14.00	0.50	2.50	0.01
360.	47.00	120.00	90.00	68.00	237.00	16.00	0.50	2.50	0.00
362.	43.00	121.00	72.00	61.00	222.00	8.00	0.50	20.00	0.01
363.	45.00	106.00	117.00	90.00	314.00	9.00	1.80	13.00	0.00
364.	77.00	93.00	79.00	107.00	190.00	9.00	0.50	55.00	0.01
365.	65.00	156.00	103.00	64.00	308.00	18.00	0.50	2.50	0.00
366.	49.00	88.00	63.00	86.00	233.00	20.00	0.50	2.50	0.01
368.	35.00	109.00	62.00	78.00	362.00	10.00	0.50	2.50	0.00
369.	20.00	86.00	52.00	56.00	288.00	4.00	0.50	2.50	0.00
370.	40.00	91.00	63.00	82.00	148.00	23.00	0.50	2.50	0.00
371.	45.00	129.00	58.00	81.00	203.00	9.00	0.50	2.50	0.01
372.	39.00	120.00	88.00	124.00	272.00	12.00	0.50	2.50	0.00
373.	35.00	97.00	92.00	92.00	400.00	14.00	0.50	13.00	0.00
374.	31.00	97.00	78.00	75.00	464.00	11.00	0.50	2.50	0.01
375.	32.00	94.00	96.00	74.00	709.00	12.00	1.40	2.50	0.00
376.	33.00	84.00	63.00	85.00	410.00	14.00	1.20	22.00	0.00
377.	5.00	61.00	58.00	76.00	981.00	12.00	0.50	74.00	0.00
378.	33.00	80.00	69.00	76.00	657.00	11.00	0.50	20.00	0.01
379.	38.00	92.00	77.00	91.00	309.00	17.00	0.50	23.00	0.01
381.	38.00	111.00	53.00	63.00	410.00	12.00	0.50	19.00	0.01
382.	30.00	87.00	79.00	69.00	708.00	12.00	0.50	2.50	0.01
383.	26.00	84.00	67.00	65.00	634.00	10.00	0.50	2.50	0.01
384.	57.00	166.00	101.00	35.00	283.00	14.00	0.50	8.00	0.01
385.	56.00	136.00	70.00	66.00	253.00	14.00	0.50	9.00	0.00
386.	15.00	83.00	72.00	69.00	245.00	7.00	0.50	2.50	0.30
387.	28.00	84.00	90.00	58.00	322.00	12.00	0.50	2.50	0.01
389.	19.00	127.00	77.00	75.00	286.00	10.00	0.50	2.50	0.01
390.	36.00	128.00	73.00	86.00	374.00	8.00	0.50	2.50	0.00
391.	21.00	82.00	68.00	55.00	345.00	9.00	0.50	2.50	0.01
392.	32.00	104.00	81.00	53.00	309.00	11.00	0.50	2.50	0.00
393.	31.00	92.00	96.00	63.00	399.00	22.00	0.50	2.50	0.01
394.	23.00	92.00	91.00	89.00	374.00	10.00	1.50	19.00	0.01
395.	24.00	56.00	62.00	56.00	551.00	11.00	0.50	22.00	0.01
396.	69.00	93.00	95.00	73.00	379.00	15.00	2.90	13.00	0.01
398.	61.00	136.00	80.00	64.00	207.00	12.00	0.50	2.50	0.01
399.	22.00	198.00	57.00	78.00	197.00	16.00	0.50	2.50	0.01
400.	22.00	86.00	85.00	88.00	224.00	9.00	0.50	2.50	0.00
401.	43.00	149.00	95.00	55.00	235.00	6.00	0.50	2.50	0.01

SAMPNUMB	SNP XRF	ASP XRF	CAP XRF	CEP XRF	SBP XRF	SRP XRF	ZRP XRF	UP XRF	MOP XRF
165.	4.50	4.00	1810.00	63.00	4.00	80.00	200.00	1.10	2.00
166.	4.50	3.00	6520.00	90.00	4.00	120.00	230.00	1.10	1.00
167.	56.00	13.00	440.00	24700.00	4.00	120.00	280.00	40.00	1.00
168.	13.00	1.00	200.00	11800.00	4.00	100.00	280.00	10.00	1.00
169.	31.00	5.00	440.00	23700.00	4.00	120.00	250.00	30.00	1.00
170.	4.50	3.00	12330.00	263.00	4.00	130.00	580.00	1.10	3.00
171.	4.50	5.00	4260.00	107.00	4.00	100.00	280.00	1.10	1.00
172.	4.50	4.00	12750.00	212.00	4.00	170.00	350.00	1.10	1.00
173.	24.00	3.00	9750.00	973.00	4.00	140.00	330.00	1.10	4.00
174.	4.50	2.00	9510.00	289.00	4.00	140.00	440.00	10.00	2.00
175.	38.00	6.00	3170.00	346.00	4.00	80.00	370.00	1.10	2.00
176.	27.00	3.00	3370.00	197.00	4.00	90.00	380.00	1.10	1.00
177.	11.00	8.00	9470.00	1321.00	4.00	120.00	450.00	1.10	3.00
178.	14.00	1.00	12530.00	3318.00	4.00	130.00	780.00	1.10	4.00
179.	4.50	1.00	860.00	44.00	4.00	100.00	220.00	1.10	1.00
180.	29.00	2.00	240.00	32700.00	4.00	130.00	280.00	50.00	1.00
181.	4.50	1.00	210.00	21700.00	4.00	120.00	280.00	30.00	1.00
182.	4.50	5.00	440.00	17800.00	4.00	120.00	260.00	20.00	1.00
183.	38.00	6.00	880.00	8698.00	4.60	100.00	250.00	10.00	1.00
184.	291.00	29.00	1800.00	6123.00	9.00	90.00	180.00	20.00	7.00
185.	157.00	1.00	7000.00	1179.00	4.00	90.00	800.00	1.10	2.00
186.	119.00	5.00	10610.00	1213.00	4.00	130.00	950.00	1.10	4.00
187.	73.00	10.00	9150.00	3057.00	4.00	120.00	660.00	1.10	1.00
188.	13.00	9.00	4850.00	610.00	4.00	120.00	310.00	1.10	1.00
189.	4.50	3.00	17400.00	6211.00	4.00	190.00	280.00	10.00	1.00
190.	4.50	6.00	9330.00	336.00	4.00	130.00	270.00	1.10	1.00
191.	4.50	4.00	16690.00	3024.00	8.00	150.00	280.00	10.00	3.00
192.	4.50	1.00	9400.00	361.00	4.00	160.00	300.00	1.10	1.00
193.	4.50	10.00	9890.00	194.00	4.00	160.00	280.00	1.10	1.00
194.	4.50	6.00	5530.00	5356.00	9.00	110.00	180.00	1.10	1.00
195.	4.50	2.00	7470.00	20600.00	4.00	100.00	260.00	20.00	1.00
196.	4.50	7.00	16990.00	670.00	4.00	180.00	990.00	10.00	1.00
197.	4.50	4.00	3640.00	12800.00	4.00	100.00	280.00	10.00	1.00
198.	4.50	4.00	3900.00	9063.00	4.00	100.00	240.00	10.00	1.00
200.	4.50	11.00	33820.00	463.00	4.00	200.00	380.00	1.10	1.00
201.	4.50	4.00	36620.00	1173.00	4.00	220.00	330.00	1.10	1.00
202.	29.00	6.00	7670.00	1605.00	4.00	110.00	890.00	1.10	1.00
203.	13.00	1.00	6240.00	491.00	4.00	120.00	630.00	10.00	1.00
204.	4.50	12.00	510.00	15900.00	4.00	90.00	190.00	20.00	1.00
207.	52.00	7.00	550.00	32600.00	4.00	90.00	210.00	40.00	1.00
208.	94.00	5.00	790.00	33200.00	4.00	90.00	240.00	40.00	1.00
209.	67.00	8.00	3790.00	8816.00	4.00	50.00	2080.00	10.00	1.00
210.	4.50	19.00	4010.00	360.00	4.00	90.00	180.00	1.10	1.00
211.	4.50	1.00	15000.00	423.00	4.00	230.00	420.00	1.10	1.00
212.	4.50	2.00	13940.00	482.00	4.00	220.00	680.00	1.10	1.00
213.	68.00	1.00	2060.00	84.00	4.00	100.00	1780.00	1.10	1.00
214.	4.50	4.00	4570.00	1173.00	4.00	110.00	220.00	1.10	1.00
215.	30.00	1.00	5130.00	1240.00	4.00	110.00	200.00	1.10	2.00
216.	4.50	1.00	22180.00	664.00	4.00	200.00	510.00	1.10	1.00
217.	4.50	9.00	1150.00	15200.00	4.00	100.00	200.00	10.00	2.00
218.	10.00	5.00	350.00	6618.00	4.00	100.00	190.00	10.00	1.00
219.	74.00	1.00	12570.00	323.00	4.00	140.00	430.00	1.10	1.00
220.	4.50	1.00	14840.00	48.00	4.00	100.00	240.00	1.10	2.00
221.	4.50	4.00	12520.00	271.00	4.00	120.00	190.00	10.00	4.00
222.	4.50	1.00	18990.00	272.00	4.00	260.00	230.00	1.10	1.00
223.	4.50	8.00	22290.00	283.00	4.00	300.00	220.00	1.10	1.00

SAMPNUMB	EASTING	NORTHING	CUC AAS	PBC AAS	ZNC AAS	BAC OES	FEC OES	MNC OES	COC OES
224.	21430.	23445.	10.00	30.00	170.00	397.00	47800.00	1050.00	27.00
225.	21134.	23106.	25.00	40.00	180.00	581.00	47700.00	3010.00	45.00
226.	21160.	23077.	25.00	40.00	180.00	655.00	50000.00	4070.00	54.00
227.	21413.	23047.	10.00	40.00	230.00	500.00	43900.00	1070.00	35.00
228.	21180.	23139.	30.00	50.00	180.00	454.00	65500.00	2630.00	85.00
229.	21188.	23144.	25.00	40.00	140.00	419.00	53400.00	2470.00	64.00
230.	21256.	23542.	10.00	30.00	130.00	564.00	33000.00	772.00	5.00
231.	21261.	23538.	15.00	40.00	180.00	566.00	39400.00	1230.00	13.00
232.	21354.	23569.	10.00	30.00	120.00	1550.00	39000.00	599.00	5.00
233.	21305.	23169.	15.00	30.00	120.00	580.00	51300.00	3050.00	67.00
234.	21378.	23177.	15.00	40.00	660.00	583.00	85600.00	17500.00	125.00
235.	21404.	23086.	15.00	40.00	270.00	552.00	58500.00	7820.00	75.00
236.	21312.	23534.	15.00	40.00	180.00	826.00	49100.00	2420.00	16.00
237.	21800.	23492.	30.00	50.00	120.00	424.00	44400.00	1080.00	11.00
238.	21837.	23560.	10.00	20.00	90.00	644.00	43400.00	1420.00	5.00
239.	21740.	23550.	30.00	40.00	140.00	620.00	43800.00	1160.00	12.00
240.	21231.	22988.	20.00	20.00	120.00	741.00	52000.00	1630.00	23.00
241.	21230.	22954.	20.00	30.00	180.00	589.00	49300.00	3470.00	39.00
242.	21254.	22891.	15.00	30.00	190.00	648.00	53300.00	4750.00	56.00
243.	21292.	22853.	20.00	30.00	240.00	573.00	52700.00	3210.00	61.00
245.	21440.	22899.	15.00	40.00	190.00	515.00	48400.00	1450.00	28.00
246.	21524.	22842.	20.00	30.00	130.00	412.00	43900.00	1220.00	27.00
247.	21499.	23070.	15.00	40.00	110.00	704.00	39400.00	650.00	12.00
248.	20736.	23298.	15.00	50.00	230.00	545.00	62800.00	3240.00	59.00
249.	20730.	23374.	25.00	40.00	220.00	503.00	61700.00	5620.00	64.00
251.	21815.	23677.	25.00	70.00	100.00	409.00	40800.00	481.00	10.00
252.	21818.	23061.	20.00	30.00	110.00	435.00	45100.00	881.00	14.00
253.	21493.	23697.	15.00	30.00	140.00	474.00	49700.00	2680.00	32.00
255.	20859.	23793.	10.00	30.00	130.00	525.00	34800.00	1420.00	13.00
256.	20920.	23794.	5.00	20.00	130.00	433.00	28400.00	1910.00	5.00
257.	20930.	23720.	10.00	30.00	90.00	499.00	31200.00	794.00	10.00
258.	21273.	23936.	25.00	50.00	130.00	619.00	43200.00	2870.00	36.00
259.	21227.	23932.	15.00	30.00	110.00	419.00	43400.00	1090.00	13.00
260.	21445.	23036.	15.00	70.00	210.00	620.00	51300.00	2760.00	25.00
261.	21497.	23108.	20.00	60.00	200.00	737.00	53100.00	1590.00	20.00
262.	20774.	23370.	15.00	60.00	390.00	581.00	76800.00	4420.00	56.00
263.	20746.	23389.	25.00	60.00	350.00	569.00	61900.00	5050.00	83.00
264.	20701.	23401.	25.00	40.00	360.00	428.00	71200.00	5540.00	48.00
265.	20660.	23416.	25.00	60.00	200.00	404.00	52800.00	3420.00	29.00
266.	20629.	23422.	25.00	60.00	260.00	367.00	49500.00	1860.00	38.00
267.	20773.	23083.	35.00	50.00	260.00	466.00	52200.00	8760.00	77.00
268.	20738.	23063.	30.00	50.00	290.00	515.00	66800.00	13400.00	92.00
269.	20709.	23042.	30.00	50.00	230.00	466.00	59500.00	13100.00	111.00
270.	21448.	22952.	20.00	60.00	170.00	613.00	48400.00	3050.00	29.00
271.	21437.	22821.	25.00	40.00	190.00	600.00	59400.00	1940.00	35.00
272.	21445.	23012.	15.00	40.00	210.00	656.00	48600.00	1400.00	21.00
273.	20744.	23290.	15.00	40.00	400.00	552.00	68500.00	13200.00	118.00
274.	20754.	23342.	45.00	40.00	260.00	359.00	78700.00	9070.00	138.00
275.	20697.	23387.	25.00	40.00	230.00	446.00	63000.00	2620.00	63.00
276.	20718.	23161.	40.00	50.00	210.00	422.00	63500.00	3149.00	56.00
277.	20728.	23134.	30.00	40.00	160.00	398.00	58000.00	1960.00	40.00
278.	20729.	23098.	35.00	40.00	260.00	519.00	70100.00	4500.00	60.00
279.	21371.	23910.	15.00	30.00	100.00	365.00	41400.00	901.00	16.00
280.	20697.	23374.	10.00	40.00	230.00	728.00	67900.00	5690.00	58.00
281.	20810.	23158.	20.00	50.00	160.00	539.00	52900.00	7770.00	77.00
282.	20830.	23160.	20.00	40.00	140.00	618.00	58500.00	12000.00	82.00

SAMPNUMB	SNP XRF	ASP XRF	CAP XRF	CEP XRF	SBP XRF	SRP XRF	ZRP XRF	UP XRF	MOP XRF
341.	96.00	8.00	6290.00	21100.00	4.00	110.00	200.00	20.00	1.00
342.	55.00	8.00	2000.00	470.00	4.00	70.00	240.00	1.10	1.00
343.	239.00	11.00	2450.00	1091.00	4.00	70.00	270.00	1.10	1.00
344.	4.50	5.00	8690.00	92.00	4.00	100.00	270.00	1.10	1.00
345.	4.50	5.00	2960.00	131.00	4.00	90.00	290.00	1.10	2.00
346.	4.50	6.00	2010.00	138.00	4.00	80.00	240.00	1.10	1.00
347.	4.50	8.00	3060.00	241.00	4.00	80.00	210.00	10.00	1.00
348.	9.00	1.00	7480.00	918.00	4.00	110.00	290.00	10.00	2.00
349.	15.00	19.00	4040.00	149.00	4.00	80.00	260.00	1.10	1.00
350.	138.00	16.00	1970.00	1005.00	12.00	90.00	750.00	1.10	4.00
351.	4.50	4.00	1190.00	153.00	86.00	70.00	470.00	1.10	2.00
352.	4.50	5.00	7940.00	1505.00	4.00	120.00	350.00	10.00	1.00
353.	4.50	7.00	2070.00	2016.00	4.00	100.00	1260.00	10.00	1.00
354.	4.50	1.00	1960.00	77.00	4.00	80.00	160.00	1.10	2.00
355.	67.00	4.00	10400.00	549.00	4.00	120.00	230.00	1.10	1.00
356.	9.00	1.00	3390.00	119.00	4.00	90.00	200.00	1.10	1.00
357.	4.50	1.00	1210.00	57.00	4.00	70.00	190.00	1.10	1.00
358.	4.50	3.00	1930.00	61.00	4.00	70.00	190.00	1.10	1.00
359.	4.50	9.00	2270.00	64.00	4.00	60.00	180.00	1.10	3.00
360.	66.00	8.00	1880.00	355.00	4.00	50.00	320.00	10.00	1.00
362.	4.50	1.00	12990.00	88.00	4.00	140.00	280.00	1.10	1.00
363.	558.00	6.00	6510.00	104.00	15.00	90.00	160.00	1.10	3.00
364.	938.00	8.00	6260.00	2044.00	9.00	60.00	420.00	1.10	3.00
365.	4.50	4.00	3640.00	1611.00	4.00	70.00	490.00	1.10	3.00
366.	17.00	3.00	2330.00	9407.00	4.00	80.00	400.00	20.00	1.00
368.	38.00	5.00	16900.00	1933.00	4.00	140.00	600.00	1.10	4.00
369.	4.50	1.00	25540.00	3343.00	4.00	190.00	990.00	1.10	4.00
370.	16.00	6.00	1540.00	389.00	4.00	110.00	160.00	1.10	1.00
371.	56.00	1.00	2160.00	4730.00	4.00	60.00	340.00	10.00	3.00
372.	36.00	6.00	2260.00	142.00	4.00	90.00	270.00	1.10	2.00
373.	347.00	6.00	2170.00	1459.00	13.00	30.00	380.00	1.10	1.00
374.	129.00	4.00	2510.00	1231.00	4.00	30.00	500.00	1.10	1.00
375.	33.00	2.00	12690.00	1423.00	4.00	110.00	650.00	1.10	2.00
376.	265.00	4.00	4640.00	1328.00	4.00	40.00	260.00	1.10	1.00
377.	9.00	8.00	3240.00	2167.00	4.30	30.00	590.00	10.00	1.00
378.	70.00	1.00	7000.00	2478.00	4.00	70.00	870.00	10.00	1.00
379.	213.00	15.00	6010.00	2688.00	19.00	60.00	530.00	10.00	3.00
381.	4.50	5.00	4520.00	227.00	4.00	60.00	110.00	1.10	1.00
382.	4.50	10.00	5820.00	1470.00	4.00	80.00	130.00	1.10	2.00
383.	37.00	9.00	2330.00	3095.00	4.00	40.00	300.00	10.00	1.00
384.	4.50	7.00	3810.00	77.00	4.00	90.00	220.00	1.10	2.00
385.	27.00	3.00	24940.00	3209.00	4.00	130.00	770.00	1.10	5.00
386.	21.00	1.00	24120.00	5116.00	4.00	140.00	790.00	10.00	2.00
387.	29.00	2.00	4780.00	607.00	4.00	80.00	190.00	1.10	1.00
389.	4.50	18.00	2840.00	69.00	4.00	110.00	200.00	1.10	3.00
390.	4.50	4.00	20620.00	2104.00	4.00	150.00	720.00	1.10	4.00
391.	55.00	1.00	11830.00	2703.00	4.00	100.00	520.00	1.10	1.00
392.	4.50	1.00	18580.00	861.00	4.00	160.00	470.00	1.10	4.00
393.	17.00	13.00	3780.00	1109.00	9.00	50.00	330.00	1.10	1.00
394.	660.00	1.00	5260.00	2943.00	4.00	60.00	260.00	10.00	1.00
395.	374.00	4.00	3910.00	1290.00	4.00	60.00	250.00	1.10	2.00
396.	217.00	9.00	5030.00	782.00	4.00	60.00	200.00	1.10	3.00
398.	10.00	7.00	4150.00	133.00	4.30	60.00	750.00	1.10	5.00
399.	12.00	4.00	1400.00	418.00	4.00	1.00	610.00	1.10	11.00
400.	4.50	4.00	3430.00	50.00	4.00	100.00	190.00	1.10	2.00
401.	4.50	3.00	6470.00	162.00	4.00	110.00	180.00	1.10	2.00

SAMPNUMB	EASTING	NORTHING	CUC AAS	PBC AAS	ZNC AAS	BAC OES	FEC OES	MNC OES	COC OES
402.	21530.	23041.	15.00	30.00	110.00	669.00	41600.00	1030.00	20.00
403.	20140.	23997.	35.00	70.00	210.00	848.00	44200.00	5920.00	48.00
404.	20140.	23921.	30.00	30.00	210.00	605.00	39703.00	4080.00	5.00
405.	19889.	23619.	15.00	50.00	120.00	532.00	42100.00	1730.00	18.00
406.	20223.	23479.	25.00	30.00	210.00	616.00	56000.00	5290.00	38.00
407.	20262.	23492.	20.00	30.00	130.00	692.00	49600.00	4230.00	27.00
408.	20254.	23541.	35.00	30.00	240.00	426.00	72800.00	7370.00	127.00
409.	20277.	23537.	25.00	30.00	140.00	499.00	52200.00	1490.00	29.00
410.	23220.	23811.	15.00	30.00	60.00	247.00	13200.00	290.00	5.00
411.	20222.	23786.	10.00	20.00	60.00	398.00	19700.00	546.00	5.00
412.	19922.	23666.	35.00	60.00	140.00	569.00	44000.00	2310.00	19.00
413.	19953.	23705.	15.00	30.00	110.00	488.00	34800.00	1400.00	12.00
415.	19864.	23559.	20.00	20.00	80.00	362.00	32400.00	963.00	5.00
416.	20383.	23210.	25.00	30.00	180.00	698.00	58300.00	6530.00	43.00
417.	20333.	23242.	25.00	30.00	130.00	489.00	41900.00	4680.00	18.00
418.	20279.	23290.	20.00	30.00	140.00	653.00	47500.00	5180.00	34.00
419.	20222.	23358.	25.00	30.00	260.00	712.00	58100.00	12400.00	84.00
420.	20132.	23328.	20.00	30.00	110.00	397.00	44600.00	3820.00	30.00
422.	20122.	23335.	25.00	50.00	180.00	320.00	58600.00	4899.00	30.00
423.	20149.	23362.	25.00	50.00	230.00	539.00	57800.00	7990.00	48.00
424.	20093.	23548.	15.00	30.00	130.00	714.00	53500.00	2540.00	14.00
425.	20064.	23500.	25.00	40.00	240.00	505.00	52200.00	6560.00	26.00
426.	20218.	23430.	45.00	60.00	250.00	623.00	58000.00	9240.00	46.00
427.	20226.	23424.	35.00	60.00	280.00	719.00	51000.00	7340.00	20.00
428.	20238.	23415.	45.00	60.00	150.00	899.00	58700.00	2580.00	46.00
429.	20192.	23412.	25.00	40.00	270.00	620.00	52900.00	10600.00	69.00
430.	19972.	23763.	60.00	70.00	110.00	496.00	39100.00	1420.00	12.00
431.	20710.	23703.	15.00	20.00	110.00	471.00	44700.00	760.00	10.00
432.	20659.	23602.	20.00	20.00	90.00	411.00	37700.00	804.00	10.00
434.	20503.	23819.	15.00	130.00	170.00	488.00	33700.00	708.00	5.00
435.	20475.	23640.	15.00	30.00	210.00	706.00	48200.00	2880.00	38.00
436.	20518.	23606.	30.00	20.00	110.00	372.00	60900.00	1160.00	31.00
437.	20322.	23397.	30.00	40.00	170.00	591.00	45200.00	12100.00	49.00
438.	20337.	23490.	20.00	30.00	90.00	695.00	36900.00	2430.00	15.00
440.	21711.	23161.	20.00	50.00	90.00	423.00	42200.00	987.00	13.00
445.	19756.	23552.	15.00	40.00	80.00	473.00	34500.00	1071.00	5.00
446.	19[illegible]	23554.	20.00	30.00	70.00	737.00	37500.00	2650.00	10.00
447.	19756.	23594.	15.00	40.00	200.00	472.00	40400.00	4380.00	22.00
448.	19871.	23522.	35.00	70.00	430.00	630.00	52200.00	6670.00	76.00
449.	19859.	23476.	15.00	150.00	149.00	430.00	38400.00	3250.00	50.00
450.	19648.	23499.	20.00	40.00	150.00	560.00	31000.00	1010.00	5.00
451.	21245.	23083.	15.00	40.00	90.00	551.00	22800.00	363.00	10.00
452.	20532.	23089.	30.00	50.00	210.00	383.00	51200.00	3600.00	42.00
453.	20536.	23097.	20.00	40.00	60.00	477.00	34800.00	740.00	10.00
454.	19606.	23076.	30.00	110.00	90.00	503.00	28400.00	4240.00	5.00
456.	19663.	23442.	30.00	30.00	150.00	544.00	43000.00	3940.00	32.00
459.	19438.	23124.	20.00	40.00	140.00	741.00	46400.00	2350.00	25.00
460.	19491.	23091.	20.00	40.00	180.00	727.00	45600.00	4030.00	35.00
461.	19570.	23090.	25.00	50.00	190.00	825.00	47300.00	14560.00	60.00
462.	19674.	23231.	20.00	50.00	170.00	881.00	51800.00	3550.00	59.00
463.	19696.	23140.	10.00	60.00	150.00	951.00	41700.00	4130.00	33.00
464.	19734.	23147.	20.00	50.00	300.00	790.00	50800.00	3750.00	25.00
465.	19732.	23215.	30.00	50.00	150.00	736.00	44400.00	3975.00	30.00
466.	19873.	22930.	20.00	40.00	160.00	657.00	57800.00	6300.00	95.00
467.	19906.	23002.	25.00	40.00	160.00	660.00	51300.00	6260.00	115.00
468.	19645.	22907.	25.00	40.00	230.00	726.00	48300.00	7360.00	102.00

DATA DESCRIPTION

FILE TITLE :TEMPFILE

NO. OF FIELDS : 40 NO. OF RECORDS : 358 WORDS PER RECORD : 40

CARD INPUT FORMAT

THE FORMAT USED TO PRINT THE FOURTH AND SUBSEQUENT LINES IS THAT USED FOR THE THIRD LINE. IT MAY PRODUCE ODD RESULTS, IN WHICH CASE USE GPPINT WITH A SUITABLE FORMAT TO PRINT THE FILE. THE DATA WILL BE UNHARMED, ALTHOUGH IT MAY LOOK ODD.

	SAMPNUMB	EASTING	NORTHING	CUC AAS	PBC AAS	ZNC AAS	BAC OES	FEC OES	MNC OES	COC OES
FIELD LENGTH	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **
FIELD TYPE	F	F	F	F	F	F	F	F	F	F
UPPER LIMIT	491.	22260.	23997.	60.00	4700.00	1300.00	5190.00	91900.00	25700.00	261.00
LOWER LIMIT	101.	19438.	22798.	5.00	20.00	30.00	197.00	13200.00	124.00	5.00
ABSENT DATA VALUE	-1.	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DICTIONARY SEGMENT IDENTIFIER										

	SAMPNUMB	NIC OES	VC OES	CRC OES	BC OES	ZRC OES	ASC XRF	MOC OES	SNC OES	CUW AAS
FIELD LENGTH	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **
FIELD TYPE	F	F	F	F	F	F	F	F	F	F
UPPER LIMIT	491.	129.00	242.00	220.00	133.00	4230.00	90.00	19.00	106.00	0.13
LOWER LIMIT	101.	5.00	14.00	21.00	13.00	117.00	2.00	0.50	2.50	0.00
ABSENT DATA VALUE	-1.	0.0	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
DICTIONARY SEGMENT IDENTIFIER										

	SAMPNUMB	ZNW AAS	CUP XRF	PBP XRF	ZNP XRF	BAP XRF	FEP XRF	MNP XRF	TIP XRF	NIP XRF
FIELD LENGTH	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **
FIELD TYPE	F	F	F	F	F	F	F	F	F	F
UPPER LIMIT	491.	0.18	3740.00	21884.00	9915.00	14200.00	234530.00	18840.00	241000.00	103.00
LOWER LIMIT	101.	0.00	3.00	6.50	24.00	13.50	13690.00	210.00	2310.00	2.50
ABSENT DATA VALUE	-1.	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
DICTIONARY SEGMENT IDENTIFIER										

	SAMPNUMB	SNP XRF	ASP XRF	CAP XRF	CEP XRF	SBP XRF	SRP XRF	ZRP XRF	UP XRF	MOP XRF
FIELD LENGTH	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **	1 ** **
FIELD TYPE	F	F	F	F	F	F	F	F	F	F
UPPER LIMIT	491.	2455.00	66.00	44840.00	84500.00	111.00	300.00	4270.00	100.00	19.00
LOWER LIMIT	101.	4.50	1.00	200.00	37.00	4.00	1.00	90.00	1.10	1.00
ABSENT DATA VALUE	-1.	-1.00	-1 00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
DICTIONARY SEGMENT IDENTIFIER										

SAMPNUMB	NIC OES	VC OES	CRC OES	BC OES	ZRC OES	ASC XRF	MOC OES	SNC OES	CUW **
224.	48.00	143.00	116.00	45.00	243.00	17.00	1.40	2.50	0.0
225.	67.00	123.00	108.00	66.00	138.00	14.00	1.70	2.50	0.0
226.	70.00	135.00	102.00	54.00	184.00	18.00	1.30	2.50	0.0
227.	50.00	99.00	112.00	62.00	231.00	13.00	0.50	2.50	0.0
228.	69.00	153.00	86.00	47.00	234.00	28.00	1.50	2.50	0.0
229.	68.00	128.00	121.00	72.00	289.00	19.00	1.30	2.50	0.00
230.	15.00	64.00	72.00	32.00	626.00	18.00	2.20	2.50	0.01
231.	23.00	61.00	98.00	53.00	532.00	23.00	2.40	9.00	0.01
232.	26.00	118.00	103.00	66.00	325.00	9.00	3.70	2.50	0.01
233.	43.00	121.00	102.00	84.00	422.00	18.00	1.20	2.50	0.00
234.	79.00	135.00	131.00	78.00	238.00	76.00	2.40	2.50	0.00
235.	62.00	140.00	168.00	81.00	279.00	23.00	0.50	2.50	0.01
236.	26.00	106.00	98.00	60.00	473.00	18.00	4.90	12.00	0.01
237.	43.00	151.00	120.00	109.00	324.00	13.00	0.50	8.00	0.02
238.	42.00	184.00	120.00	109.00	381.00	9.00	1.80	2.50	0.00
239.	41.00	144.00	100.00	102.00	399.00	15.00	3.70	2.50	0.01
240.	49.00	187.00	146.00	113.00	213.00	14.00	0.50	2.50	0.00
241.	59.00	148.00	121.00	90.00	280.00	20.00	2.50	2.50	0.01
242.	63.00	242.00	81.00	99.00	339.00	12.00	1.60	2.50	0.00
243.	69.00	161.00	99.00	76.00	270.00	16.00	2.10	2.50	0.00
245.	44.00	147.00	96.00	58.00	326.00	16.00	0.50	16.00	0.01
246.	60.00	169.00	220.00	83.00	316.00	7.00	2.20	2.50	0.00
247.	39.00	145.00	152.00	97.00	334.00	8.00	0.50	2.50	0.00
248.	49.00	179.00	155.00	75.00	255.00	46.00	2.00	2.50	0.00
249.	68.00	171.00	145.00	88.00	242.00	18.00	2.40	2.50	0.00
251.	40.00	143.00	68.00	101.00	561.00	14.00	2.50	35.00	0.00
252.	43.00	131.00	135.00	103.00	329.00	16.00	1.70	2.50	0.01
253.	50.00	157.00	98.00	99.00	279.00	17.00	2.40	2.50	0.00
255.	26.00	86.00	124.00	68.00	453.00	16.00	4.60	2.50	0.00
256.	29.00	64.00	157.00	82.00	707.00	15.00	1.60	2.50	0.00
257.	27.00	102.00	141.00	35.00	561.00	8.00	2.10	2.50	0.00
258.	44.00	140.00	110.00	92.00	276.00	21.00	2.60	2.50	0.00
259.	40.00	154.00	134.00	90.00	286.00	13.00	2.10	2.50	0.00
260.	44.00	143.00	140.00	66.00	353.00	31.00	3.00	34.00	0.00
261.	37.00	144.00	168.00	82.00	279.00	11.00	1.90	7.00	0.00
262.	66.00	174.00	173.00	63.00	237.00	44.00	2.50	6.00	0.00
263.	67.00	187.00	164.00	84.00	220.00	25.00	1.70	2.50	0.00
264.	48.00	193.00	139.00	66.00	359.00	19.00	2.50	2.50	0.01
265.	46.00	163.00	148.00	78.00	346.00	15.00	1.20	7.00	0.01
266.	52.00	157.00	178.00	78.00	300.00	15.00	2.30	9.00	0.00
267.	66.00	138.00	172.00	76.00	222.00	30.00	2.20	2.50	0.01
268.	70.00	163.00	160.00	73.00	352.00	35.00	1.70	2.50	0.00
269.	78.00	148.00	154.00	72.00	331.00	35.00	0.50	2.50	0.00
270.	36.00	136.00	134.00	71.00	343.00	14.00	1.50	7.00	0.00
271.	57.00	154.00	186.00	70.00	289.00	9.00	1.50	7.00	0.00
272.	40.00	123.00	149.00	83.00	300.00	10.00	1.80	8.00	0.00
273.	71.00	132.00	155.00	81.00	195.00	26.00	1.60	5.00	0.00
274.	90.00	208.00	265.00	43.00	229.00	14.00	2.30	2.50	0.00
275.	60.00	200.00	150.00	55.00	403.00	25.00	1.70	2.50	0.00
276.	66.00	202.00	194.00	65.00	314.00	18.00	1.90	2.50	0.01
277.	57.00	171.00	182.00	68.00	275.00	17.00	1.60	2.50	0.00
278.	73.00	206.00	198.00	75.00	205.00	16.00	1.90	5.00	0.00
279.	40.00	106.00	166.00	76.00	327.00	10.00	0.50	2.50	0.01
280.	54.00	177.00	151.00	56.00	251.00	23.00	1.80	6.00	0.00
281.	50.00	160.00	141.00	80.00	247.00	32.00	0.50	2.50	0.00
282.	64.00	140.00	166.00	79.00	192.00	46.00	1.70	2.50	0.00

SAMPNUMB	ZNW AAS	CUP XRF	PBP XRF	ZNP XRF	BAP XRF	FEP XRF	MNP XRF	TIP XRF	NIP XRF
224.	0.00	3.00	62.00	135.00	311.00	68640.00	970.00	20830.00	25.00
225.	0.00	24.00	27.00	164.00	437.00	87180.00	3340.00	16310.00	52.00
226.	0.00	46.00	26.00	176.00	521.00	88950.00	3850.00	13260.00	53.00
227.	0.00	9.00	26.00	132.00	350.00	59954.00	740.00	17410.00	29.00
228.	0.00	20.00	26.00	152.00	437.00	86290.00	1270.00	11550.00	44.00
229.	0.00	17.00	31.00	158.00	564.00	81800.00	1300.00	15570.00	43.00
230.	0.04	3.00	24.00	57.00	13.50	36950.00	1150.00	26110.00	32.00
231.	0.03	24.00	92.00	117.00	368.00	46650.00	440.00	9710.00	9.00
232.	0.00	6.00	52.00	108.00	125.00	54680.00	590.00	14280.00	17.00
233.	0.00	15.00	32.00	135.00	436.00	73250.00	680.00	12770.00	40.00
234.	0.00	7.00	27.00	251.00	698.00	72650.00	2680.00	11570.00	47.00
235.	0.00	10.00	6.50	114.00	13.50	46976.00	1740.00	21830.00	89.00
236.	0.01	7.00	53.00	92.00	243.00	49150.00	690.00	17580.00	9.00
237.	0.01	14.00	34.00	98.00	13.50	27080.00	680.00	4590.00	103.00
238.	0.18	408.00	6.50	120.00	13.50	52230.00	640.00	5970.00	54.00
239.	0.00	23.00	44.00	161.00	383.00	66640.00	720.00	7120.00	55.00
240.	0.01	17.00	52.00	111.00	193.00	64400.00	1610.00	49270.00	31.00
241.	0.00	16.00	28.00	166.00	495.00	76000.00	2240.00	18850.00	47.00
242.	0.00	8.00	16.00	169.00	573.00	74090.00	2190.00	12110.00	44.00
243.	0.00	11.00	41.00	179.00	277.00	75550.00	2600.00	29050.00	49.00
245.	0.00	15.00	94.00	152.00	314.00	73390.00	1450.00	32400.00	35.00
246.	0.00	16.00	46.00	127.00	257.00	74350.00	2040.00	41600.00	43.00
247.	0.00	13.00	45.00	140.00	627.00	65460.00	530.00	15890.00	34.00
248.	0.00	14.00	39.00	161.00	284.00	83380.00	3960.00	50800.00	48.00
249.	0.00	34.00	31.00	193.00	274.00	116010.00	7170.00	70700.00	53.00
251.	0.00	17.00	199.00	108.00	13.50	56770.00	550.00	4030.00	30.00
252.	0.00	26.00	397.00	111.00	13.50	52940.00	510.00	3950.00	30.00
253.	0.02	14.00	28.00	101.00	151.00	56590.00	410.00	5010.00	33.00
255.	0.01	3.00	6.50	27.00	13.50	23680.00	720.00	4370.00	14.00
256.	0.00	3.00	48.00	24.00	13.50	17910.00	430.00	3440.00	7.00
257.	0.00	3.00	32.00	37.00	115.00	30030.00	450.00	8580.00	14.00
258.	0.00	24.00	54.00	61.00	46.00	36530.00	400.00	3030.00	18.00
259.	0.00	3.00	16.00	54.00	13.50	35280.00	470.00	3280.00	26.00
260.	0.01	13.00	84.00	124.00	218.00	65180.00	1220.00	25260.00	34.00
261.	0.00	24.00	119.00	158.00	347.00	70410.00	1020.00	19140.00	34.00
262.	0.01	6.00	45.00	173.00	69.00	98460.00	8080.00	100900.00	38.00
263.	0.01	8.00	29.00	205.00	13.50	132250.00	17200.00	191400.00	19.00
264.	0.01	19.00	34.00	215.00	96.00	124200.00	11670.00	122600.00	37.00
265.	0.01	31.00	108.00	237.00	209.00	110670.00	7470.00	76600.00	45.00
266.	0.00	24.00	107.00	247.00	13.50	118470.00	12020.00	121500.00	39.00
267.	0.00	37.00	34.00	233.00	361.00	97770.00	4250.00	23860.00	62.00
268.	0.01	25.00	24.00	206.00	207.00	92290.00	4150.00	35160.00	60.00
269.	0.00	31.00	35.00	188.00	322.00	97820.00	4590.00	31110.00	56.00
270.	0.00	16.00	42.00	186.00	572.00	73620.00	870.00	11290.00	33.00
271.	0.00	14.00	58.00	140.00	268.00	73170.00	2090.00	35700.00	38.00
272.	0.00	8.00	41.00	119.00	282.00	57890.00	780.00	16530.00	25.00
273.	0.00	14.00	24.00	219.00	518.00	83100.00	2710.00	19330.00	54.00
274.	0.00	34.00	28.00	179.00	432.00	98710.00	3560.00	37100.00	60.00
275.	0.00	17.00	35.00	179.00	207.00	102680.00	7010.00	79000.00	45.00
276.	0.01	36.00	28.00	202.00	298.00	114070.00	5650.00	54800.00	63.00
277.	0.00	32.00	28.00	183.00	309.00	107080.00	4880.00	49900.00	60.00
279.	0.00	29.00	44.00	223.00	347.00	103490.00	4200.00	42300.00	57.00
279.	0.00	3.00	26.00	40.00	13.50	26100.00	450.00	3340.00	25.00
280.	0.00	13.00	26.00	185.00	53.00	129800.00	16490.00	165600.00	27.00
281.	0.01	22.00	33.00	215.00	398.00	87940.00	2960.00	34550.00	51.00
282.	0.00	19.00	32.00	168.00	506.00	84670.00	3450.00	13760.00	46.00

SAMPNUMB	SNP XRF	ASP XRF	CAP XRF	CEP XRF	SBP XRF	SRP XRF	ZRP XRF	LP XRF	MOP XRF
224.	4.50	5.00	13140.00	173.00	4.00	220.00	210.00	1.10	2.00
225.	4.50	7.00	1350.00	3859.00	4.00	90.00	200.00	10.00	1.00
226.	9.00	6.00	1080.00	916.00	4.00	90.00	180.00	10.00	2.00
227.	4.50	2.00	11640.00	325.00	4.00	140.00	230.00	1.10	1.00
228.	16.00	4.00	1430.00	52.00	4.00	90.00	210.00	1.10	1.00
229.	4.50	2.00	1830.00	155.00	4.00	90.00	220.00	1.10	1.00
230.	58.00	4.00	14180.00	13900.00	4.00	160.00	2190.00	20.00	1.00
231.	17.00	1.00	4150.00	456.00	4.00	80.00	1350.00	1.10	1.00
232.	22.00	5.00	7620.00	2817.00	4.00	100.00	1060.00	10.00	1.00
233.	4.50	3.00	12770.00	3380.00	4.00	170.00	220.00	10.00	3.00
234.	4.50	11.00	5780.00	171.00	4.00	120.00	200.00	1.10	1.00
235.	4.50	1.00	16160.00	63400.00	4.00	180.00	280.00	50.00	1.00
236.	50.00	2.00	11300.00	318.00	4.00	150.00	510.00	1.10	1.00
237.	53.00	1.00	580.00	84500.00	4.00	160.00	180.00	100.00	1.00
238.	10.00	3.00	870.00	26200.00	4.00	120.00	280.00	30.00	1.00
239.	9.00	8.00	1310.00	16200.00	4.00	110.00	220.00	20.00	1.00
240.	56.00	4.00	6850.00	1675.00	4.00	80.00	290.00	1.10	1.00
241.	12.00	2.00	1940.00	1760.00	4.00	90.00	220.00	1.10	1.00
242.	11.00	2.00	1280.00	723.00	4.00	90.00	200.00	1.10	1.00
243.	20.00	1.00	3960.00	4443.00	4.00	110.00	240.00	10.00	2.00
244.	77.00	4.00	12040.00	706.00	4.00	140.00	410.00	1.10	2.00
246.	4.50	4.00	9990.00	171.00	4.00	190.00	450.00	1.10	1.00
247.	18.00	3.00	1290.00	52.00	4.00	80.00	240.00	1.10	1.00
248.	11.00	13.00	8210.00	90.00	4.00	130.00	420.00	1.10	1.00
249.	9.00	3.00	4640.00	130.00	4.00	90.00	540.00	1.10	1.00
251.	1018.00	8.00	16450.00	14600.00	4.00	140.00	150.00	10.00	1.00
252.	2455.00	3.00	16190.00	14000.00	4.00	140.00	140.00	10.00	1.00
253.	34.00	9.00	660.00	3666.00	4.00	80.00	200.00	10.00	1.00
255.	10.00	9.00	2750.00	3195.00	4.00	40.00	810.00	1.10	1.00
256.	10.00	8.00	1690.00	1631.00	4.00	30.00	760.00	1.10	1.00
257.	4.50	3.00	16520.00	323.00	4.00	160.00	1330.00	1.10	1.00
258.	171.00	9.00	880.00	2464.00	4.00	40.00	180.00	10.00	1.00
259.	61.00	6.00	880.00	7089.00	4.00	50.00	170.00	10.00	1.00
260.	200.00	12.00	21340.00	1257.00	4.00	210.00	470.00	1.10	1.00
261.	83.00	5.00	11980.00	599.00	4.00	150.00	330.00	1.10	1.00
262.	4.50	6.00	33740.00	206.00	4.00	250.00	600.00	1.10	3.00
263.	10.00	8.00	12920.00	763.00	4.00	80.00	960.00	10.00	6.00
264.	21.00	7.00	11590.00	331.00	4.00	90.00	730.00	1.10	4.00
265.	107.00	6.00	11420.00	571.00	4.00	100.00	550.00	1.10	2.00
266.	53.00	3.00	11380.00	2226.00	4.00	90.00	740.00	10.00	6.00
267.	12.00	11.00	2080.00	2028.00	4.00	80.00	220.00	1.10	1.00
268.	4.50	4.00	2580.00	4056.00	4.00	95.00	270.00	10.00	1.00
269.	4.50	10.00	1750.00	2263.00	4.00	80.00	240.00	10.00	1.00
270.	16.00	2.00	4400.00	58.00	4.00	90.00	200.00	1.10	1.00
271.	23.00	1.00	9630.00	199.00	4.00	150.00	400.00	1.10	1.00
272.	10.00	1.00	8020.00	353.00	4.00	110.00	280.00	1.10	1.00
273.	4.50	3.00	7350.00	109.00	4.00	110.00	220.00	1.10	1.00
274.	4.50	1.00	4330.00	73.00	4.00	80.00	360.00	1.10	1.00
275.	4.50	8.00	11030.00	318.00	4.00	100.00	590.00	1.10	1.00
276.	4.50	3.00	5830.00	75.00	4.00	80.00	480.00	1.10	1.00
277.	4.50	3.00	7260.00	55.00	4.00	80.00	440.00	1.10	2.00
278.	20.00	2.00	5630.00	58.00	4.00	80.00	410.00	1.10	1.00
279.	46.00	7.00	970.00	14400.00	4.00	40.00	250.00	20.00	1.00
280.	10.00	3.00	12240.00	502.00	4.00	70.00	890.00	1.10	4.00
281.	4.50	0.00	2280.00	108.00	4.00	80.00	260.00	1.10	1.00
282.	4.50	7.00	370.00	1447.00	4.00	90.00	190.00	1.10	1.00

SAMPNUMB	NIC OES	VC OES	CRC OES	BC OES	ZRC OES	ASC XRF	MOC OES	SNC OES	CUV AAS
402.	33.00	111.00	106.00	83.00	225.00	7.00	0.50	2.50	0.01
403.	46.00	133.00	173.00	105.00	339.00	15.00	1.00	13.00	0.01
404.	38.00	116.00	83.00	71.00	386.00	14.00	0.50	13.00	0.01
405.	30.00	103.00	86.00	92.00	301.00	12.00	0.50	2.50	0.00
406.	72.00	126.00	99.00	75.00	252.00	11.00	0.50	2.50	0.01
407.	47.00	102.00	78.00	78.00	246.00	15.00	0.50	2.50	0.13
408.	83.00	134.00	104.00	58.00	191.00	17.00	0.50	2.50	0.00
409.	36.00	94.00	83.00	81.00	190.00	17.00	0.50	2.50	0.00
410.	10.00	46.00	85.00	31.00	424.00	4.00	0.50	2.50	0.02
411.	14.00	66.00	80.00	60.00	862.00	5.00	0.50	2.50	0.00
412.	40.00	105.00	114.00	99.00	317.00	11.00	1.00	21.00	0.01
413.	39.00	101.00	124.00	93.00	342.00	9.00	0.50	2.50	0.00
415.	27.00	73.00	84.00	77.00	312.00	11.00	0.50	2.50	0.00
416.	55.00	123.00	100.00	92.00	188.00	17.00	1.00	2.50	0.01
417.	37.00	97.00	93.00	80.00	307.00	13.00	0.50	8.00	0.00
418.	47.00	111.00	113.00	94.00	248.00	13.00	0.50	19.00	0.00
419.	78.00	146.00	93.00	87.00	221.00	16.00	0.50	2.50	0.00
420.	38.00	139.00	53.00	60.00	316.00	14.00	0.50	2.50	0.00
422.	68.00	178.00	47.00	71.00	183.00	19.00	0.50	2.50	0.01
423.	60.00	155.00	88.00	72.00	221.00	20.00	1.40	11.00	0.00
424.	45.00	121.00	103.00	101.00	196.00	11.00	0.50	12.00	0.01
425.	58.00	111.00	94.00	91.00	275.00	12.00	0.50	2.50	0.00
426.	86.00	104.00	114.00	97.00	159.00	14.00	0.50	27.00	0.00
427.	62.00	103.00	99.00	104.00	171.00	16.00	0.50	11.00	0.01
428.	73.00	125.00	83.00	102.00	185.00	24.00	3.20	2.50	0.00
429.	69.00	116.00	75.00	78.00	239.00	17.00	0.50	2.50	0.00
430.	34.00	88.00	90.00	84.00	312.00	14.00	0.50	45.00	0.00
431.	23.00	97.00	66.00	45.00	865.00	6.00	0.50	2.50	0.00
432.	23.00	86.00	86.00	53.00	446.00	8.00	0.50	2.50	0.00
434.	14.00	65.00	77.00	39.00	804.00	11.00	0.50	106.00	0.01
435.	27.00	107.00	55.00	58.00	274.00	15.00	0.50	8.00	0.01
436.	57.00	174.00	128.00	57.00	227.00	6.00	0.50	2.50	0.03
437.	50.00	86.00	69.00	76.00	222.00	18.00	0.50	14.00	0.01
438.	49.00	99.00	80.00	121.00	146.00	5.00	0.50	2.50	0.02
440.	37.00	121.00	117.00	58.00	350.00	12.00	0.50	9.00	0.01
445.	22.00	34.00	70.00	65.00	279.00	10.00	0.50	2.50	0.00
446.	33.00	31.00	69.00	68.00	274.00	12.00	0.50	2.50	0.00
447.	30.00	38.00	74.00	64.00	291.00	13.00	0.50	13.00	0.00
448.	77.00	49.00	77.00	76.00	183.00	21.00	0.50	22.00	0.00
449.	30.00	37.00	79.00	68.00	384.00	15.00	0.50	2.50	0.00
450.	25.00	26.00	76.00	66.00	264.00	9.00	0.50	2.50	0.00
451.	25.00	81.00	94.00	127.00	237.00	9.00	1.10	2.50	0.00
452.	53.00	115.00	70.00	63.00	174.30	24.00	0.50	2.50	0.00
453.	15.00	41.00	58.00	73.00	315.00	17.00	0.50	2.50	0.00
454.	35.00	22.00	78.00	65.00	267.00	11.00	0.50	2.50	0.00
456.	54.00	41.00	62.00	75.00	191.00	14.00	0.50	2.50	0.00
459.	37.00	50.00	56.00	75.00	176.00	15.00	0.50	2.50	0.00
460.	46.00	47.00	53.00	61.00	245.00	15.00	0.50	2.50	0.00
461.	49.00	101.00	70.00	78.00	205.00	29.00	0.50	2.50	0.00
462.	62.00	103.00	84.00	72.00	210.00	16.00	1.20	20.00	0.00
463.	30.00	119.00	68.00	59.00	120.00	11.00	0.50	2.50	0.00
464.	44.00	93.00	71.00	77.00	180.00	13.00	0.50	2.50	0.00
465.	45.00	106.00	76.00	89.00	224.00	16.00	1.50	36.00	0.00
466.	40.00	115.00	59.00	78.00	185.00	21.00	0.50	9.00	0.00
467.	74.00	117.00	73.00	78.00	178.00	16.00	0.50	10.00	0.00
468.	79.00	103.00	75.00	101.00	228.00	15.00	0.50	13.00	0.00

SAMPNUMB	ZNW AAS	CUP XRF	PBP XRF	ZNP XRF	BAP XRF	FEP XRF	MNP XRF	TIP XRF	NIP XRF
402.	0.01	21.00	33.00	127.00	888.00	67963.00	370.00	8520.00	36.00
403.	0.01	116.00	1197.00	157.00	301.00	103810.00	5860.00	3920.00	41.00
404.	0.01	11.00	171.00	61.00	120.00	37900.00	400.00	2710.00	13.00
405.	0.00	7.00	69.00	66.00	136.00	49790.00	760.00	12240.00	18.00
406.	0.01	25.00	51.00	211.00	639.00	92710.00	2060.00	8620.00	56.00
407.	0.08	91.00	86.00	181.00	566.00	121640.00	16630.00	8730.00	65.00
408.	0.01	69.00	35.00	443.00	220.00	234530.00	6550.00	11350.00	82.00
409.	0.01	22.00	25.00	162.00	167.00	95140.00	1470.00	25000.00	34.00
410.	0.02	12.00	45.00	79.00	105.00	59970.00	1240.00	26730.00	24.00
411.	0.00	12.00	43.00	44.00	13.50	33730.00	1150.00	28480.00	15.00
412.	0.01	268.00	495.00	110.00	13.50	69300.00	2180.00	34300.00	42.00
413.	0.01	17.00	91.00	90.00	13.50	58380.00	2750.00	41500.00	30.00
415.	0.00	8.00	27.00	68.00	189.00	49730.00	560.00	7950.00	21.00
416.	0.00	16.00	29.00	193.00	423.00	91540.00	5560.00	45000.00	45.00
417.	0.00	22.00	45.00	172.00	347.00	96650.00	7940.00	64500.00	41.00
418.	0.00	27.00	696.00	185.00	154.00	104940.00	10440.00	94800.00	37.00
419.	0.01	21.00	41.00	217.00	350.00	96680.00	6450.00	51500.00	46.00
420.	0.00	9.00	26.00	165.00	13.50	157950.00	18430.00	226000.00	13.00
422.	0.01	14.00	29.00	205.00	13.50	157040.00	17050.00	218300.00	17.00
423.	0.00	27.00	52.00	279.00	343.00	123440.00	12840.00	74700.00	46.00
424.	0.00	23.00	31.00	129.00	148.00	83700.00	3420.00	42600.00	46.00
425.	0.00	24.00	82.00	216.00	301.00	87450.00	3100.00	27340.00	54.00
426.	0.00	38.00	300.00	222.00	13.50	84230.00	5046.00	11690.00	77.00
427.	0.00	100.00	86.00	236.00	730.00	104040.00	4450.00	7380.00	58.00
428.	0.00	36.00	78.00	252.00	589.00	123920.00	3050.00	7070.00	56.00
429.	0.00	19.00	66.00	226.00	635.00	87710.00	4160.00	21710.00	48.00
430.	0.00	3740.00	1275.00	226.00	13.50	111090.00	1540.00	9050.00	31.00
431.	0.00	13.00	40.00	106.00	207.00	64080.00	1810.00	40770.00	22.00
432.	0.00	22.00	57.00	98.00	122.00	67660.00	2320.00	36300.00	20.00
434.	0.01	9.00	166.00	97.00	146.00	40630.00	490.00	7400.00	12.00
435.	0.01	14.00	23.00	128.00	70.00	87050.00	5020.00	70900.00	22.00
436.	0.08	37.00	17.00	162.00	133.00	111590.00	6120.00	80500.00	40.00
437.	0.02	127.00	158.00	193.00	13.50	69690.00	3890.00	19700.00	69.00
438.	0.04	16.00	39.00	127.00	700.00	63860.00	1360.00	10150.00	49.00
440.	0.02	49.00	66.00	179.00	458.00	120180.00	1090.00	13620.00	70.00
445.	0.00	20.00	20.00	51.00	247.00	48760.00	550.00	5140.00	17.00
446.	0.00	479.00	90.00	70.00	270.00	60810.00	740.00	6380.00	27.00
447.	0.00	8.00	172.00	88.00	121.00	54250.00	1110.00	10180.00	24.00
448.	0.00	11.00	128.00	101.00	67.00	74460.00	3970.00	37100.00	41.00
449.	0.00	32.00	921.00	146.00	231.00	88080.00	3470.00	46300.00	28.00
450.	0.00	37.00	259.00	81.00	306.00	42710.00	470.00	5920.00	21.00
451.	0.00	13.00	38.00	123.00	827.00	57840.00	270.00	8310.00	35.00
452.	0.00	58.00	71.00	222.00	494.00	92320.00	3750.00	38920.00	50.00
453.	0.00	20.00	34.00	100.00	615.00	71370.00	1300.00	12470.00	28.00
454.	0.04	33.00	72.00	159.00	653.00	89150.00	3470.00	25320.00	60.00
456.	0.01	21.00	17.00	161.00	583.00	75010.00	3020.00	26250.00	53.00
459.	0.10	29.00	45.00	142.00	538.00	72203.00	1230.00	23750.00	54.00
460.	0.03	14.00	43.00	153.00	497.00	73220.00	1970.00	22550.00	49.00
461.	0.01	25.00	33.00	139.00	658.00	77630.00	3340.00	35470.00	47.00
462.	0.01	18.00	116.00	171.00	564.00	75820.00	2870.00	41830.00	42.00
463.	0.01	17.00	77.00	179.00	1094.00	71460.00	2360.00	23090.00	40.00
464.	0.01	16.00	97.00	198.00	442.00	74300.00	2150.00	27030.00	32.00
465.	0.00	31.00	82.00	169.00	868.00	80350.00	2130.00	7450.00	42.00
466.	0.00	14.00	29.00	95.00	13.50	61710.00	3370.00	49030.00	33.00
467.	0.00	9.00	28.00	101.00	246.00	53840.00	2590.00	36440.00	22.00
468.	0.00	14.00	43.00	153.00	166.00	74080.00	5010.00	43900.00	40.00

SAMPNUMB	SNP XRF	ASP XRF	CAP XRF	CEP XRF	SSP XRF	SRP XRF	ZRP XRF	UP XRF	MOP XRF
402.	4.50	2.00	720.00	72.00	4.00	80.00	290.00	1.10	1.00
403.	175.00	12.00	24460.00	2457.00	4.00	110.00	110.00	1.10	10.00
404.	48.00	11.00	1740.00	513.00	4.00	40.00	90.00	1.10	1.00
405.	12.00	4.00	3010.00	1516.00	4.00	50.00	290.00	1.10	1.00
406.	22.00	10.00	3050.00	1000.00	8.00	100.00	180.00	1.10	1.00
407.	40.00	30.00	2670.00	3951.00	4.00	130.00	160.00	10.00	3.00
408.	12.00	40.00	3810.00	2814.00	4.00	70.00	150.00	10.00	3.00
409.	4.50	12.00	4310.00	3357.00	4.00	70.00	230.00	10.00	2.00
410.	35.00	6.00	5030.00	1304.00	4.00	60.00	1910.00	1.10	1.00
411.	60.00	1.00	5480.00	5175.00	4.00	50.00	660.00	10.00	1.00
412.	343.00	2.00	8770.00	20400.00	4.00	80.00	740.00	20.00	1.00
413.	178.00	1.00	10360.00	8017.00	4.00	90.00	740.00	10.00	1.00
415.	57.00	3.00	2460.00	1049.00	4.00	50.00	180.00	1.10	1.00
416.	4.50	6.00	2400.00	150.50	4.00	70.00	380.00	1.10	1.00
417.	15.00	4.00	2030.00	1688.00	4.00	70.00	490.00	1.10	3.00
418.	35.00	9.00	3030.00	2142.00	4.00	50.00	600.00	1.10	5.00
419.	98.00	7.00	2680.00	749.00	4.00	60.00	330.00	1.10	1.00
420.	11.00	5.00	1020.00	297.00	4.00	10.00	690.00	1.10	10.00
422.	13.00	3.00	1170.00	390.00	10.00	10.00	640.00	1.10	9.00
423.	4.50	9.00	2260.00	288.00	4.00	60.00	400.00	1.10	5.00
424.	12.00	3.00	8070.00	6859.00	8.00	120.00	390.00	10.00	1.00
425.	23.00	3.00	4500.00	4636.00	4.00	110.00	260.00	10.00	2.00
426.	228.00	10.00	4000.00	20400.00	4.00	130.00	180.00	20.00	1.00
427.	19.00	21.00	1120.00	756.00	4.00	120.00	170.00	1.10	1.00
428.	48.00	10.00	1770.00	2177.00	4.00	100.00	150.00	1.10	4.00
429.	31.00	8.00	1910.00	197.00	4.00	90.00	200.00	1.10	3.00
430.	441.00	13.00	5220.00	3982.00	23.00	50.00	120.00	10.00	3.00
431.	15.00	3.00	5660.00	990.00	4.00	80.00	650.00	1.10	3.00
432.	19.00	2.00	15100.00	1186.00	4.00	170.00	730.00	1.10	1.00
434.	235.00	3.00	3710.00	596.00	4.00	50.00	320.00	1.10	2.00
435.	4.50	1.00	22400.00	2400.00	4.00	180.00	520.00	10.00	3.00
436.	4.50	1.00	20800.00	292.00	4.00	160.00	600.00	1.10	5.00
437.	212.00	7.00	4190.00	29100.00	4.00	140.00	240.00	40.00	1.00
438.	4.50	1.00	640.00	2394.00	4.00	130.00	200.00	1.10	1.00
440.	4.50	9.00	2150.00	49.00	4.00	50.00	160.00	1.10	1.00
445.	4.50	3.00	1850.00	170.00	4.00	30.00	170.00	1.10	1.00
446.	310.00	12.00	2610.00	546.00	4.00	100.00	240.00	1.10	1.00
447.	143.00	6.00	4660.00	1924.00	4.00	50.00	310.00	1.10	1.00
448.	74.00	2.00	4100.00	5886.00	4.00	70.00	410.00	10.00	2.00
449.	478.00	6.00	3530.00	963.00	4.00	60.00	500.00	1.10	2.00
450.	29.00	1.00	1250.00	237.00	4.00	30.00	210.00	1.10	3.00
451.	4.50	1.00	1500.00	64.00	4.00	100.00	240.00	1.10	1.00
452.	12.00	1.00	2170.00	97.00	4.00	90.00	290.00	1.10	1.00
453.	4.50	7.00	670.00	104.00	4.00	120.00	230.00	1.10	1.00
454.	4.50	12.00	4910.00	64.00	4.00	80.00	260.00	1.10	2.00
456.	4.50	5.00	1200.00	613.00	4.00	100.00	240.00	1.10	2.00
459.	4.50	4.00	2330.00	238.00	4.00	130.00	230.00	1.10	1.00
460.	10.00	7.00	3780.00	185.00	4.00	100.00	220.00	1.10	4.00
461.	4.50	20.00	1860.00	279.00	4.00	100.00	270.00	1.10	5.00
462.	89.00	5.00	1890.00	563.00	4.00	70.00	360.00	1.10	4.00
463.	4.50	3.00	820.00	188.00	4.00	70.00	240.00	1.10	3.00
464.	4.50	5.00	3940.00	322.00	4.00	160.00	260.00	1.10	1.00
465.	62.00	9.00	1120.00	197.00	4.00	90.00	160.00	1.10	1.00
466.	13.00	3.00	4520.00	13600.00	4.00	90.00	280.00	10.00	3.00
467.	4.50	1.00	7890.00	335.00	4.00	110.00	240.00	1.10	2.00
468.	54.00	2.00	8240.00	3743.00	4.00	100.00	410.00	1.10	2.00

SAMPNUMB	EASTING	NORTHING	CUC AAS	PBC AAS	ZNC AAS	BAC OES	FEC OES	MNC OES	COC OES
101.	21730.	23777.	15.00	30.00	100.00	455.00	39400.00	704.00	15.00
102.	21824.	23777.	15.00	30.00	100.00	470.00	39800.00	587.00	19.00
103.	21816.	23806.	15.00	40.00	110.00	433.00	43100.00	622.00	14.00
104.	21804.	23752.	20.00	40.00	100.00	426.00	36500.00	581.00	13.00
105.	21626.	23823.	15.00	30.00	90.00	356.00	41700.00	575.00	10.00
106.	21599.	23716.	20.00	40.00	110.00	428.00	40900.00	934.00	15.00
107.	21675.	23694.	20.00	50.00	130.00	375.00	37600.00	758.00	14.00
108.	21971.	23672.	15.00	40.00	120.00	413.00	38700.00	1020.00	18.00
109.	21963.	23678.	15.00	40.00	110.00	381.00	38300.00	739.00	13.00
110.	21730.	23482.	30.00	40.00	180.00	3179.00	49400.00	975.00	23.00
111.	21936.	23475.	15.00	40.00	110.00	462.00	41200.00	874.00	19.00
112.	21672.	23686.	20.00	40.00	120.00	833.00	44800.00	871.00	15.00
113.	22028.	23699.	15.00	30.00	110.00	417.00	42200.00	821.00	17.00
114.	22109.	23278.	35.00	50.00	210.00	3130.00	46500.00	1470.00	21.00
115.	22118.	23308.	15.00	30.00	110.00	550.00	39800.00	752.00	21.00
116.	22005.	23318.	50.00	60.00	240.00	5198.00	84300.00	3740.00	42.00
117.	21926.	23132.	20.00	49.00	150.00	1380.00	45800.00	1180.00	27.00
118.	21922.	23124.	25.00	50.00	240.00	775.00	51400.00	1570.00	40.00
119.	21950.	22883.	25.00	620.00	340.00	4210.00	50800.00	814.00	18.00
120.	22244.	23155.	60.00	4700.00	1300.00	3420.00	53000.00	2560.00	49.00
121.	21751.	23528.	20.00	40.00	110.00	593.00	47900.00	782.00	17.00
122.	21755.	23602.	15.00	40.00	110.00	424.00	41200.00	788.00	13.00
123.	22113.	23312.	20.00	50.00	130.00	451.00	39600.00	852.00	24.00
124.	22096.	23308.	30.00	40.00	110.00	4510.00	53100.00	397.00	5.00
125.	22143.	23143.	25.00	60.00	350.00	1550.00	54500.00	8400.00	75.00
126.	21709.	23003.	25.00	40.00	180.00	578.00	48500.00	1120.00	28.00
127.	21916.	23003.	15.00	40.00	250.00	1450.00	48200.00	15700.00	48.00
128.	21918.	22916.	20.00	40.00	150.00	651.00	39600.00	639.00	17.00
129.	22260.	23229.	25.00	70.00	130.00	1250.00	43800.00	1160.00	23.00
130.	22160.	23043.	25.00	40.00	150.00	2840.00	36000.00	349.00	5.00
131.	22254.	22128.	15.00	40.00	80.00	1660.00	48100.00	1190.00	18.00
132.	22044.	22967.	15.00	30.00	140.00	3060.00	34300.00	609.00	20.00
133.	22084.	22959.	30.00	800.00	480.00	3330.00	48400.00	875.00	23.00
134.	21874.	23266.	15.00	30.00	130.00	949.00	48900.00	752.00	20.00
135.	21872.	23280.	20.00	60.00	220.00	3540.00	44800.00	1310.00	20.00
136.	21622.	23226.	15.00	50.00	220.00	465.00	53000.00	14000.00	26.00
137.	21456.	23596.	30.00	60.00	170.00	1150.00	42800.00	1050.00	19.00
138.	21425.	23598.	20.00	30.00	110.00	1000.00	43100.00	1010.00	16.00
139.	21196.	23469.	15.00	30.00	210.00	720.00	54900.00	16200.00	51.00
140.	21172.	23480.	15.00	40.00	180.00	580.00	52500.00	15300.00	61.00
141.	22181.	23048.	35.00	1200.00	510.00	3350.00	43200.00	811.00	17.00
142.	22106.	23068.	20.00	40.00	120.00	1590.00	37000.00	631.00	14.00
143.	21842.	22821.	30.00	40.00	120.00	751.00	45700.00	609.00	31.00
144.	21834.	22798.	25.00	50.00	140.00	1260.00	36100.00	717.00	17.00
145.	21573.	23164.	20.00	40.00	170.00	461.00	52100.00	1910.00	47.00
146.	21566.	23170.	15.00	40.00	120.00	529.00	60700.00	3040.00	35.00
147.	21513.	23121.	20.00	30.00	250.00	537.00	47900.00	1290.00	27.00
148.	21564.	23585.	25.00	70.00	150.00	1180.00	42000.00	908.00	14.00
149.	21523.	23669.	15.00	30.00	110.00	739.00	45300.00	1000.00	19.00
150.	21467.	23426.	15.00	30.00	190.00	539.00	43200.00	993.00	14.00
151.	21486.	23530.	20.00	30.00	100.00	1380.00	42100.00	766.00	5.00
152.	21660.	23447.	25.00	180.00	280.00	1140.00	43500.00	900.00	15.00
153.	21348.	23498.	15.00	40.00	160.00	459.00	47400.00	1550.00	19.00
161.	21332.	23482.	10.00	30.00	160.00	256.00	40400.00	1150.00	23.00
162.	21379.	23658.	20.00	30.00	120.00	668.00	44800.00	1170.00	22.00
164.	20961.	23278.	55.00	60.00	350.00	370.00	63500.00	13300.00	131.00

SAMPNUM1	NIC OES	VC OES	CRC OES	BC OES	ZRC OES	ASC XRF	MOC OES	SNC OES	CUW AAS
101.	41.00	115.00	81.00	77.00	233.00	9.00	0.50	5.00	0.00
102.	49.00	138.00	92.00	78.00	245.00	10.00	0.50	2.50	0.00
103.	42.00	119.00	81.00	77.00	240.00	12.00	1.30	2.50	0.00
104.	43.00	114.00	93.00	84.00	311.00	13.00	0.50	2.50	0.00
105.	43.00	118.00	93.00	80.00	266.00	14.00	1.60	10.00	0.00
106.	40.00	131.00	75.00	89.00	289.00	13.00	0.50	2.50	0.00
107.	34.00	116.00	86.00	75.00	245.00	13.00	1.30	5.00	0.00
108.	34.00	107.00	96.00	85.00	355.00	14.00	0.50	2.50	0.00
109.	32.00	112.00	92.00	92.00	461.00	11.00	0.50	5.00	0.00
110.	52.00	154.00	114.30	95.00	257.00	35.00	6.80	2.50	0.00
111.	37.00	121.00	120.00	105.00	329.00	16.00	0.50	2.50	0.00
112.	39.00	142.00	104.00	97.00	281.00	15.00	2.10	2.50	0.00
113.	37.00	116.00	106.00	84.00	324.00	15.00	0.50	2.50	0.00
114.	37.00	125.00	92.00	66.00	305.00	18.00	4.30	11.00	0.01
115.	33.00	116.00	83.30	80.00	380.00	18.00	1.10	2.50	0.00
116.	68.00	195.00	103.00	93.00	180.00	90.00	19.00	8.00	0.00
117.	31.00	121.00	104.00	65.00	300.00	16.00	0.50	2.50	0.00
118.	58.00	135.00	150.00	87.00	234.00	12.00	2.60	8.00	0.00
119.	34.00	149.00	98.00	100.00	264.00	33.00	6.00	23.00	0.00
120.	54.00	147.00	103.00	97.00	192.00	52.00	8.40	2.50	0.00
121.	43.00	144.00	111.00	100.00	273.00	16.00	0.50	2.50	0.00
122.	33.00	125.00	102.00	90.00	346.00	16.00	1.40	2.50	0.00
123.	30.00	122.00	87.00	78.00	372.00	20.00	1.40	2.50	0.00
124.	41.00	183.00	91.00	112.00	226.00	43.00	11.90	2.50	0.00
125.	50.00	132.00	97.00	45.00	300.00	24.00	3.30	2.50	0.00
126.	53.00	164.00	122.00	90.00	433.00	10.00	0.50	2.50	0.00
127.	47.00	128.00	126.00	103.00	300.00	16.00	2.30	6.00	0.00
128.	36.00	115.00	104.00	56.00	431.00	13.00	0.50	6.00	0.00
129.	48.00	150.00	143.00	117.00	340.00	19.00	3.40	2.50	0.00
130.	16.00	123.00	71.00	63.00	423.00	13.00	2.30	2.50	0.00
131.	38.00	140.00	99.00	133.00	310.00	21.00	4.80	2.50	0.00
132.	23.00	77.00	59.00	60.00	434.00	12.00	2.90	2.50	0.00
133.	43.00	138.00	105.00	93.00	397.00	28.00	4.10	19.00	0.00
134.	30.00	116.00	87.00	65.00	444.00	14.00	2.10	2.50	0.00
135.	31.00	133.00	109.00	60.00	390.00	12.00	3.90	2.50	0.00
136.	23.00	155.00	71.00	24.00	346.00	25.00	0.50	2.50	0.00
137.	35.00	117.00	94.00	74.00	391.00	13.00	2.60	5.00	0.00
138.	31.00	108.00	101.00	69.00	335.00	21.00	2.80	2.50	0.00
139.	51.00	119.00	147.00	70.00	319.00	16.00	0.50	2.50	0.00
140.	31.00	101.00	113.00	49.00	222.00	21.00	2.20	2.50	0.00
141.	39.00	134.00	129.00	118.00	292.00	28.00	7.30	9.00	0.00
142.	29.00	116.00	136.00	66.00	325.00	19.00	2.50	2.50	0.00
143.	42.00	123.00	113.00	72.00	361.00	8.00	0.50	6.00	0.01
144.	32.00	131.00	119.00	58.00	631.00	12.00	2.80	2.50	0.00
145.	43.00	163.00	158.00	46.00	349.00	20.00	0.50	2.50	0.00
146.	38.00	179.00	129.00	48.00	318.00	20.00	1.70	2.50	0.00
147.	47.00	150.00	141.00	58.00	368.00	12.00	1.00	2.50	0.00
148.	29.00	135.00	91.00	75.00	544.00	15.00	3.50	2.50	0.03
149.	44.00	139.00	103.00	95.00	329.00	16.00	3.00	5.00	0.00
150.	18.00	71.00	75.00	22.00	597.00	14.00	2.30	2.50	0.00
151.	33.00	146.00	113.00	82.00	306.00	24.00	1.60	8.00	0.01
152.	29.00	104.00	78.00	36.00	921.00	14.00	3.00	5.00	0.00
153.	19.00	115.00	75.00	25.00	415.00	11.00	1.80	2.50	0.00
161.	30.00	112.00	125.00	59.00	406.00	12.00	1.90	2.50	3.00
162.	39.00	127.00	132.00	96.00	340.00	12.00	2.20	2.50	0.01
164.	129.00	199.00	175.00	71.00	235.00	46.00	0.50	2.50	0.00

SAMPNUMB	EASTING	NORTHING	CUC AAS	PBC AAS	ZNC AAS	BAC OES	FEC OES	MNC OES	COC OES
283.	20816.	23121.	25.00	40.00	140.00	396.00	45800.00	4740.00	40.00
284.	20825.	23061.	30.00	60.00	180.00	483.00	51300.00	7610.00	98.00
285.	20577.	23338.	30.00	40.00	170.00	651.00	52500.00	2780.00	25.00
286.	20560.	23372.	35.00	40.00	180.00	491.00	59600.00	1940.00	43.00
287.	20563.	23477.	30.00	50.00	190.00	589.00	52200.00	6160.00	50.00
288.	20588.	23454.	20.00	40.00	180.00	448.00	49700.00	3550.00	31.00
289.	21932.	23654.	10.00	30.00	80.00	438.00	33900.00	558.00	18.00
290.	21329.	23729.	20.00	30.00	120.00	546.00	47500.00	1300.00	15.00
292.	21315.	23848.	25.00	40.00	120.00	525.00	46300.00	1360.00	14.00
294.	21070.	23528.	25.00	60.00	260.00	582.00	38200.00	1410.00	18.00
295.	20830.	23738.	10.00	30.00	150.00	306.00	22900.00	586.00	5.00
296.	20793.	23731.	20.00	30.00	150.00	367.00	28400.00	829.00	10.00
297.	20751.	23616.	25.00	30.00	190.00	495.00	50200.00	1130.00	25.00
298.	20791.	23555.	20.00	30.00	170.00	388.00	53500.00	2050.00	40.00
299.	20644.	23575.	25.00	30.00	160.00	459.00	48500.00	890.00	25.00
300.	20983.	23705.	5.00	50.00	190.00	486.00	22400.00	750.00	5.00
301.	21244.	23894.	15.00	40.00	130.00	845.00	41000.00	754.00	10.00
302.	21249.	23896.	25.00	50.00	140.00	603.00	44700.00	1430.00	16.00
303.	21250.	23905.	15.00	40.00	110.00	381.00	37000.00	1090.00	19.00
304.	21296.	23694.	25.00	40.00	130.00	704.00	43000.00	1730.00	31.00
305.	21342.	23854.	10.00	30.00	90.00	330.00	36900.00	990.00	10.00
306.	21340.	23849.	35.00	70.00	190.00	458.00	42700.00	1730.00	17.00
307.	21096.	23662.	5.00	20.00	140.00	553.00	31700.00	2030.00	5.00
308.	21022.	23533.	10.00	50.00	180.00	559.00	26100.00	592.00	5.00
309.	20739.	23658.	25.00	30.00	110.00	437.00	43400.00	1190.00	23.00
310.	20695.	23019.	20.00	40.00	140.00	545.00	55900.00	8850.00	55.00
311.	20585.	23343.	40.00	40.00	190.00	378.00	59800.00	3460.00	62.00
312.	20547.	23426.	30.00	40.00	170.00	511.00	52300.00	1780.00	33.00
313.	20570.	23456.	30.00	40.00	160.00	555.00	52490.00	3410.00	38.00
314.	21979.	23629.	15.00	40.00	90.00	452.00	34200.00	1020.00	15.00
315.	21996.	23590.	10.00	30.00	100.00	449.00	37300.00	695.00	15.00
316.	21433.	23858.	10.00	30.00	250.00	428.00	43600.00	3230.00	26.00
317.	21130.	23584.	20.00	30.00	260.00	657.00	36500.00	2140.00	14.00
318.	20788.	23779.	15.00	30.00	110.00	495.00	46900.00	1880.00	27.00
319.	21924.	23591.	10.00	30.00	80.00	445.00	31600.00	446.00	20.00
320.	21316.	23905.	15.00	30.00	120.00	396.00	41900.00	1620.00	19.00
321.	21184.	23903.	20.00	40.00	130.00	528.00	42600.00	1720.00	22.00
322.	21082.	23882.	20.00	40.00	120.00	505.00	45000.00	1830.00	20.00
323.	20794.	23782.	10.00	30.00	120.00	380.00	23100.00	398.00	5.00
324.	21122.	23697.	20.00	30.00	160.00	521.00	27500.00	1280.00	5.00
325.	21134.	23700.	15.00	30.00	270.00	600.00	39400.00	2460.00	17.00
326.	21167.	23574.	45.00	50.00	250.00	691.00	46600.00	4840.00	26.00
327.	20444.	23499.	30.00	50.00	310.00	540.00	60200.00	6380.00	56.00
328.	20418.	23544.	20.00	20.00	140.00	528.00	53700.00	883.00	27.00
329.	20554.	23561.	20.00	20.00	190.00	476.00	60800.00	4510.00	42.00
330.	20746.	23666.	10.00	20.00	90.00	355.00	24600.00	575.00	5.00
331.	20714.	23595.	25.00	50.00	360.00	401.00	53200.00	4580.00	51.00
332.	20712.	23610.	25.00	40.00	330.00	485.00	46500.00	2390.00	36.00
333.	20535.	23510.	25.00	20.00	180.00	609.00	60500.00	3530.00	39.00
334.	20404.	23589.	20.00	20.00	160.00	605.00	39000.00	2520.00	44.00
335.	20454.	23746.	15.00	20.00	330.00	658.00	55900.00	6070.00	57.00
336.	20532.	23543.	15.00	20.00	130.00	197.00	26600.00	825.00	14.00
337.	20542.	23554.	20.00	20.00	150.00	546.00	50200.00	2450.00	30.00
338.	20546.	23555.	25.00	20.00	90.00	531.00	42100.00	933.00	28.00
339.	20471.	23356.	25.00	30.00	220.00	571.00	66600.00	9430.00	71.00
340.	20410.	23452.	30.00	30.00	270.00	726.00	55400.00	25700.00	85.00

SAMPNUMB	NIC OES	VC OES	CRC OES	BC OES	ZRC OES	ASC XRF	MOC OES	SNC OES	CUW AAS
283.	30.00	127.00	172.00	58.00	307.00	20.00	2.40	2.50	0.00
284.	61.00	120.00	128.00	73.00	299.00	43.00	3.20	2.50	0.00
285.	41.00	146.00	187.00	87.00	298.00	12.00	3.10	2.50	0.00
286.	81.00	167.00	177.00	70.00	267.00	18.00	2.30	13.00	0.01
287.	63.00	156.00	142.00	89.00	253.00	18.00	1.90	2.50	0.00
288.	46.00	146.00	183.00	69.00	296.00	13.00	2.50	2.50	0.00
289.	37.00	111.00	138.00	100.00	438.00	15.00	1.50	2.50	0.00
290.	48.00	134.00	133.00	106.00	272.00	11.00	2.00	2.50	0.00
292.	45.00	160.00	118.00	86.00	360.00	12.00	2.70	2.50	0.00
294.	28.00	71.00	93.00	41.00	365.00	10.00	1.30	24.00	0.00
295.	15.00	53.00	61.00	61.00	3490.00	7.00	0.50	2.50	0.00
296.	27.00	56.00	47.00	54.00	4230.00	11.00	0.50	11.00	0.00
297.	43.00	133.00	64.00	79.00	242.00	10.00	0.50	2.50	0.00
298.	49.00	135.00	79.00	69.00	188.00	11.00	0.50	2.50	0.00
299.	49.00	120.00	74.00	92.00	174.00	9.00	0.50	2.50	0.01
300.	17.00	37.00	133.00	29.00	799.00	6.00	1.70	2.50	0.00
301.	33.00	138.00	122.00	86.00	341.00	27.00	4.70	2.50	0.00
302.	46.00	145.00	138.00	76.00	335.00	15.00	2.30	21.00	0.00
303.	43.00	114.00	114.00	82.00	541.00	10.00	2.70	2.50	0.00
304.	43.00	149.00	124.00	110.00	227.00	20.00	2.60	2.50	0.00
305.	35.00	109.00	124.00	62.00	502.00	12.00	1.40	2.50	0.00
306.	44.00	124.00	109.00	76.00	437.00	15.00	2.10	34.00	0.00
307.	5.00	30.00	30.00	31.00	628.00	6.00	0.50	2.50	0.01
308.	12.00	40.00	38.00	27.00	381.00	17.00	1.20	2.50	0.00
309.	36.00	109.00	61.00	79.00	244.00	9.00	0.50	2.50	0.00
310.	52.00	152.00	134.00	74.00	430.00	26.00	1.00	2.50	0.00
311.	95.00	160.00	175.00	64.00	305.00	13.00	3.00	2.50	0.00
312.	54.00	140.00	101.00	80.00	304.00	23.00	1.70	7.00	0.00
313.	61.00	168.00	95.00	70.00	269.00	18.00	1.40	2.50	0.00
314.	22.00	131.00	95.00	87.00	479.00	19.00	3.00	2.50	0.00
315.	37.00	130.00	126.00	105.00	475.00	13.00	2.20	2.50	0.00
316.	36.00	107.00	59.00	87.00	222.00	23.00	0.50	2.50	0.00
317.	22.00	62.00	32.00	40.00	269.00	11.00	0.50	17.00	0.00
318.	39.00	117.00	53.00	71.00	351.00	10.00	0.50	11.00	0.00
319.	32.00	112.00	143.00	92.00	475.00	16.00	2.20	2.50	0.00
320.	39.00	125.00	122.00	95.00	322.00	13.00	2.30	2.50	0.00
321.	42.00	145.00	145.00	100.00	327.00	12.00	2.60	2.50	0.00
322.	40.00	145.00	162.00	87.00	403.00	15.00	2.60	2.50	0.00
323.	25.00	101.00	68.00	56.00	448.00	9.00	0.50	9.00	0.00
324.	10.00	40.00	32.00	29.00	842.00	6.00	0.50	22.00	0.00
325.	25.00	79.00	44.00	34.00	334.00	13.00	1.10	25.00	0.01
326.	26.00	58.00	40.00	34.00	538.00	10.00	1.20	27.00	0.00
327.	86.00	153.00	46.00	59.00	283.00	13.00	0.50	11.00	0.01
328.	49.00	116.00	61.00	64.00	263.00	15.00	0.50	2.50	0.02
329.	50.00	139.00	69.00	69.00	207.00	13.00	0.50	2.50	0.01
330.	18.00	90.00	119.00	60.00	963.00	6.00	1.20	2.50	0.01
331.	63.00	125.00	69.00	61.00	237.00	12.00	0.50	10.00	0.00
332.	52.00	119.00	54.00	67.00	376.00	16.00	0.50	2.50	0.00
333.	69.00	151.00	88.00	78.00	147.00	9.00	0.50	2.50	0.00
334.	59.00	129.00	83.00	90.00	212.00	7.00	0.50	2.50	0.00
335.	42.00	82.00	48.00	29.00	341.00	14.00	1.20	2.50	0.00
336.	29.00	75.00	46.00	38.00	117.00	11.00	0.50	2.50	0.00
337.	53.00	128.00	72.00	86.00	166.00	9.00	0.50	2.50	0.01
338.	51.00	133.00	87.00	98.00	263.00	9.00	1.00	2.50	0.01
339.	75.00	113.00	93.00	82.00	211.00	20.00	0.50	9.00	0.00
340.	114.00	108.00	90.00	118.00	194.00	15.00	0.50	6.00	0.00

SAMPNUMB	EASTING	NORTHING	CUC AAS	PBC AAS	ZNC AAS	BAC OES	FEC OES	MNC OES	COC OES
469.	19932.	22977.	20.00	40.00	100.00	580.00	45000.00	3840.00	46.00
470.	20005.	23040.	10.00	40.00	100.00	702.00	49000.00	6320.00	69.00
471.	19997.	23023.	20.00	40.00	130.00	645.00	55000.00	5820.00	32.00
472.	20092.	22985.	25.00	40.00	160.00	574.00	51800.00	3370.00	42.00
473.	20117.	22989.	25.00	40.00	150.00	391.00	46800.00	5360.00	37.00
474.	20202.	23060.	35.00	60.00	110.00	286.00	37400.00	3010.00	23.00
475.	20196.	23116.	25.00	40.00	140.00	483.00	40200.00	1750.00	21.00
476.	20181.	23170.	35.00	40.00	50.00	533.00	49500.00	2780.00	36.00
477.	20177.	23168.	15.00	30.00	60.00	613.00	30400.00	2340.00	27.00
478.	20340.	23010.	45.00	40.00	130.00	495.00	50200.00	4190.00	81.00
479.	20360.	23043.	20.00	40.00	150.00	525.00	45700.00	4680.00	42.00
481.	20659.	22822.	20.00	50.00	170.00	1040.00	47600.00	5180.00	33.00
482.	20614.	22860.	40.00	60.00	260.00	469.00	44000.00	4210.00	40.00
483.	20425.	23033.	20.00	40.00	140.00	507.00	47600.00	4030.00	38.00
484.	20284.	23014.	35.00	40.00	50.00	464.00	58100.00	1050.00	12.00
486.	20036.	23246.	15.00	40.00	90.00	404.00	45000.00	1470.00	5.00
487.	20506.	22831.	15.00	40.00	90.00	503.00	31000.00	823.00	12.00
488.	20489.	22841.	20.00	30.00	60.00	339.00	37500.00	969.00	11.00
489.	20221.	22904.	40.00	40.00	90.00	435.00	57000.00	1370.00	37.00
490.	19899.	23424.	45.00	80.00	240.00	527.00	48200.00	9720.00	79.00
491.	19946.	23274.	25.00	30.00	310.00	464.00	59200.00	4380.00	195.00
-1.	0.	0.	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SAMPNUMB	NIC OES	VC OES	CRC OES	BC OES	ZRC OES	ASC XRF	MOC OES	SNC OES	CUW AAS
469.	36.00	102.00	80.00	62.00	286.00	13.00	0.50	9.00	0.00
470.	40.00	107.00	74.00	100.00	227.00	16.00	0.50	2.50	0.00
471.	56.00	126.00	108.00	92.00	201.00	12.00	0.50	2.50	0.00
472.	57.00	101.00	78.00	87.00	282.00	15.00	0.50	2.50	0.00
473.	46.00	120.00	121.00	80.00	402.00	16.00	0.50	2.50	0.01
474.	31.00	88.00	46.00	45.00	177.00	13.00	0.50	2.50	0.00
475.	44.00	112.00	79.00	71.00	271.00	11.00	1.50	2.50	0.00
476.	60.00	143.00	84.00	73.00	293.00	15.00	0.50	2.50	0.00
477.	28.00	98.00	84.00	89.00	289.00	10.00	0.50	2.50	0.00
478.	47.00	105.00	67.00	75.00	290.00	28.00	0.50	2.50	0.00
479.	37.00	97.00	79.00	70.00	253.00	18.00	0.50	2.50	0.00
481.	43.00	112.00	77.00	83.00	189.00	13.00	0.50	9.00	0.00
482.	44.00	96.00	52.00	50.00	197.00	18.00	0.50	2.50	0.00
483.	40.00	107.00	58.00	84.00	219.00	19.00	0.50	13.00	0.00
484.	31.00	85.00	55.00	115.00	301.00	29.00	1.00	8.00	0.00
486.	24.00	137.00	31.00	85.00	304.00	12.00	0.50	6.00	0.00
487.	13.00	83.00	66.00	73.00	211.00	14.00	0.50	2.50	0.00
488.	28.00	85.00	65.00	68.00	415.00	13.00	0.50	2.50	0.00
489.	55.00	102.00	88.00	83.00	192.00	25.00	0.50	2.50	0.00
490.	117.00	103.00	77.00	76.00	208.00	20.00	0.50	12.00	0.00
491.	110.00	165.00	92.00	83.00	196.00	18.00	1.20	2.50	0.00
-1.	0.0	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00