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# Baldcypress Tree Ring Elemental Concentrations at Reelfoot Lake, Tennessee, From AD 1795 to AD 1820

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Prepared by  
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Prepared for  
U.S. Nuclear Regulatory Commission

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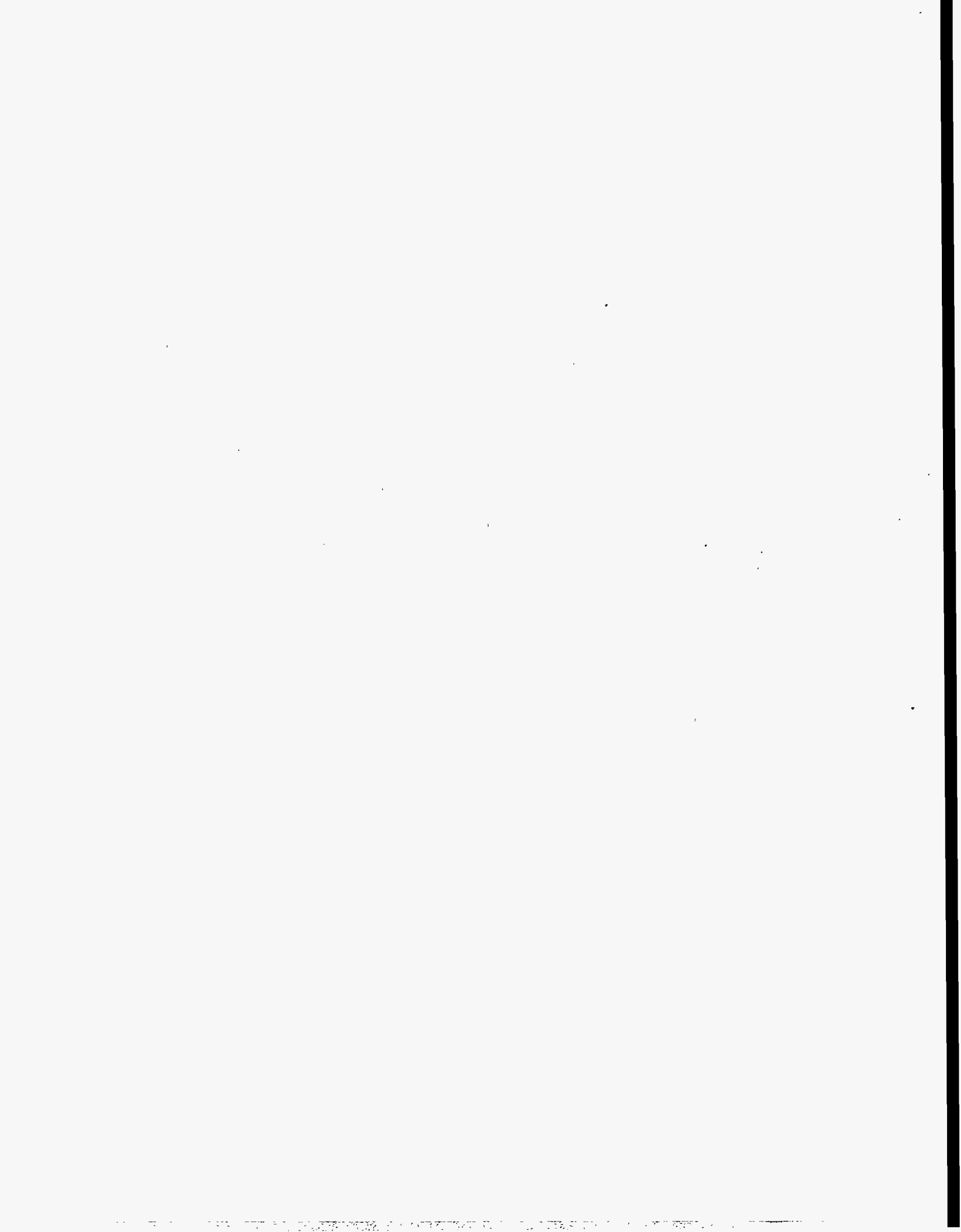
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## ABSTRACT

Many two hundred year old baldcypress trees in Reelfoot Lake, Tennessee, lived through the great New Madrid earthquakes of 1811-1812. This study was undertaken to determine if the elemental composition of baldcypress tree rings showed any systematic variation through the earthquake period of AD 1795 through AD 1820. Multiple cores were collected from two Reelfoot Lake baldcypress trees and analyzed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Individual yearly rings and five-year ring segments were analyzed to determine their elemental compositions. The cores were analyzed for Li through U but only Ba, Ce, Cs, Cu, I, La, Mg, Mn, Nd, Rb, Sm, Sr, and Zn were found to be in appropriate concentrations for this study. Of these elements only Ce, I, La, Nd, Rb, and Sm showed any systematic changes within individual cores.

Comparison of three cores taken from one tree reveal that tree-ring elemental concentrations and changes in tree-ring elemental concentration through time are very different among the cores. When comparing the elemental concentrations of tree rings for the same years in the two different trees neither elemental concentrations nor changes in elemental concentration through time were similar. We conclude that the elemental concentrations in the tree rings of the two baldcypress trees analyzed in this study show no systematic change through the earthquake period of AD 1795 through AD 1820.



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## INTRODUCTION

The New Madrid seismic zone (NMSZ) of the central United States was the site of three earthquakes during the winter of 1811-1812 with estimated moment magnitudes ( $M$ ) between 7.8 and 8.1 (Johnston<sup>1</sup>) and remains the most seismically active region east of the Rocky Mountains (Johnston and Kanter, 1990; Chiu et al., 1992) (Fig. 1). Fuller's (1912) classic paper was the most comprehensive early study to present evidence of co-seismic deformation associated with these earthquakes. Subsequent studies have supported Fuller's tectonic origins of northwestern Tennessee landforms that include the Reelfoot Lake basin, Reelfoot scarp, and the Lake County uplift (Fig. 2) (Stearns, 1979; Hamilton and Zoback, 1982; Russ, 1982; Crone and Brockman, 1982; Stahle et al., 1992; Kelson et al., 1992; Van Arsdale et al., 1994). The Reelfoot scarp is the topographic boundary between the Reelfoot Lake basin and the Lake County uplift. Reelfoot Lake is believed to have formed by the damming of the predecessor west-flowing Reel Foot River during 1812 uplift along the Reelfoot scarp (Van Arsdale et al., 1991; 1993; Stahle et al., 1992).

Tree-ring analyses of baldcypress from Reelfoot Lake, Tennessee, support historical accounts that the lake formed during the great New Madrid earthquakes of 1811-1812 (Stahle et al., 1992) and probably the February 7, 1812 earthquake (Johnston<sup>1</sup>). As a consequence of lake formation, bottomland hardwood trees within the lake were killed. However, many water tolerant baldcypress trees survived and hundreds of 200 to 800 year old baldcypress outline the positions of former stream channels drowned by the formation of Reelfoot Lake. Dendrochronological analyses of multiple cores from 21 baldcypress in the lake reveal several pronounced growth responses to the 1811-12 earthquakes. These responses include a great surge in radial growth during the decade following the earthquakes (Fig. 3), a permanent reduction in wood density beginning in 1812, and extensively broken wood in the pre-1812 portions of the cores (Van Arsdale et al., 1991; 1993; Stahle et al., 1992). In summary, the previous Reelfoot Lake research has demonstrated a dramatic baldcypress physiological response to the earthquakes of 1811-1812.

Recent studies have demonstrated the effectiveness of dendrochronology in determining changes in trace element chemistry through time (Long et al., 1987; Guyette and McGinnes, 1987; Hall, 1987, McClenahan et al., 1987; Hall et al., 1990). For example Hall et al. (1990) have shown dramatic changes in trace element concentrations the year after volcanic eruptions. The purpose of this study was to determine the trace element chemistry within the Reel Foot River basin prior to the earthquakes and the trace element chemistry within Reelfoot Lake after the earthquakes as revealed in baldcypress tree rings. Our goal was to determine if there was any systematic change in the tree ring element chemistry through the earthquake period from AD 1795 through AD 1820.

## METHODOLOGY

Our original plan was to chemically analyze baldcypress tree rings that were already collected from a previous study at Reelfoot Lake, Tennessee, and Lake St. Francis, Arkansas. However, the cores collected were 0.5 cm diameter cores that had been glued to wooden mounts for age dating. When these cores were separated into individual rings for trace element analysis the volume of wood was found to be insufficient to obtain reliable results. Thus, it was necessary to

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<sup>1</sup>In press. Geophysical Journal International.

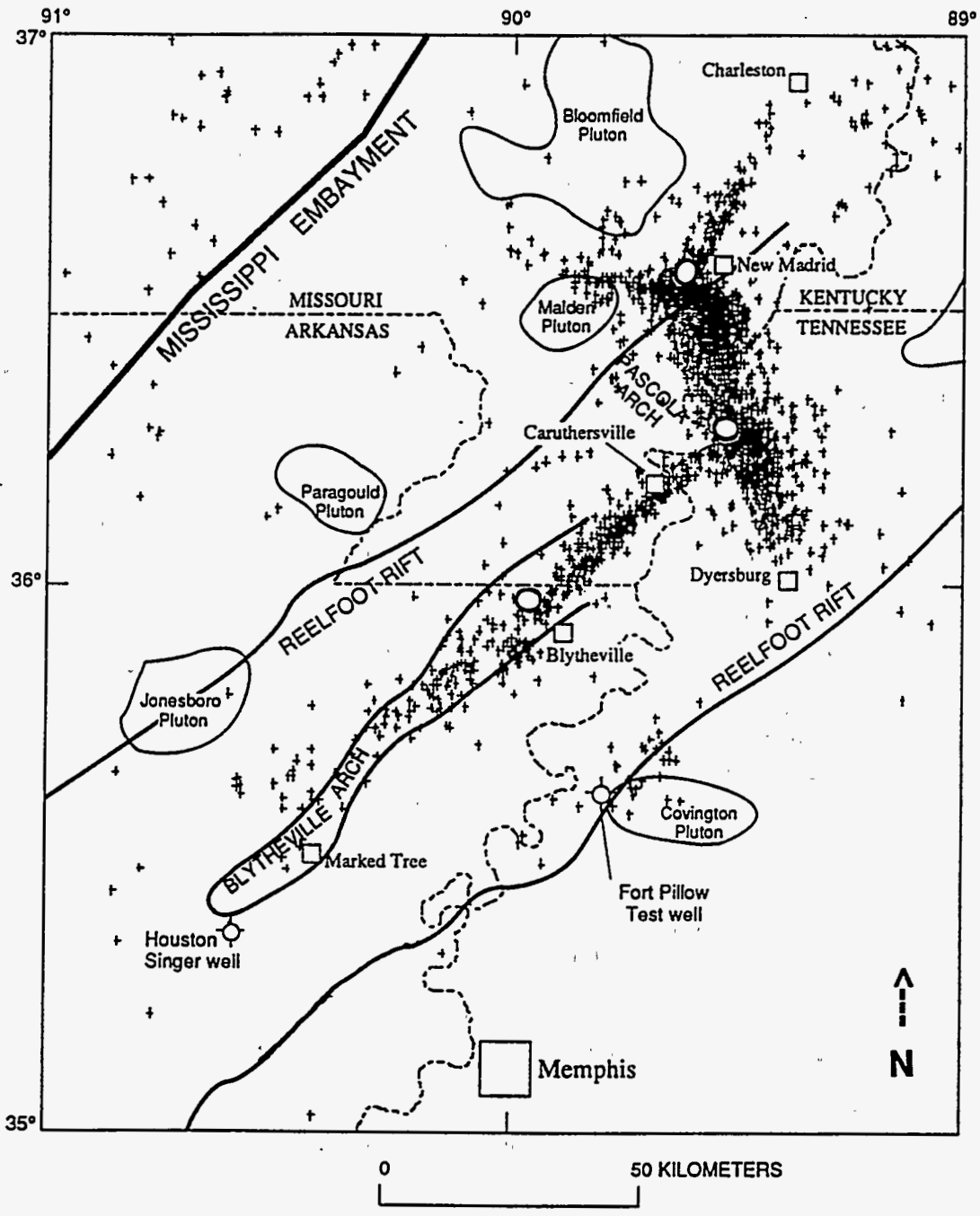


Figure 1. Microearthquake epicenters (crosses) in the New Madrid seismic zone. Circles within the area of crosses are the epicenters of the 1811-1812 earthquakes. Reelfoot Lake is located near the center circle 20 km northeast of Caruthersville.

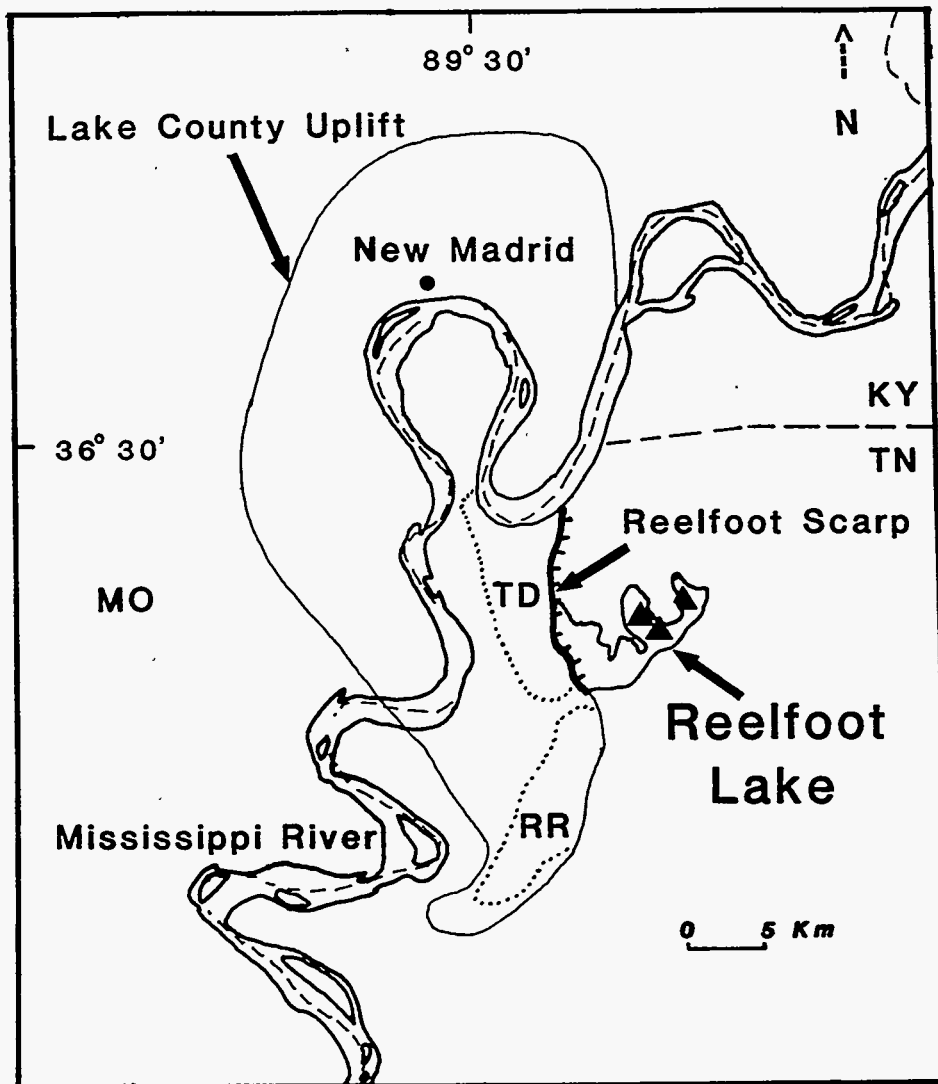


Figure 2. Reelfoot Lake and the Lake County uplift. RR = Ridgely Ridge and TD = Tiptonville Dome. The Lake County uplift is largely coincident with the northwestern trending seismicity of Figure 1. Triangles in Reelfoot Lake represent tree ring sample sites. The southern triangle is the site where samples were collected for chemical analyses.

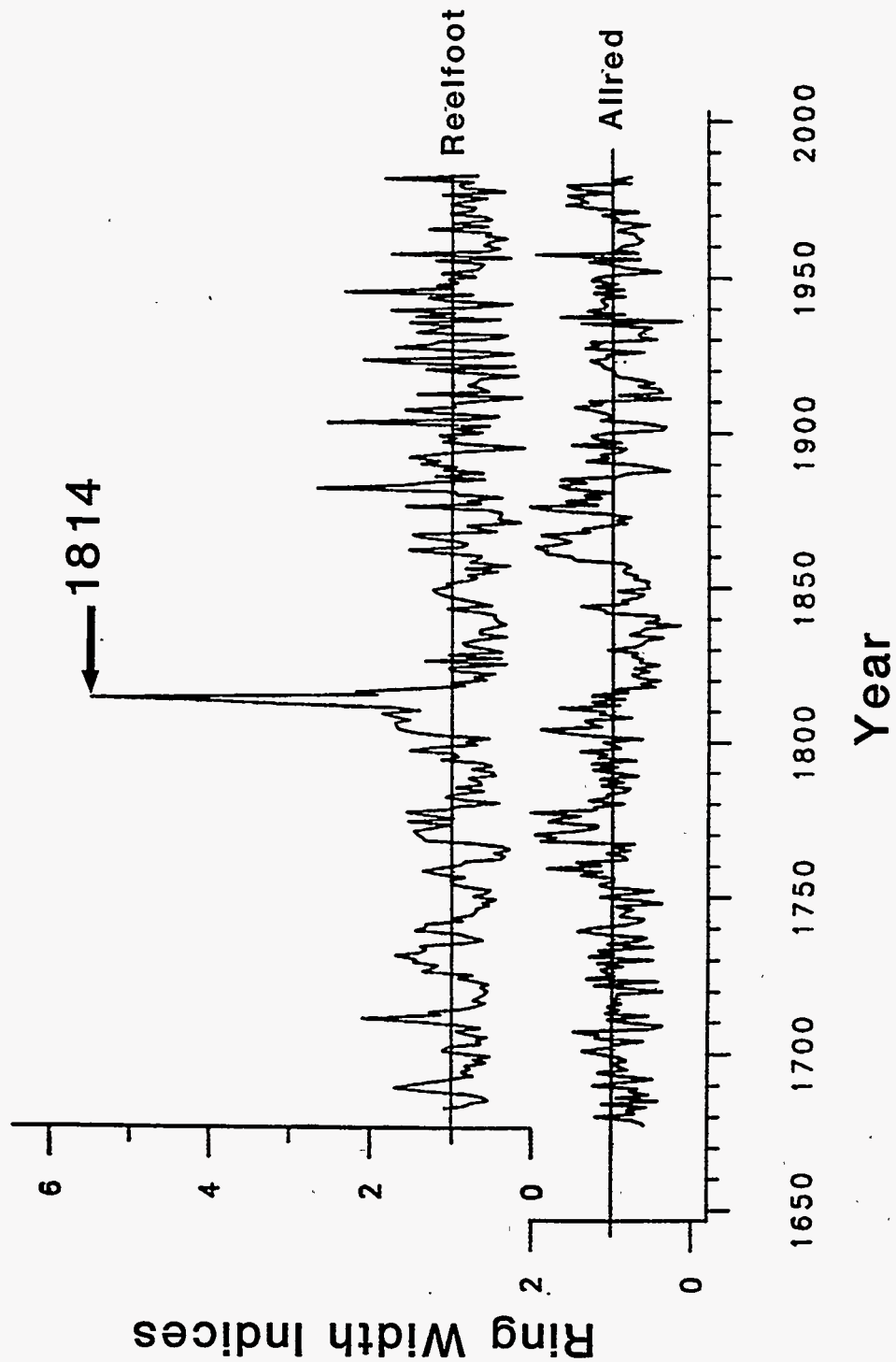


Figure 3. Standardized tree-ring-width chronologies from Reelfoot Lake, Tennessee, and Allred Lake, Missouri. These mean ring-width index chronologies are dimensionless indices of growth for each year. Biological or age-related growth trends were removed and each core series was indexed before averaging into the chronology (from Stahle et al., 1992).

re-sample trees using a 1 cm diameter Swedish Increment Borer and then to re-date the cores. Because we had to re-sample and re-date the tree ring cores the scope of the project was reduced. We only re-sampled baldcypress trees in Reelfoot Lake, Tennessee.

Upon review of the Reelfoot Lake baldcypress cores, we decided to determine the concentration of trace elements in a number of cores from two trees (trees numbered 29 and 37) because these trees had individual rings that were large enough to provide sufficient wood volume for multielement analyses. The trees are in the central portion of the lake and within approximately 100 m of each other (Fig. 2). Five cores were dated and divided into one-year rings (RL29N, RL29S, RL29E, RL37N, RL37Sa and b) and three other cores were divided into five-year increments (RV29S, RV29E, RV37S) at the Tree-ring Laboratory of the University of Arkansas by David Stahle. Cores RL29N, RL29S, and RL29E were collected from one tree (tree number 29) from the north, south, and east sides respectively. Comparison of these three cores allowed us to evaluate the elemental variation within one tree as a function of what side of the tree was sampled because studies have shown that the concentrations of trace elements in tree rings are not constant around the 360 degrees of a tree (MacLauchlan et al., 1987; McClenahan et al., 1989). This variation is attributed to discontinuities in the soil element composition. We also collected two cores from tree 29 (RV29S, and RV29E) from the south and east sides and divided the cores into five-year increments. This was done to determine if systematic chemical variations occurred in five-year increments, to study the elemental chemistry of the tree over a longer period of time, and to be able to compare the one-year increment chemistry with the five-year increment chemistry for the same time period. In the same way RL37N, RL37Sa and b, and RV37S were all from tree 37 but were collected at different azimuths. Individual rings were analyzed in cores RL37N and RL37Sa and b and five-year increments were analyzed in RV37S. The rings and core segments were chemically analyzed at Rutgers University.

Sample preparation of the individual tree rings and five-year core segments involved dissolving them in ultra high purity nitric acid. We then spiked all samples with three internal standards of Sc, In, and Tl, to normalize all element ion intensities to determine the concentrations of the elements. The solutions were diluted and analyzed for the elements lithium through uranium using Inductively Coupled Plasma Mass Spectrometry (ICP-MS). This instrument allows simultaneous determination of the concentrations of the elements lithium (atomic number 3) through uranium (atomic number 92) in individual tree rings (Hall et al., 1990). The analytical protocol was validated by analyzing cellulose standard reference material that is certified for 20 elements.

A sample of wood from each set of tree rings was analyzed for all the elements from Li through U to determine the elemental concentrations. The elements S, Na, C, N, O, K, Ar, P, Si, and Ca were not included in the scan because they have such high concentrations that any subtle changes from ring to ring would not be discernable. Ne, F, and Cl were not included because they can not be measured by ICP-MS. From these preliminary analyses it was determined that most of the elements from Li-U were below the detection limit of the ICP-MS. Therefore, only those elements that gave reasonable counts above background were chosen. We specifically focused on the determination of the elements Ba, Ce, Cs, Cu, I, La, Mg, Mn, Nd, Rb, Sm, Sr, and Zn. Previous studies have shown that rare earth elements are most sensitive to changes in geological and environmental conditions.

Data analysis involved the determination of the concentration in parts per billion (ppb) of all

the elements listed above that were contained in the individual yearly rings and in the five-year core segments. Of the 13 elements only Ce, I, La, Nd, Rb, and Sm were above the limit of detection and showed any systematic changes. The concentration in ppb of the elements found in the rings and core segments are illustrated in Figures 4-11.

## RESULTS

### Tree 29

RL29N, RL29S, and RL29E are cores collected from the north, south, and east sides of the same tree (tree 29) (Figs. 4-6). These cores were divided into one-year rings for chemical analyses. There is a pronounced peak in elemental concentration for the year 1805 in RL29N and rise in Rb at 1815. RL29S shows a modest increase in elemental concentrations at 1812 and a pronounced increase at 1815. In RL29E the concentrations show trends similar to RL29S but the overall concentrations are so low that this sample is considered insignificant except to help show the variation in wood chemistry as a function of azimuth.

RV29S and RV29E are five-year increment cores collected from the south and east sides of tree 29 (Figs. 7 and 8). RV29S reveals a concentration spike in the time frame from 1812 to 1816. RV29E has spikes at 1787-1791, 1817-1821, and at 1827-1831.

### Tree 37

RL37N and RL37S are cores collected from the north and south sides of tree 37 (Figs. 9, 10a, and 10b). These cores were divided into one-year rings for chemical analyses. A modest concentration peak occurs at 1804 and 1810 in RL37N. In general, elemental concentrations are lower in RL37Sa with the lowest levels being in 1810 (Fig. 10a). However, iodine has a relative high concentration in RL37Sb at 1805 (Fig. 10b).

RV37S is a five-year increment core collected from the south side of tree 37 (Fig. 11). RV37S has relatively high elemental concentrations in the time frame of 1792-1796 that diminish and then rise again at 1822-1826.

## CONCLUSIONS

Comparison of figures 4-6 reveals that there is more variation in elemental concentration among the three sides of tree 29 than within any of the three sides. It is also evident that elemental concentration variation is not consistent among the three sides of tree 29. Similarly, in comparing figures 7 and 8 both the concentrations and concentration variations are quite different in the five year increments taken from the south and east sides of tree 29.

Tree 37 also shows no systematic variation in elemental concentration with time. The elemental concentrations are higher in RL37N than in RL37S and the time of overlap between these two cores from 1804 to 1810 shows no parallel changes in elemental concentrations. For example in 1810 elemental concentrations are high in RL37N and low in RL37Sa.

When comparing Figures 4 through 11 it is apparent that there are no common trends in elemental concentrations with time. Elemental concentrations in the cores vary both in time

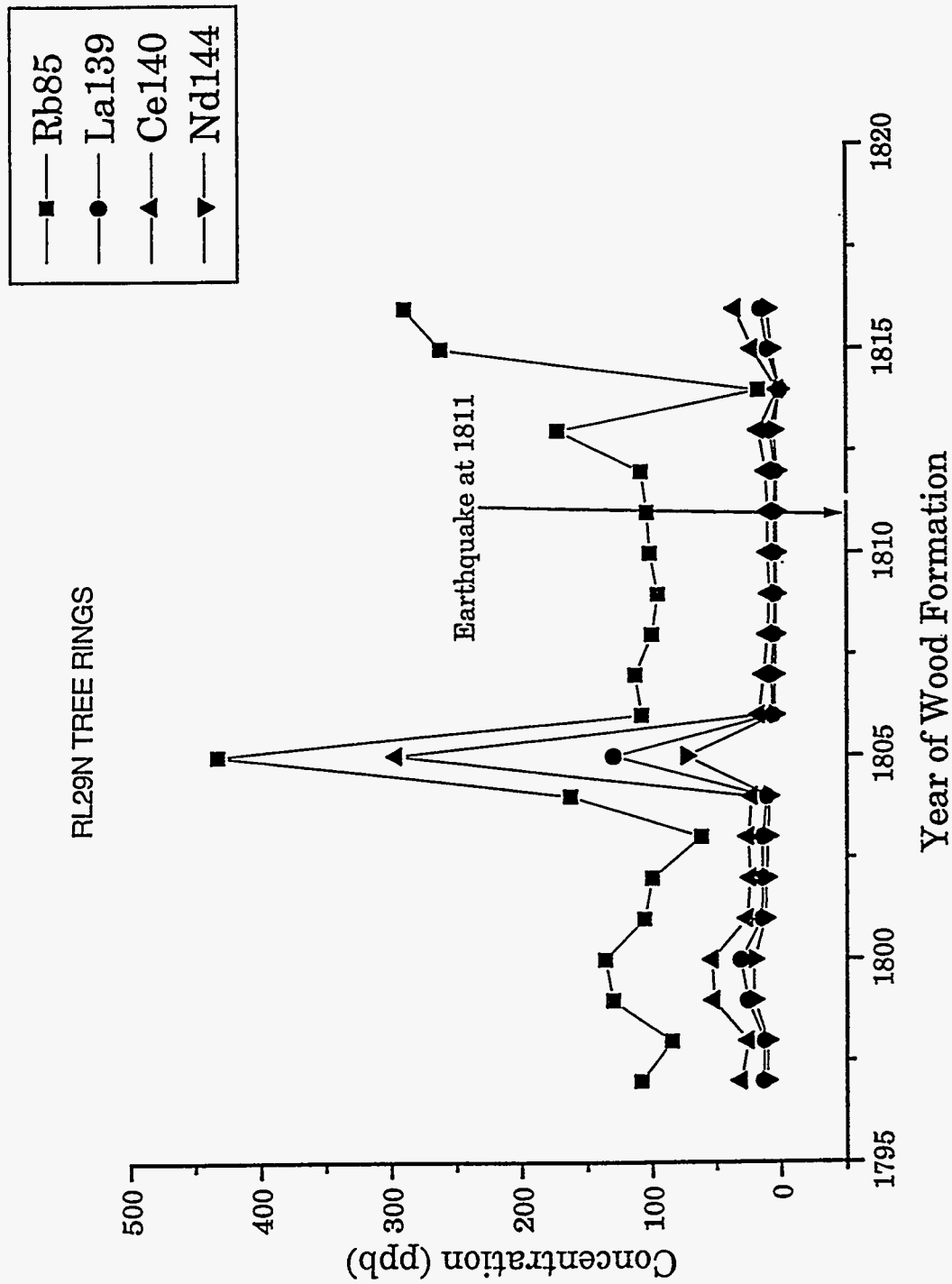


Figure 4. Elemental concentrations of yearly tree rings from a core taken from the north side of tree 29.



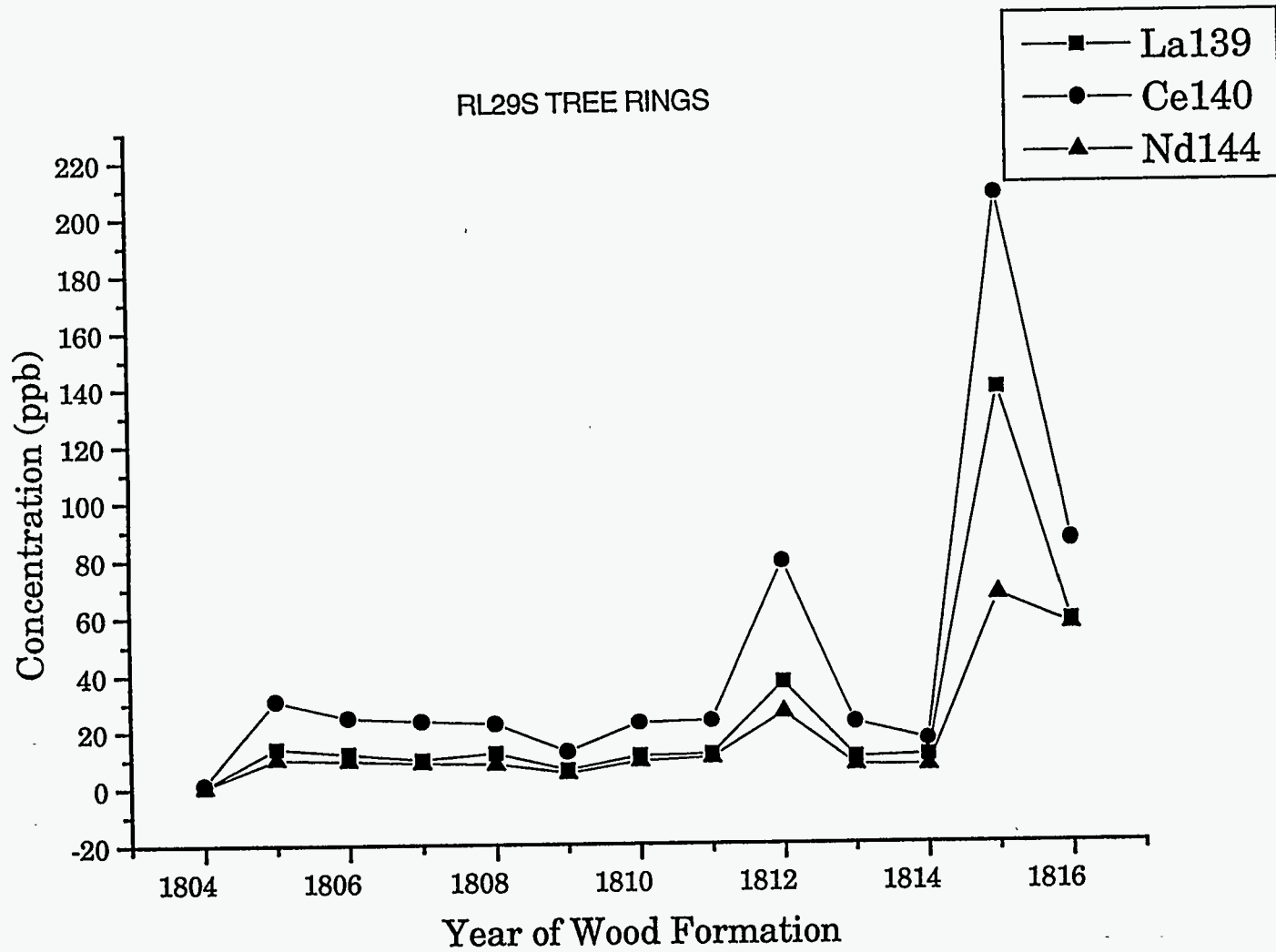


Figure 5. Elemental concentrations of yearly tree rings from a core taken from the south side of tree 29.

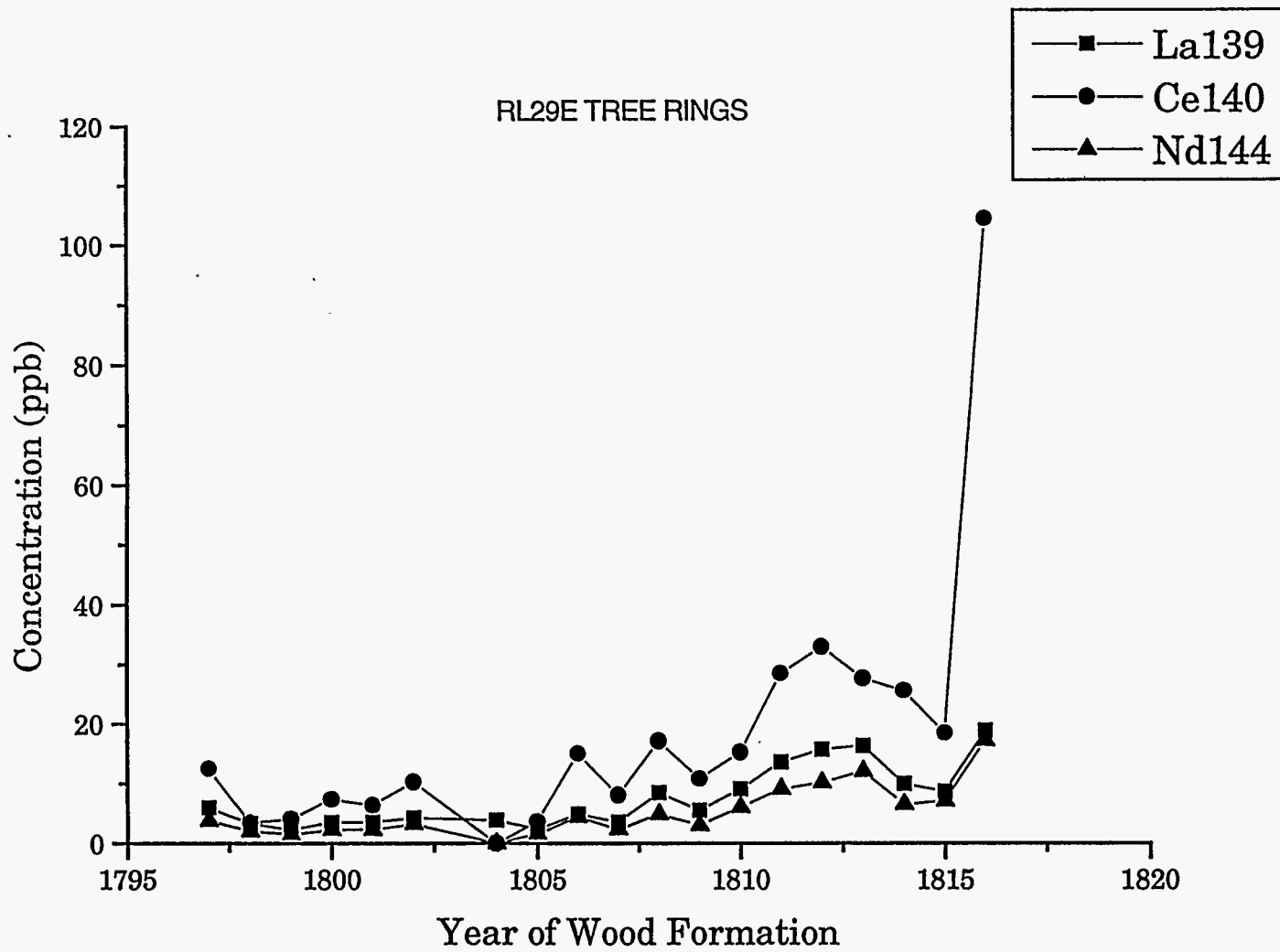


Figure 6. Elemental concentrations of yearly tree rings from a core taken from the east side of tree 29.

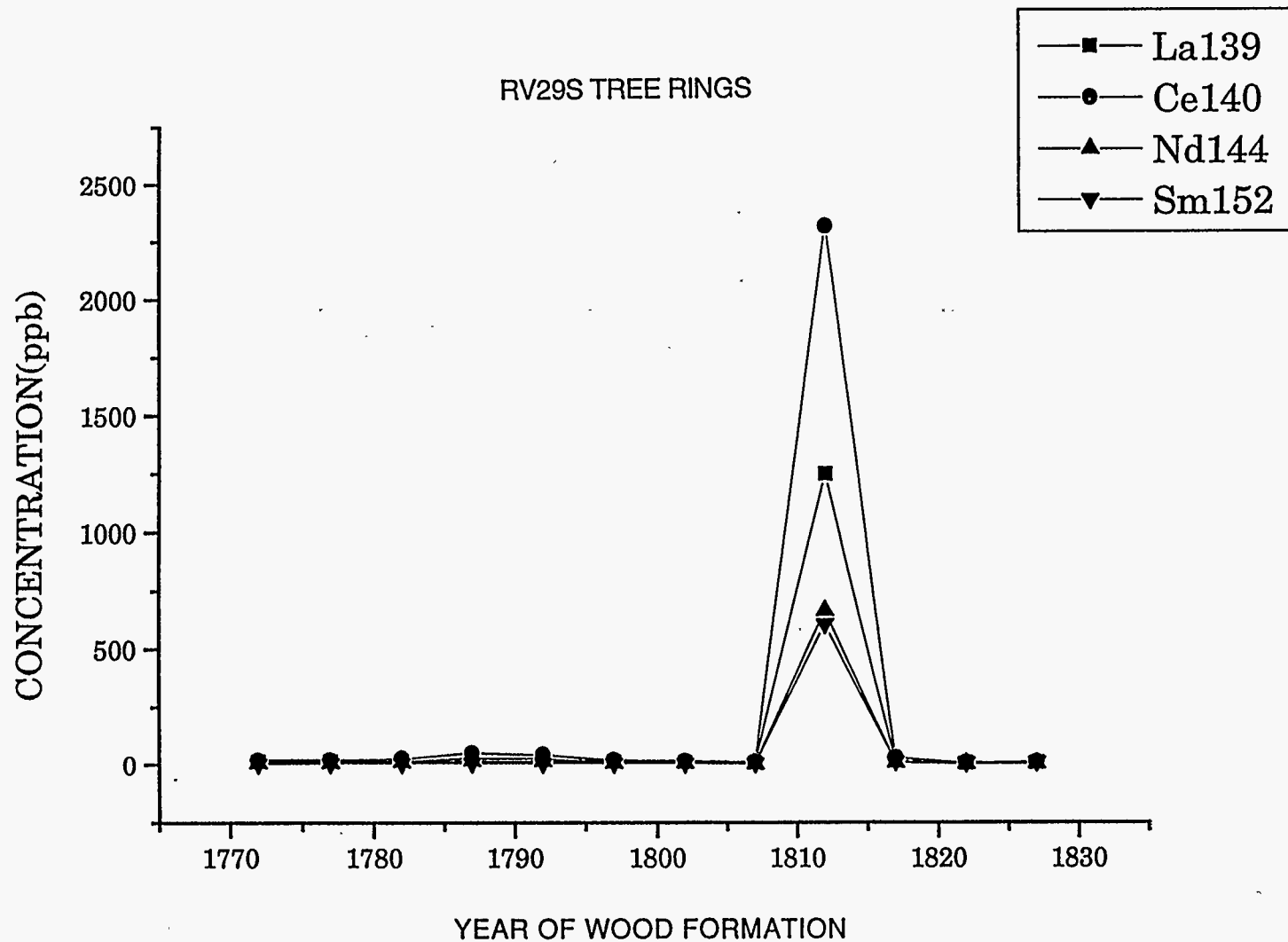


Figure 7. Elemental concentrations of five year increments from a core taken from the south side of tree 29.

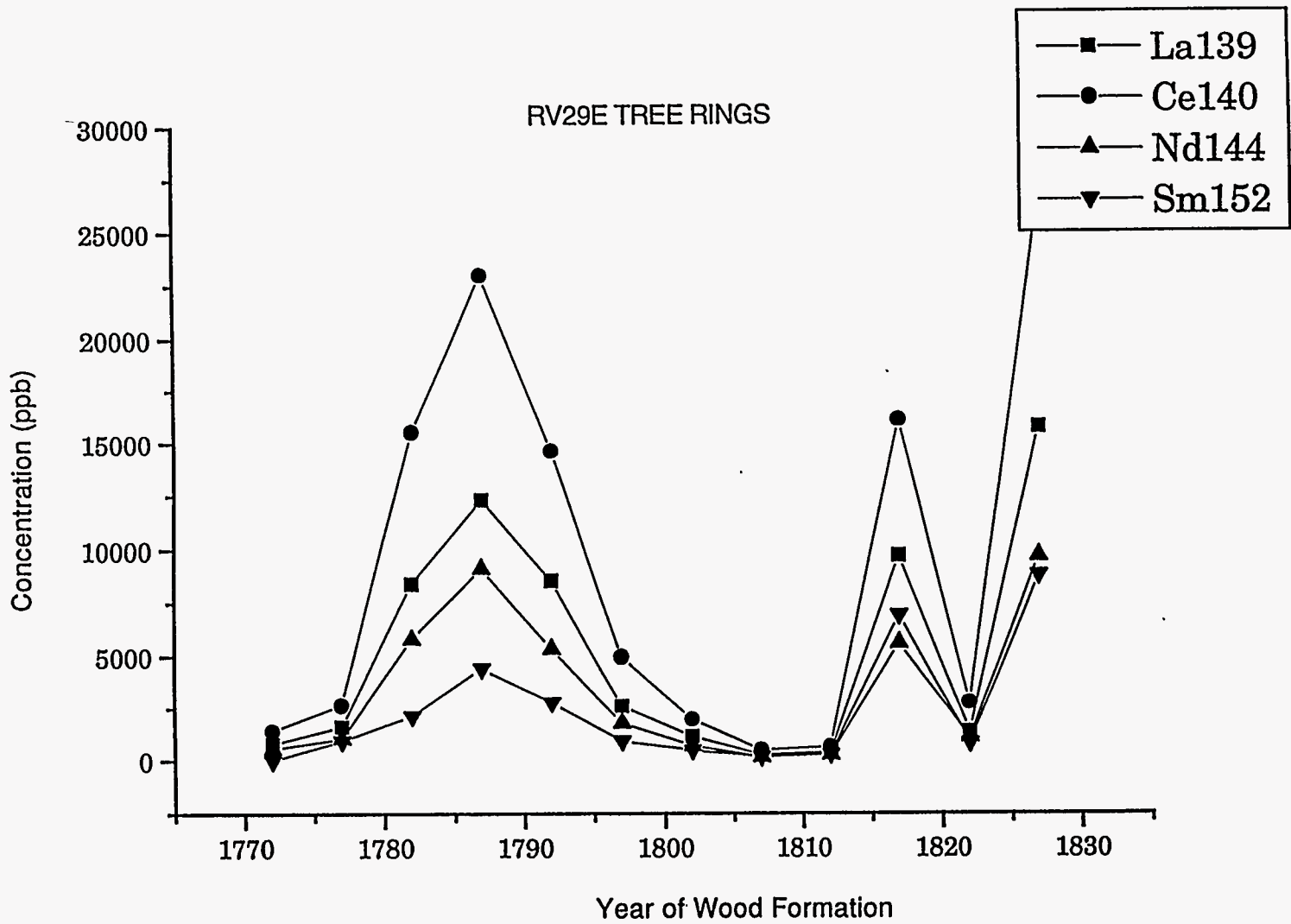


Figure 8. Elemental concentrations of five year increments from a core taken from the east side of tree 29.

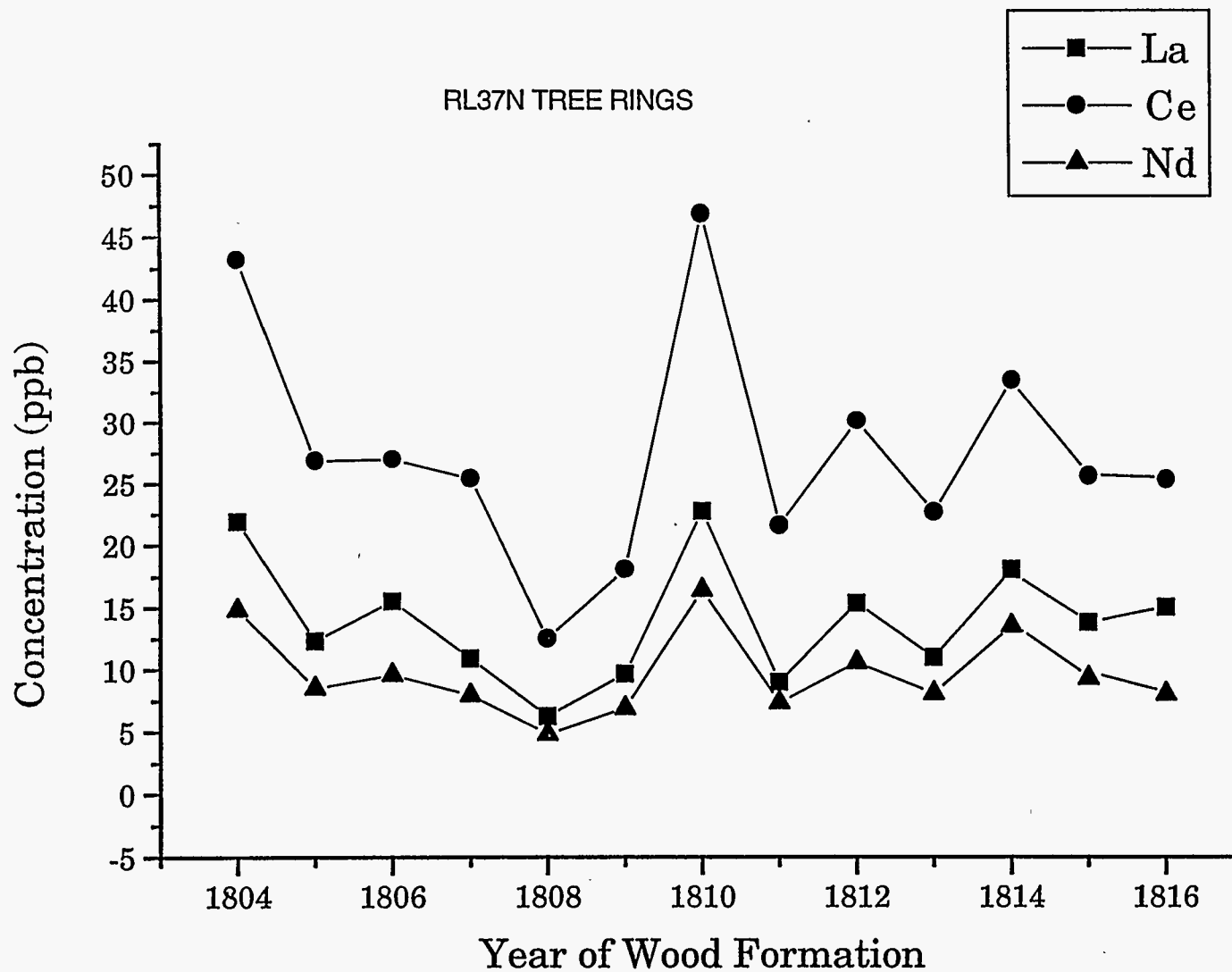
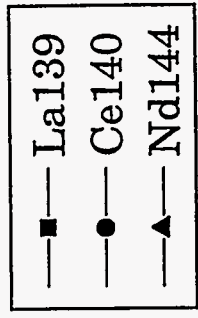


Figure 9. Elemental concentrations of yearly tree rings from a core taken from the north side of tree 37.



RL37Sa TREE RINGS

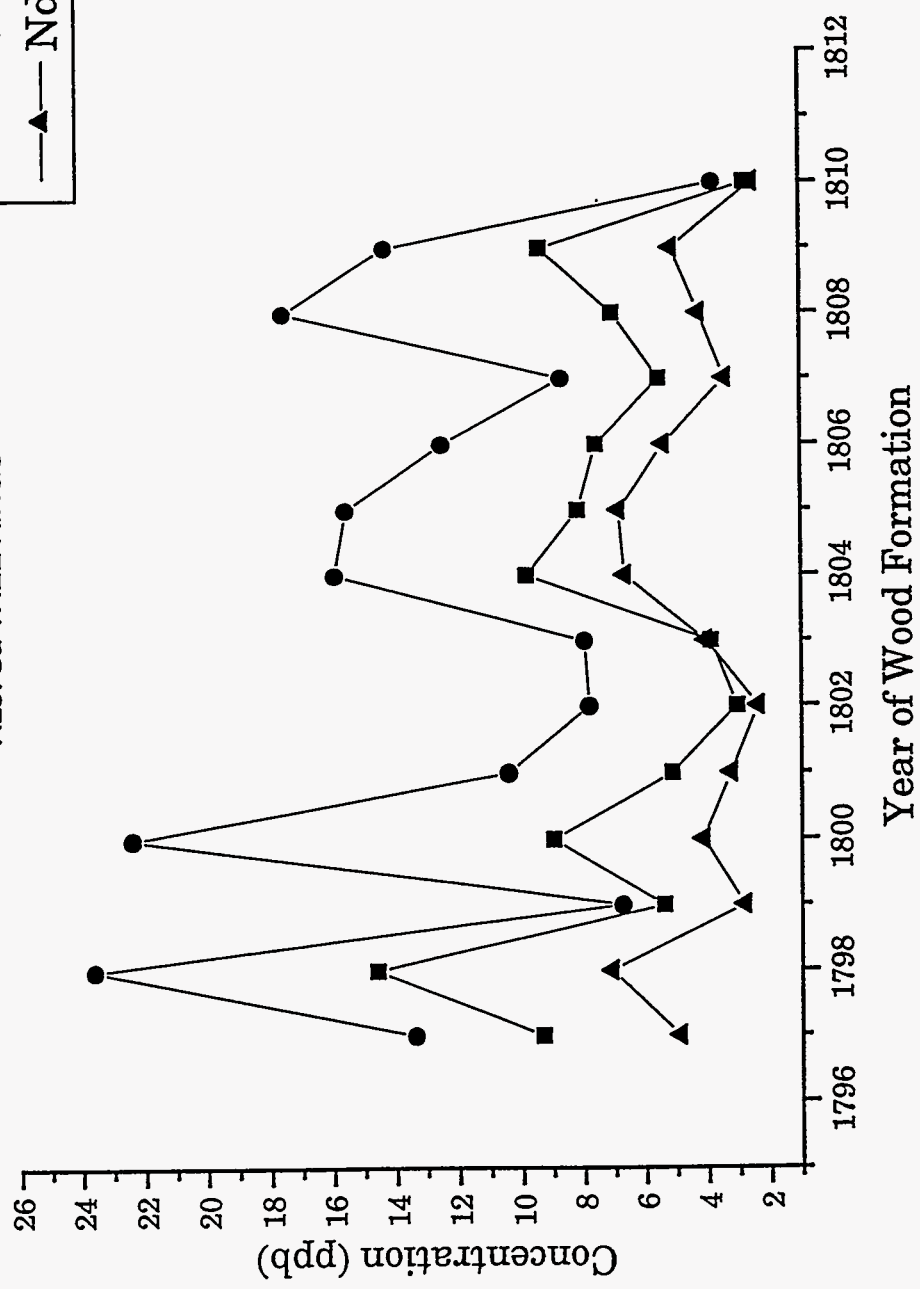


Figure 10a. Elemental concentrations of yearly tree rings from a core taken from the south side of tree 37.

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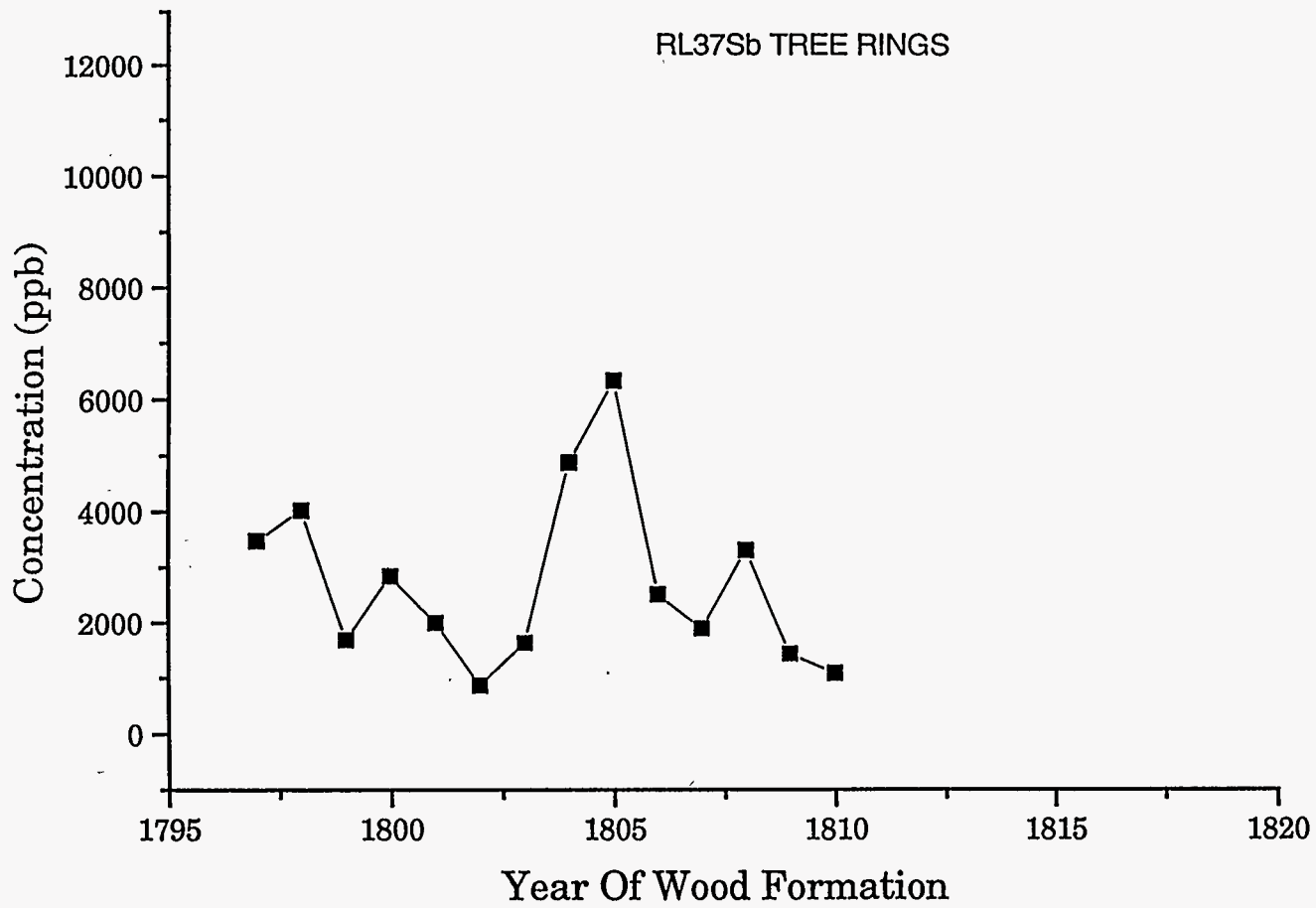


Figure 10b. Concentration of iodine in yearly tree rings from a core taken from the south side of tree 37.

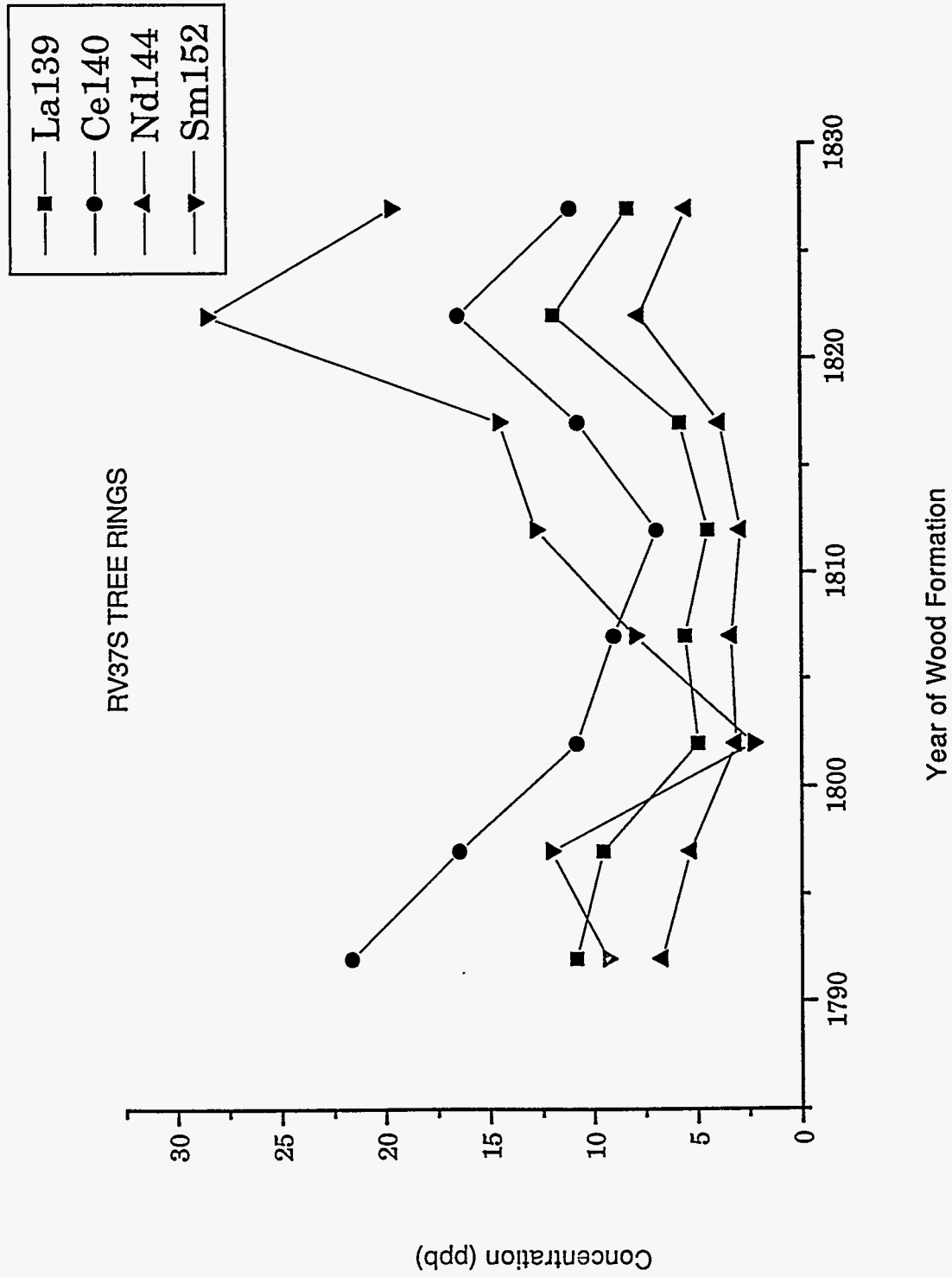


Figure 11. Elemental concentrations of five year increments from a core taken from the south side of tree 37.



and location on the tree but not in any systematic manner. Thus, we must conclude that within trees 29 and 37 of Reelfoot Lake there are no elemental variations that can be related to the earthquakes of 1811-1812.

The results of this study are negative; however, there are some curious chemical anomalies. For example, core RL29N (Fig. 4) has an elemental spike at 1805 and elemental spikes are illustrated in Figures 7 and 8. Although we do not know the origin of these elemental spikes, it is possible that they have a geologic significance.

#### REFERENCES CITED

Chiu, J.M., Johnston, A.C., and Yang, Y.T., 1992, Imaging the active faults of the central New Madrid seismic zone using PANDA array data. *Seism. Res. Lett.*, v. 63, n. 3, p. 375-393.

Crone, A.J., and Brockman, S.R., 1982, Configuration and deformation of the Paleozoic bedrock surface in the New Madrid seismic zone, in McKeown, F.A., and Pakiser, L.C., eds., *Investigations of the New Madrid, Missouri, earthquake region*, U.S. Geol. Surv. Prof. Paper 1236, p. 113-135.

Fuller, M.L., 1912, The New Madrid earthquake. *U.S. Geol. Surv. Bull.* 494, 119 p.

Guyette, R., and McGinnes, E.A., 1987, Potential in using elemental concentrations in radial increments of old growth eastern redcedar to examine the chemical history of the environment. *Proceedings of the International Symposium on Ecological Aspects of Tree-Ring Analysis*, p. 671-680.

Hall, G.S., 1987, Multielemental analysis of the tree-rings by proton-induced x-ray (PIXE) and gamma ray emission (PIXE). *Proceedings of the International Symposium on Ecological Aspects of Tree-Ring Analysis*, p. 681-689.

Hall, G.S., Yamaguchi, D.K., and Rettberg, T.M., 1990, Multielemental analyses of tree rings by Inductively Coupled Plasma Mass Spectrometry. *J. Radioanal. Nucl. Chem., Letters* 146 (4), p. 255-265.

Hamilton, R.M., and Zoback, M.D., 1982, Tectonic features of the New Madrid seismic zone from seismic-reflection profiles, in McKeown, F.A., and Pakiser, L.C., eds., *Investigations of the New Madrid, Missouri, earthquake region*. U.S. Geol. Surv. Prof. Paper 1236, p. 55-82.

Johnston, A.C., and Kanter, L.R., 1990, Earthquakes in stable continental crust. *Sci. Am.*, v. 262, n. 3, p. 68-75.

Kelson, K.I., Van Arsdale, R.B., Simpson, G.D., and Lettis, W.R., 1992, Assessment of the style and timing of surficial deformation along the central Reelfoot scarp, Lake County, Tennessee. *Seism. Res. Lett.*, v. 63, n. 3, p. 349-356.

Long, A., Leavitt, S., and Cheng, S., 1987, Carbon-13/Carbon-12 variations in bristlecone pine over the past 600 years and their relation to climate and global atmospheric CO<sub>2</sub>. *Proceedings of the International Symposium on Ecological Aspects of Tree-Ring Analysis*, P. 485-493.

MacLauchlan, L.E., Borden, J.H., Cackette, M.R., and Auria, J.M., 1987, Rapid multi-sample technique for detection of trace elements in trees by energy-dispersive X-ray fluorescence spectroscopy. *Can. J. For. Res.*, v. 17, p. 1124-1130.

McClenahan, J.R., Vimmerstedt, J.P., and Lathrop, R.C., 1987, History of the chemical environment from elemental analysis of tree rings. *Proceedings of the International Symposium on Ecological Aspects of Tree-Ring Analysis*, p. 690-694.

McClenahan, J.R., Vimmerstedt, J.P., and Scherzer, A.J., 1989, Elemental concentrations in tree rings by PIXE: statistical variability, mobility, and effects of soil chemistry. *Can. J. For. Res.*, v. 19, p. 880-888.

Russ, D.P., 1982, Style and significance of surface deformation in the vicinity of New Madrid, Missouri, in McKeown, F.A., and Pakiser, L.C., eds., *Investigations of the New Madrid Missouri, earthquake region*. U.S. Geol. Sur. Prof. Paper 1236, p. 95-114.

Stahle, D.W., Van Arsdale, R.B., Cleaveland, M.K., 1992, Tectonic signal in Baldcypress trees at Reelfoot Lake, Tennessee. *Seism. Res. Lett.*, v. 63, n. 3, p. 439-447.

Stearns, R.B., 1979, Recent vertical movement of the land surface in the Lake County uplift and Reelfoot Lake basin areas, Tennessee, Missouri, and Kentucky. U.S. Nuclear Reg. Com. NUREG/CR-0874, 37 p.

Van Arsdale, R.B., Stahle, D.W., and Cleaveland, M.K., 1991, Tectonic deformation revealed in baldcypress trees at Reelfoot Lake, Tennessee. U.S. Nuclear Reg. Com. NUREG/CR-5749, 12 p.

Van Arsdale, R.B., Stahle, D.W., and Cleaveland, M.K., 1993, Applications of dendrochronology to earthquake studies in the New Madrid seismic zone of the central United States. *Quaternary Proceedings*, n. 3, p. 85-91.

Van Arsdale, R.B., Kelson, K.I., Simpson, G.D., Lumsden, C.H., and Harris, J.B., 1994, Northern extension of the Reelfoot scarp, Kentucky and Missouri. *Geol. Soc. of Am.*, v. 26, n. 7, p. A-189.

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SUPPLEMENTARY NOTES

R. McMullen, NRC Project Manager

ABSTRACT (200 words or less)

Many 200 year old baldcypress trees in Reelfoot Lake, Tenn., lived through the great New Madrid earthquakes of 1811-1812. This study was undertaken to determine if the elemental composition of baldcypress tree rings showed any systematic variation through the earthquake period of AD 1795-1820. Cores were collected from two Reelfoot Lake baldcypress trees and analyzed using Inductively Coupled Plasma Mass Spectrometry. Individual yearly rings and five-year ring segments were analyzed to determine their elemental compositions. The cores were analyzed for Li through U but only Ba, Ce, Cs, Cu, I, La, Mg, Mn, Nd, Rb, Sm, Sr, and ZN were found to be above the detection limit. Of these only Ce, I, La, Nd, Rb, and Sm showed any systematic changes within individual cores. Comparison of three cores taken from one tree reveal that tree-ring elemental concentrations and any changes through time are very different among the cores. When comparing the elemental concentrations of tree rings for the same years in the two trees neither elemental concentrations nor changes through time were similar. The elemental concentrations show no systemic changes through the earthquake period of AD 1795-1820.

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