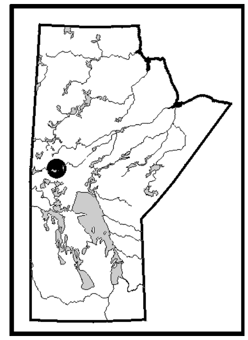
GS-9 GEOCHEMISTRY OF DRILLCORE SAMPLES, ALDERS, PEAT, BOG IRON AND TILL AT REED LAKE, MANITOBA (NTS 63K9)

by G.H. Gale



Gale, G.H. 2002: Geochemistry of drillcore samples, alders, peat, bog iron and till at Reed Lake, Manitoba (NTS 63K9); *in* Report of Activities 2002, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p.75–82.

SUMMARY

Two drillholes intersected conductive volcanosedimentary rocks, which probably represent distal exhalites from a hydrothermal vent, with positive Eu anomalies. A test survey of alder twigs in the vicinity of this zone of conductive rocks yielded several samples with anomalous Ba, Au, Mo, Re, Sb and Eu, but they did not outline the conductor. Samples of peat, bog iron and till were collected from a muskeg over the same area. Bog iron and till samples from this survey will be analyzed by selective extraction methods and reported later.

INTRODUCTION

Rock geochemical studies of drillcore from two drillholes at Reed Lake indicate that the area has the potential to contain massive sulphide deposits. Studies were initiated to determine if selective chemical extraction methods could be used to delineate geochemical anomalies in tills beneath lake bottom sediments and floating bog. Results from rare-earth element (REE) studies of sulphide-bearing rocks and ashed alders and metal contents of ashed alders are presented in this report.

BACKGROUND AND PURPOSE

Exploration of an electromagnetic anomaly under muskeg with drillhole R96-04, near the south shore of Reed Lake, in 1996 did not provide any geological explanation for the presence of a strong distinctive 1 km long conductor (Fig. GS-9-1). Examination of the drillcore by the author indicated that mostly intrusive rhyolite, which did not reveal

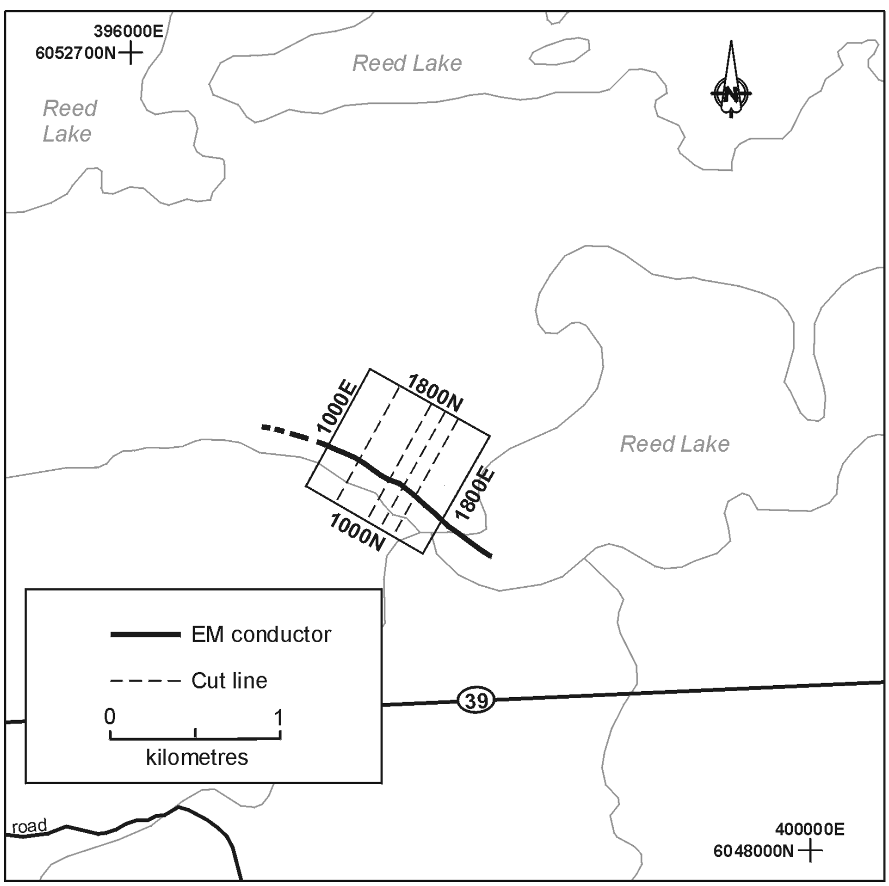


Figure GS-9-1: Location of the Reed property at Reed Lake.

significant alteration indices, had been sampled in a previous geochemical survey. This examination also revealed that felsic volcanic sandstones containing minor sulphides and blocks of altered rhyolite occur between aphanitic felsic dikes. The altered felsic volcanic sandstones were sampled during this study, with results reported below.

An initial geochemical survey of drillcore samples from hole R96-04 revealed both weakly altered rhyolite and felsic sandstone, with the latter displaying modest positive europium anomalies in several samples. Previous studies by Gale et al. (1997) have shown positive Eu anomalies to be commonly associated with exhalites and volcanogenic massive sulphide deposits. Drillhole CR-4, collared 100 m east of hole R96-04, intersected altered rhyolite, felsic volcanic sandstone, well-layered siltstones and layered barren pyrrhotite. Geochemical data on sample pulps and grab samples of drillcore indicate the presence of trace amounts of copper and zinc and positive Eu^d values in several samples of felsic sandstone. In addition, anomalous concentrations of other elements (Ba, As, Ag, Sn) in the volcanosedimentary rocks suggest the presence of distal exhalative hydrothermal vent activity at the stratigraphic level of the conductor.

The location of this conductor and the positive Eu^d anomalies obtained from the drillcore provide a unique opportunity to test the feasibility of using partial extraction methods in undisturbed surficial materials to determine if

- partial chemical extraction methods are useful exploration methods for tills underlying muskeg and floating muskeg;
- there are differences in the metal ion contents of material sampled beneath muskeg and material sampled beneath open water;
- Eu anomalies in rocks underlying bogs are reflected in the bog vegetation; and
- partial chemical extraction methods can be used to establish future drill targets along this conductor.

To test these concepts alder twigs were collected along two cut lines and cores of muskeg and Quaternary material were collected at five test sites. This report presents the methodology used in sampling the muskeg and some of the results obtained to date.

GEOLOGICAL SETTING

The Reed property is situated in a belt of felsic and mafic volcanic rocks that includes the past-producing Spruce Point mine (Fig. GS-9-1). In addition, other volcanogenic massive sulphide (VMS) type mineral occurrences have been intersected in the area (W.B. Dunlop, pers. comm., 2000). The electromagnetic conductor of interest on the Reed property is situated in an area that is covered by muskeg and water (Fig. GS-9-2), which extend for over 500 m away from the drill sites. The only geological information in the immediate vicinity is derived from drillholes R96-04 and CR-4.

Figure GS-9-2: Overview of the Reed muskeg and sample equipment.

Figure GS-9-3 illustrates the geology of the drillcores. The conductive rocks are considered to occur within felsic volcanic rocks that structurally underlie mafic volcanic rocks of variable thickness. Felsic rocks in the uppermost half of drillhole R96-04 contain abundant 5 to 7 mm quartz crystals, with a bluish tinge, embedded in a fine-grained chloritic matrix. These rocks are tentatively interpreted as an intrusion. The massive and foliated mafic rocks are considered to be basalt flows and volcaniclastic rocks. The felsic rocks in the lowermost portions of the drillholes are dominantly fine-grained, in part quartz- and feldspar-bearing rocks derived from a felsic volcanic (rhyolitic) source. Definitive volcanic flow textures, such as flow breccia and flow bands, are not present. These massive to indistinctly

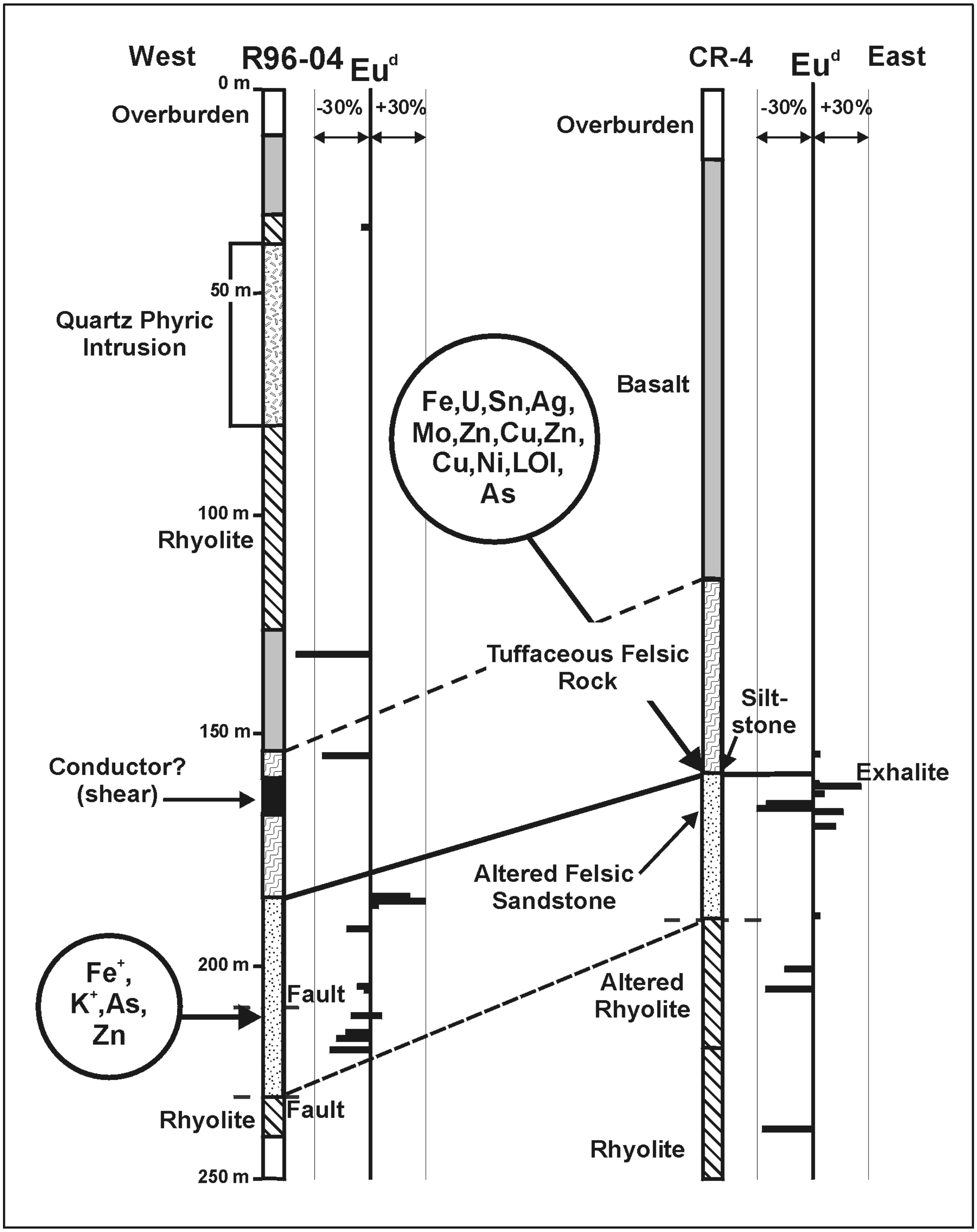


Figure GS-9-3: Geology of drillholes R96-04 and CR-4. Multi-element anomalous zones are indicated in the inset circles.

banded felsic rocks are tentatively identified as predominantly felsic volcanosedimentary rocks (sandstones).

Well-layered siltstones, intersected in drillhole CR-4, are not present in drillhole R96-04. It is possible that these distinctive rocks have been cut out of the section by a zone of brittle-ductile deformation with a deformed quartz vein in drillhole R96-04; it is also possible that the clastic sedimentary rocks represent the margin of a depositional basin, near the top of the volcanic pile, that did not extend as far as R96-04. Altered rhyolite in drillhole CR-4 occurs below the sulphide-rich, unaltered siltstones; this suggests that the stratigraphic top is probably towards the south.

Geochemistry of Drillcore Samples

Analytical data from cores collected from the two drillholes are plotted in figures GS-9-4 to GS-9-8. On the TiO_2-Zr diagram (Fig. GS-9-4), the samples clearly represent a range in compositions. Rhyolitic rocks have low TiO_2 and higher Zr contents and tend to have high Zr/TiO_2 ratios. Basalt and mafic intrusions plot closer to the abscissa on this diagram, i.e., along or immediately above the trend line shown on Figure GS-9-4. Felsic rocks near the bottom of the two drillholes are derived from similar source rocks and plot together, as outlined with the rectangular box, whereas the volcanic sandstones plot towards the field for basaltic rocks. This suggests that the detrital components of the volcanic sandstones represent both felsic and mafic volcanic source rocks. The sample plotting in the top left-hand corner of the diagram is unusual as it contains 62% SiO_2, 19% Al_2O_3 and 5% Fe_2O_3. Although the source is uncertain, the high alumina content suggests abundant clay in the original sediment.

On the feldspar model diagram (Fig. GS-9-5), the samples show a wide range in composition. In general, unaltered basaltic to rhyolitic rocks plot close to, or between, the feldspar model line and the Cpx+plag line and have Al/Zr ratios less than 0.6. The high Al/Zr ratios for most of the rocks in this sample group indicates that they represent clastic and chemical sedimentary material with high Al or unusually low Zr contents. In addition, rocks with a chemical sediment (exhalite) component commonly have Al/Zr ratios greater than 0.6; in hand sample these resemble clastic and volcaniclastic rocks and are probably mixtures of volcanic sediment and exhalite material.

The potassium alteration diagram (Fig. GS-9-6) shows that some of these rocks are altered with Ca and Na depletions and K addition because unaltered volcanic rocks plot to the right of the feldspar model line. These are not intensely altered rocks with respect to Ca and Na because the altered samples plot well within the sericite field on Figure GS-9-5 and therefore have undergone significant K addition.

The REE profiles for the felsic rocks with greater than 70% SiO_2 and the overall composition of rhyolite are

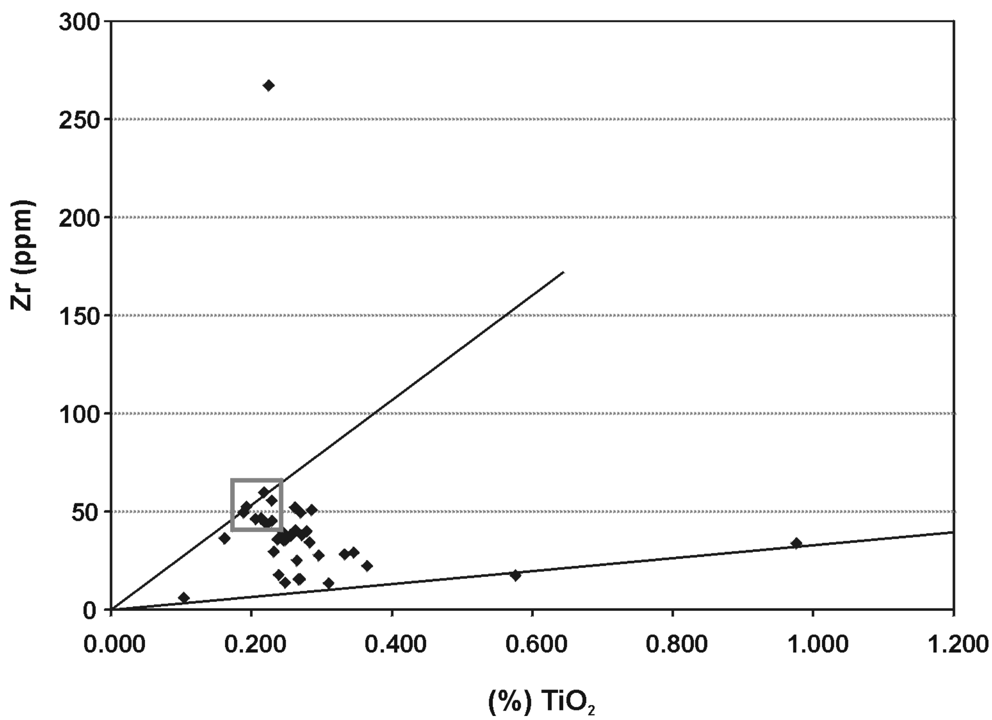


Figure GS-9-4: TiO_2-Zr plot for all samples from drillholes R96-04 and CR-4. Box outlines samples of rhyolite from the lower (relatively unaltered) portion of both drillholes.

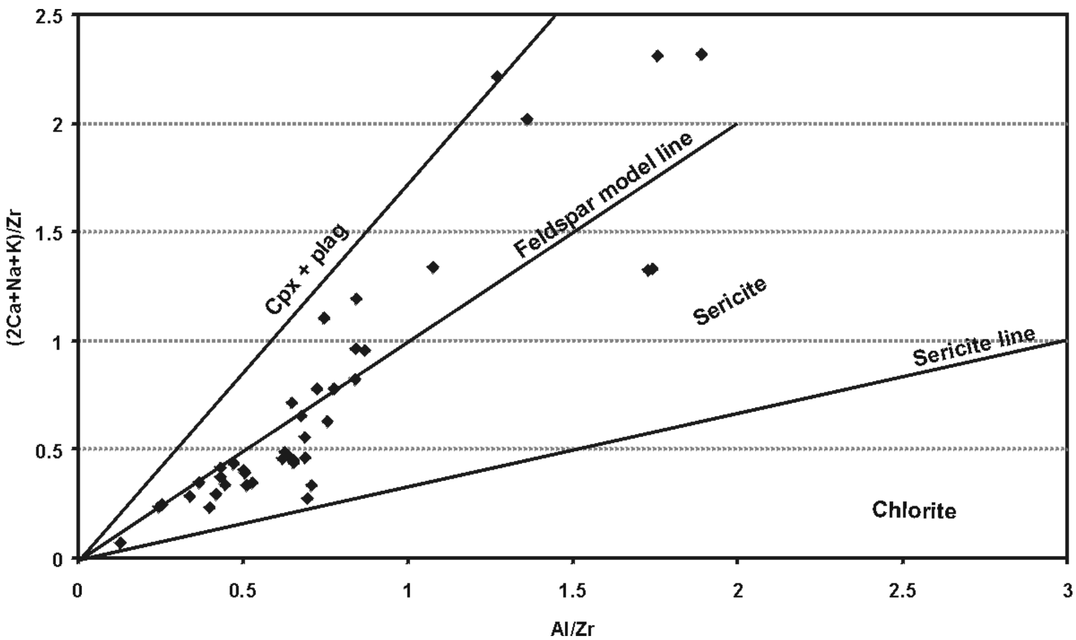


Figure GS-9-5: Feldspar model diagram for all samples (after Madeisky and Stanley, 1993).

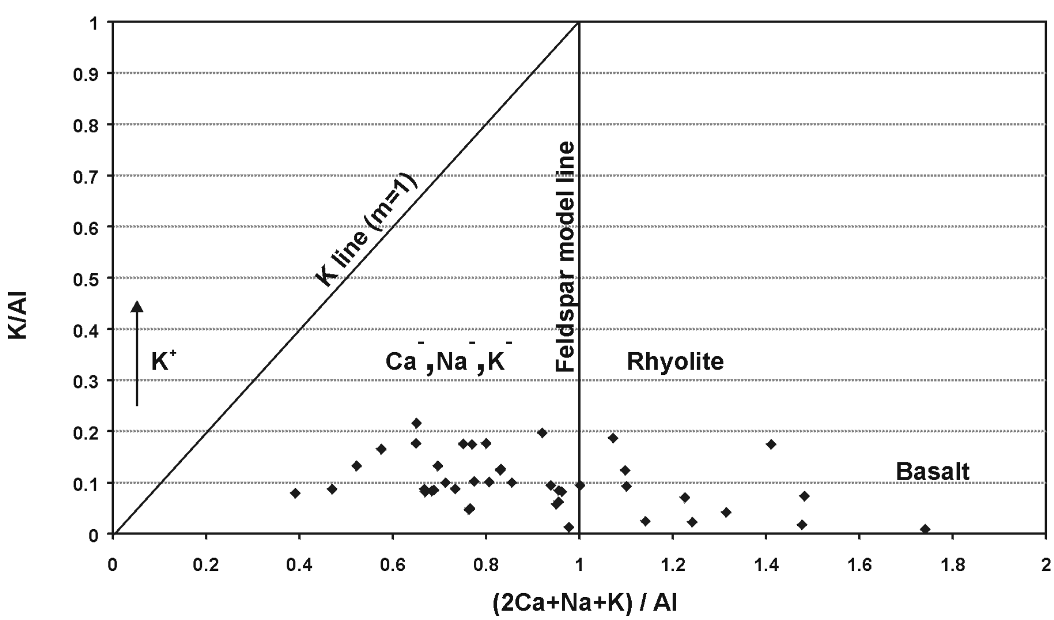


Figure GS-9-6: Potassium alteration diagram for all samples (after Madeisky and Stanley, 1993).

presented in Figure GS-9-7. The rhyolite south of the conductor, sample R96-04-32.3, is distinctly different and has more evolved light REE than those intersected in the lower portions of the drillcores. These rhyolites are considered to represent different source rocks on the basis of their divergent heavy REE profiles. These profiles provide baseline patterns for interpretation of 'mineralized zones' and chemical sedimentary component of volcanosedimentary rocks.

The REE profiles for both grab samples and pulps from two zones of mineralized rocks that represents the conductor in drillhole R96-04 are presented in Figure GS-9-8. There is no correlation between intensity of sulphide mineralization, anomalous Zn, Cu and Ag in individual samples and $Eu^d > 0$. However, rocks with $Eu^d > 0$ occur adjacent to beds with anomalous sulphides and base metal contents. $Eu^d > 0$ values are associated with most VMS type deposits and hydrothermal fluids that can transport and deposit Eu are capable of producing VMS type deposits (cf. Gale et al., 1997).

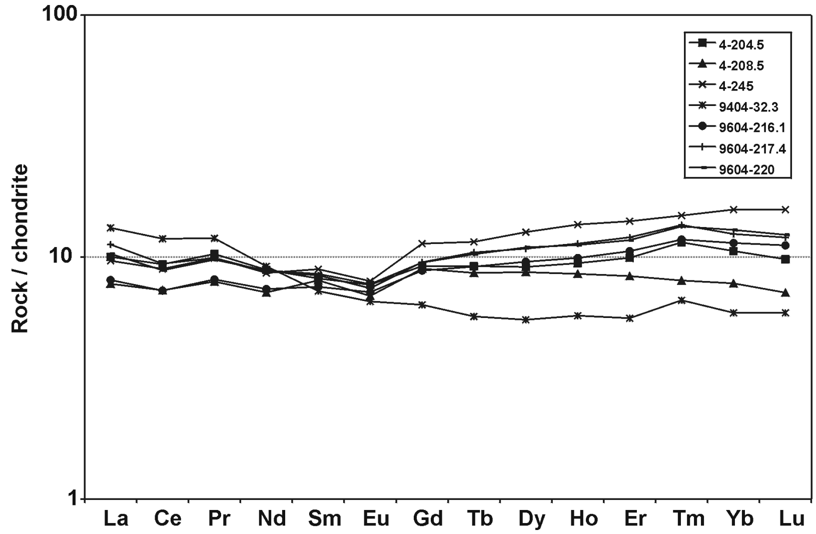


Figure GS-9-7: REE profiles for relatively unaltered 'rhyolite' from drillholes CR-4 and R96-04. Sample number includes start of sample in metres.

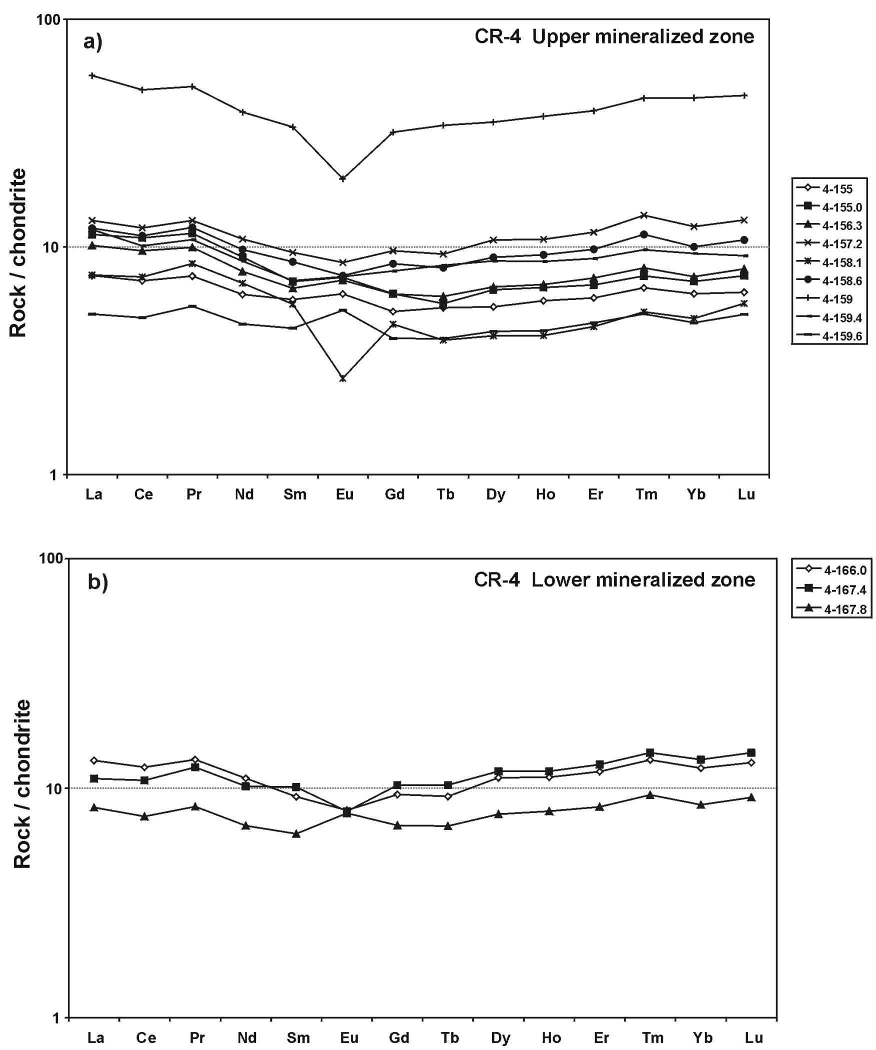


Figure GS-9-8: a) REE profiles for samples from the 'upper' zone of sulphide mineralized rocks in drillhole CR-4; b) REE profiles for samples from sulphide mineralized rocks 6 m below the 'upper' zone.

MUSKEG SAMPLE COLLECTION

Samples of muskeg and underlying Quaternary material were collected using hollow clear plastic tubing fitted with a metal shoe, after the uppermost, frozen portions of the bog were sampled with an ice auger. The plastic tubing was driven into the Quaternary material as far as possible and retrieved with the aid of a winch (Fig. GS-9-2). Compaction of peat occurred within the shoe and tubing and prevented inclusion of excessive water at sites with floating bog. Samples of frozen sphagnum, humified peat, bog iron and quaternary material will be analyzed by selective extraction methods to determine the best medium for further study.

ALDER SAMPLE GEOCHEMISTRY

Clumps of alders 1 to 1.2 m in height are scattered relatively evenly over the Reed Lake bog (Fig. GS-9-2). Bundles of samples were collected in the field and new growth clipped in the laboratory from twigs less than 4 mm in diameter to provide an orientation vegetation survey. The twigs were air dried, ashed and analyzed at Actlabs. Anomalous metal values are present at several sites as shown on figures GS-9-9 and GS-9-10. Of particular interest is the presence of anomalous positive Eu profiles in two of the twig samples that occur adjacent to samples with anomalous Ba, Mo, Re or Au contents. The cause of the anomalous Eu^d values in these two samples will be investigated.

CONCLUSIONS

Geochemical data from drillcores into an electromagnetic conductor indicate that the conductor may define rocks with positive Eu^d values. Comparison with samples from known VMS deposits suggests that these rocks probably represent distal exhalites from a hydrothermal vent capable of producing a base metal deposit. A test survey of alder twig samples over the conductor identified several samples with anomalous metal contents and corresponding anomalous Eu^d values. Further studies of different media from this unique test site will be undertaken.

ACKNOWLEDGMENTS

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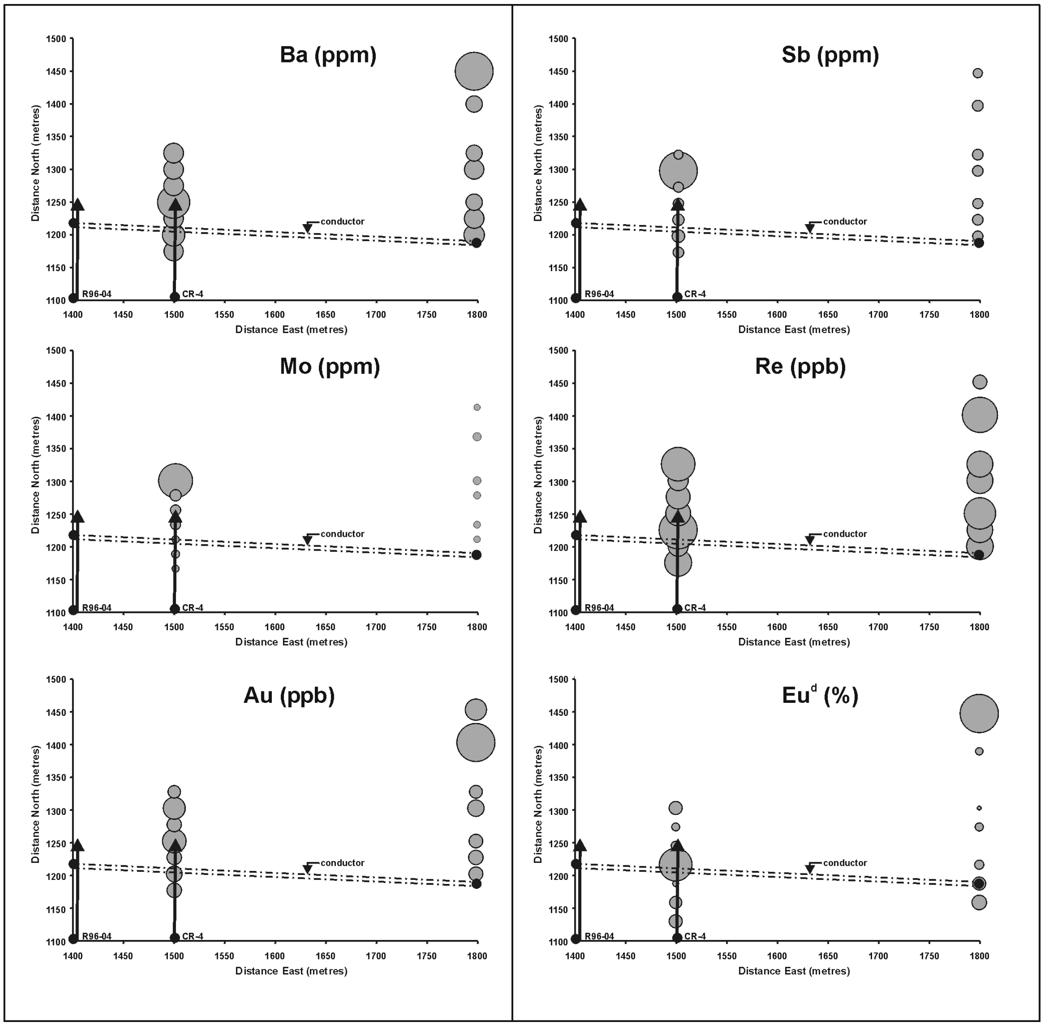

Figure GS-9-9: Metal contents of ashed alders from the Reed property. Range in contents are: Ba - 230 to 920 ppm, Sb - 0.52 to 8.89 ppm, Mo - 1.1 to 29.4 ppm, Re - 2.5 to 8.9 ppb, Au - 33 to 301 ppb, Eu^{d} - 3 to 321%. The large dots represent maximum values and other values are scaled proportionately.

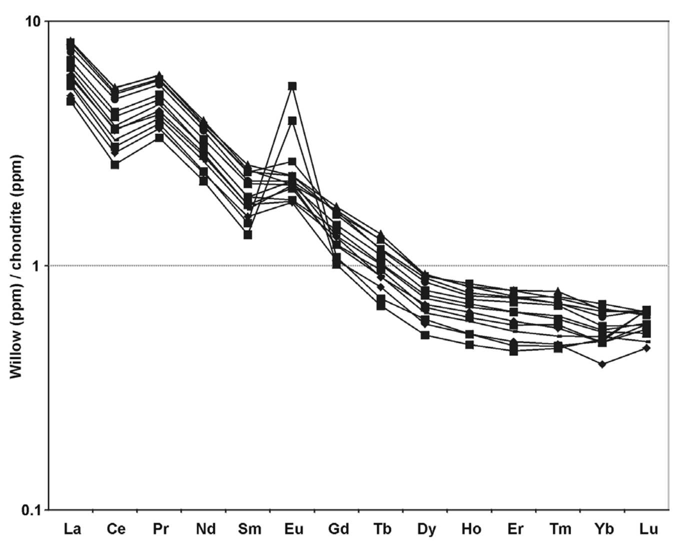

Figure GS-9-10: REE profiles for ashed alders from the Reed property. Note that two of the samples with the lower heavy and light REE metal contents have the highest Eu contents (cf. Figure GS-9-9).