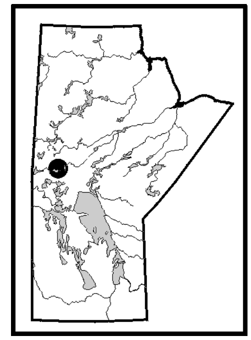
GS-6 RARE EARTH ELEMENT GEOCHEMISTRY OF SULPHIDE-BEARING STRATA IN THE FLIN FLON–SNOW LAKE AREA (NTS 63K), MANITOBA
by G.H. Gale



Gale, G.H. 2002: Rare earth element geochemistry of sulphide-bearing strata in the Flin Flon–Snow Lake area (NTS 63K), Manitoba; *in* Report of Activities 2002, Manitoba Industry, Trade and Mines, Manitoba Geological Survey, p. 59-62.

SUMMARY

Geochemical studies of sulphide-bearing strata from two areas in the Paleoproterozoic Flin Flon Belt provide data on rare earth element (REE) profiles for barren sulphide strata. Of particular interest are analyses of apparently ‘barren’ strata from the Snow Lake area, which display positive Eu anomalies normally associated with volcanogenic massive sulphide (VMS) strata. This contrasts sharply with the negative Eu anomalies shown by the adjacent and barren sulphide strata of the ‘Foot-Mud horizon’ at Snow Lake. This example from the Snow Lake area illustrates the potential use of REE analyses in correlating strata and as a vector to mineralization.

INTRODUCTION

This project aims to evaluate the feasibility of discriminating between ‘barren’ and ‘economic’ sulphide strata using their rare earth element (REE) concentrations and pathfinder elements such as Ba, Au, Mo, Re, Sb and Eu. The goal is to determine if major- and trace-element data on sulphide strata may assist in 1) evaluating the source of matrix in sulphide-bearing strata, 2) discriminating Eu anomalies ascribed to alteration and lithological processes, and 3) establishing the presence of ‘pathfinder’ elements. A number of sulphide-bearing strata (sulphide facies iron formation or SFIF) from presumably ‘barren strata’ in the Flin Flon and Snow Lake areas were analyzed to determine their chemistry and to determine background rare earth element (REE) concentrations for comparison with those associated with VMS deposits.

FLIN FLON AREA

Location 1

Two samples were collected from rusty-weathered sulphidic strata exposed in an abandoned gravel pit (UTM Zone 14, 318050E, 6072200N, NAD 27) within 500 m of the eastern highway exit to Flin Flon. These samples contain 11% (Dunlop1) and 9% (Dunlop2) Fe_2O_3, approximately 60% SiO_2 and have an overall ‘andesitic’ composition. They contain less than 1.5% Na_2O_3 and greater than 2% K_2O. Both samples plot in the fields for altered rocks on the feldspar model diagram (Fig.GS-6-1) and the potassium alteration diagram (Fig. GS-6-2), indicating that they represent chemically modified volcanic rock compositions. Both samples have undergone similar alkali alteration, as the samples plot close together on both diagrams.

The essentially parallel REE profiles (Fig. GS-6-3) indicate different REE mass rather than different REE sources; the material responsible for the ‘dilutant effects’ (i.e., the difference in heavy REE contents) between the two samples is uncertain. The negative Eu profile for sample Dunlop2 is similar to REE plots of ‘barren’ sulphide mineralization from the ‘Foot-Mud horizon’ in the Snow Lake area and elsewhere (cf. Gale et al., 1997). However, the profile for sample Dunlop1 is similar to that of some unaltered mafic rocks and some distal exhalites. At this time, it is difficult to determine if this sample records the addition of Eu to a matrix that is similar to Dunlop2, or if it represents background values for volcanic rocks of this area.

Location 2

Samples WL1 to WL6 were collected sequentially, from west to east, along the south side of a roadcut on Highway 10, south of the White Lake mine; sample WL1 is from the westernmost sulphide-bearing strata and sample WL6 is from the easternmost strata. Sample WL6 is located at UTM Zone 14, 324520E, 60639950N, NAD 27 and sample WL1 is located approximately 40 m west of WL6.

Samples WL1 and WL3 plot in the field for unaltered rocks on Figures GS-6-1 and GS-6-2. The remaining samples exhibit minor total alkali alteration. The samples contain 11 to 20% Fe_2O_3 and 41 to 58% SiO_2, but do not exhibit any systematic compositional changes; for example, samples WL2 and WL 8 have 0.24 and 0.35% MnO, but 0.43 and 0.78% TiO_2, respectively.

The REE profiles for samples WL1, WL3, WL4 and WL6 (Fig. GS-6-3) are similar to those of unaltered rocks.

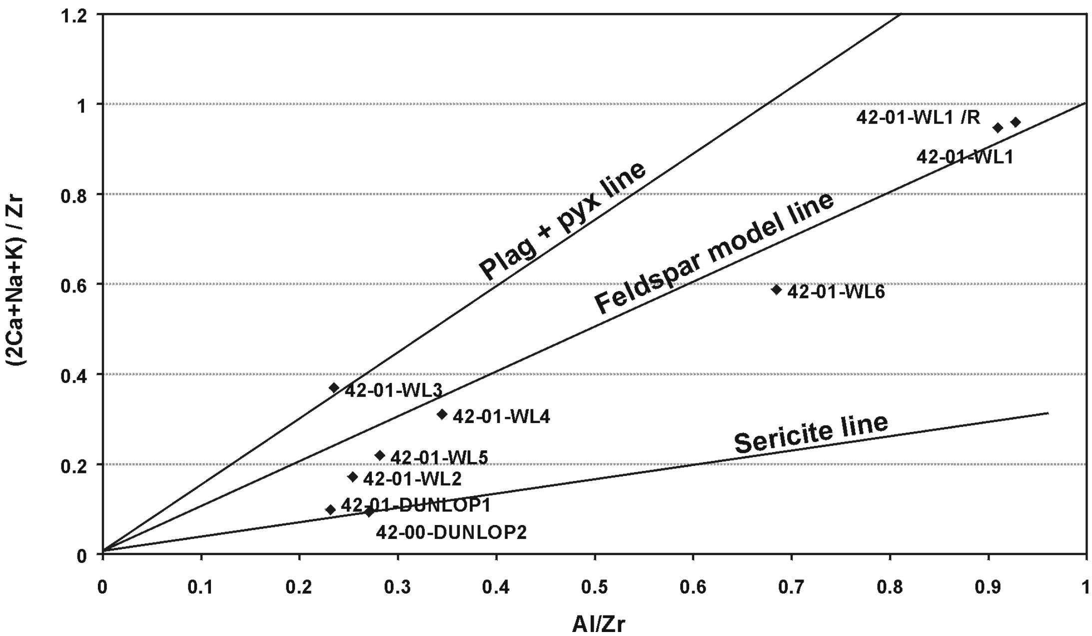


Figure GS-6-1: Feldspar model diagram (Madeisky and Stanley, 1993) for sulphide-bearing rocks, Flin Flon area. Altered rocks typically plot below the feldspar model line on this diagram.

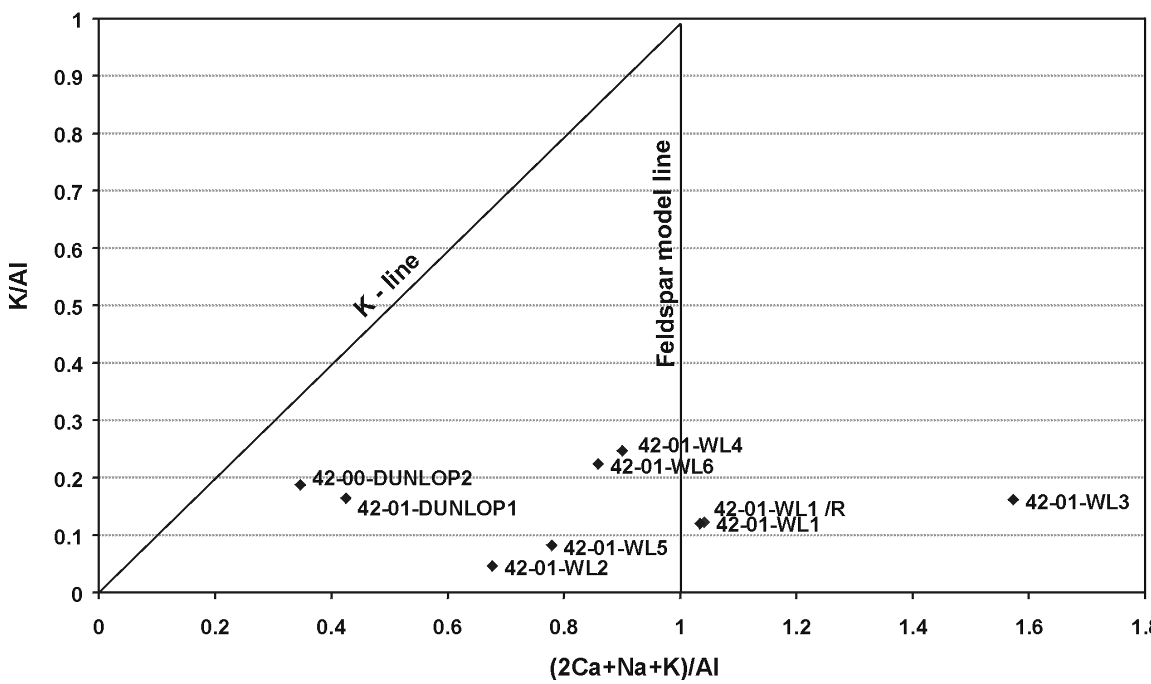


Figure GS-6-2: Potassium alteration diagram (Madeisky and Stanley, 1993) for sulphide-bearing rocks, Flin Flon area. Altered rocks typically plot to the left of the vertical line on this diagram.

However, the profiles for WL2 and WL5 differ considerably from the others, in that they have negative light REE slopes and flat to positive heavy REE slopes. This indicates either different protoliths for the clastic material or that other factors control the REE concentrations in these two rocks. These two rocks have marginally higher Fe_2O_3 than the other samples, but other element values plot within the range of the other four samples.

SNOW LAKE AREA

Samples collected from two drillholes that intersected sulphide-bearing strata north and east of the Stall Lake mine

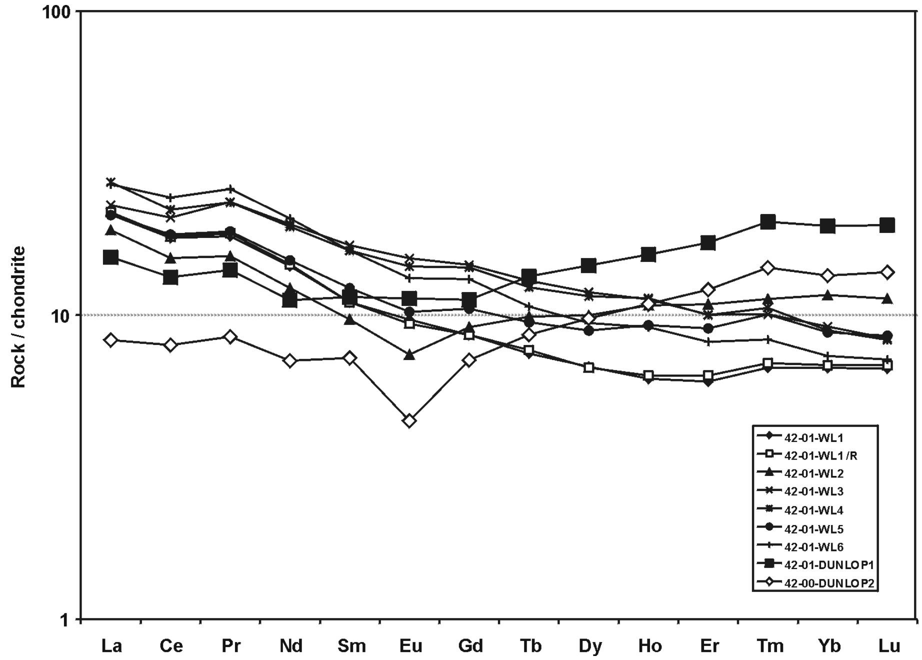


Figure GS-6-3: Rare earth element profiles for sulphide-bearing rocks, Flin Flon area.

have weak to moderately positive Eu anomalies (Fig. GS-6-4). These holes were drilled to test a geophysical conductor that appears to be the along-strike continuation of the 'Foot-Mud horizon' (Bailes and Galley, 1996). A sample from drillhole ROD31 with a weak positive Eu anomaly has minor sulphide (<15% Fe) and an overall mafic composition. This rock contains trace amounts of Pb (62 ppm), Ba (257 ppm), Cu (238 ppm), Zn (536 ppm), 2.9% Na_2O, 1.52% K_2O and 46% SiO_2, and does not appear to be altered. Three samples from drillhole ROD30, 100 m along strike from ROD31, have positive Eu anomalies. These rocks contain 12 to 35% Fe, 36 to 51% SiO_2 and 1.5 to 3.1% Na_2O_3, and have anomalous concentrations of Ba (99–400 ppm), Cu (280–620 ppm) and Zn (580–1800 ppm); similar Cu and Zn values occur in barren sulphide beds within the 'Foot-Mud horizon' (Gale et al., 1997).

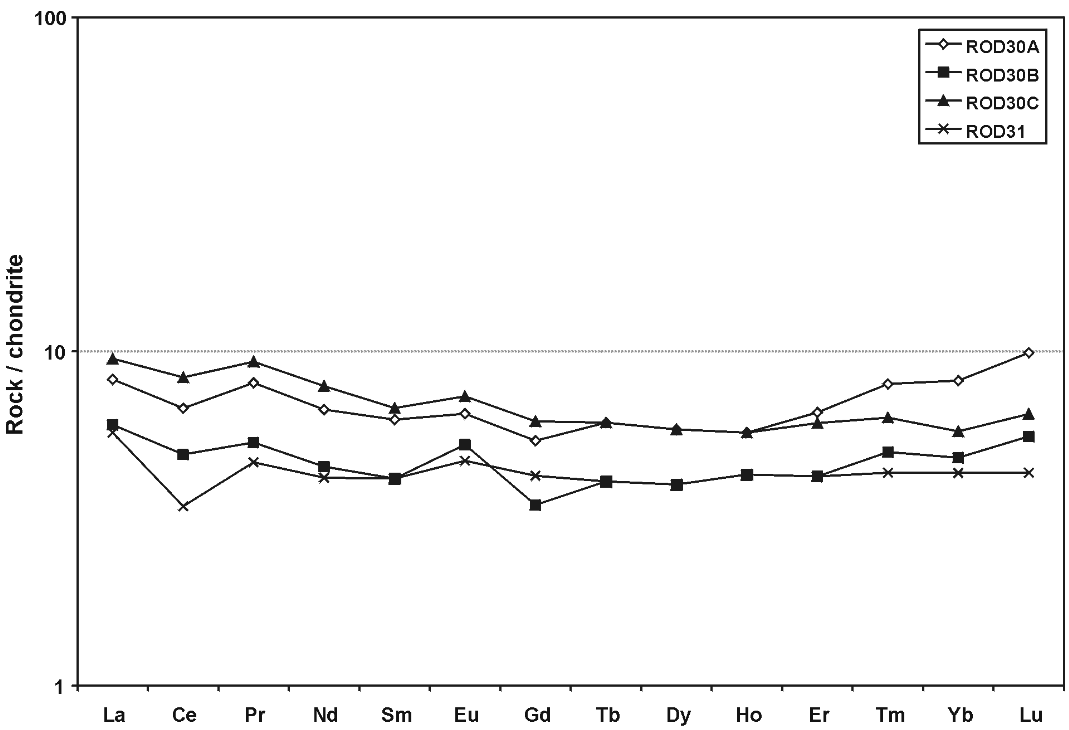


Figure GS-6-4: Rare earth element profiles for sulphide-bearing strata, Snow Lake.

These samples are unusual for the 'Foot-Mud horizon', in that they do not have the strong negative Eu anomaly characteristic of the 'Foot-Mud horizon' samples in other drill core (Gale et al., 1997). This indicates that the supposedly 'barren sulphide' conductor intersected in drill cores ROD31 and ROD30 may, in fact, be either a 'near-vent' phase of the barren 'Foot-Mud horizon' or an unrelated sulphide facies iron formation from a vent that could have been capable of producing a volcanogenic massive sulphide–type deposit. The geophysical conductors identifying the 'Foot-Mud horizon' and the sulphide strata intersected in drillholes ROD30 and ROD31 are separated by a nonconductive zone (G. Kitzler, pers. comm., 1999). Based on comparisons with other REE data (Gale et al., 1997), it appears that the sulphide sections intersected in drillholes ROD30 and ROD31 represent the distal portions of a VMS-type hydrothermal vent and warrant further exploration.

ACKNOWLEDGMENTS

Gerry Kitzler and Peter Dunlop are thanked for assistance in sample collection for this study. Peter Theyer kindly reviewed an early draft of the manuscript.

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