

Appendix 5

Geochemical Methods

Analyses of three hundred and twenty-three samples are included in this report. All weathered surfaces were removed prior to crushing. Two hundred and seven of the samples were analyzed for major, minor and trace elements, fourteen being from Hollings and Ansdell (2002). Twenty-nine samples of this group were also analyzed for Nd ratios. One hundred and seven samples were analyzed for major and selected minor elements, and nine for trace elements only. Rock sample processing and crushing were undertaken at the laboratory of the Manitoba Geological Survey.

Sample powders were submitted to various laboratories over the extended period of the mapping programs in the Kissinging-File lakes area and Central Kiseynew subdomain. A complete list showing the laboratories used and the year of the analysis is included in Appendix 4, Table 10 (DVD).

An early analyzed group was done by wet chemical technique at the W.M. Ward Laboratory in Winnipeg, Manitoba. Those in the Central Kiseynew subdomain were analyzed in 1979 using a modified method of Shapiro and Brannock (1962); those in the Kissinging-File lakes area were analyzed between 1985 and 1997 using atomic absorption spectrometry (AAS), except for SiO₂ and P₂O₅, which were done colorimetrically. Accuracy was marginally less than the earlier technique (Table 21). Loss-on-ignition (LOI) values represent the combined volatiles H₂O, CO₂ and oxides of S.

Most major-element oxide analyses between 1996 and 1999 were done by SGS Canada Inc. (formerly X-Ray Assay Laboratories Ltd.) in Don Mills, Ontario using X-ray fluorescence spectrometry (XRF), with relative standard deviations within 5%.

Trace-element analyses done between 1994 and 1999, including the rare earth elements (REE) and high-field-strength elements, were carried out using inductively coupled plasma-mass spectrometry (ICP-MS; Perkin Elmer 5000) at the

Department of Geological Sciences, University of Saskatchewan in Saskatoon following the protocol of Jenner et al. (1990) and Longerich et al. (1990), and data reduction of Jenner et al. (1990). Thorium, Nb, Hf, Zr and REE for selected samples with low trace-element contents (and all data from Hollings and Ansdell, 2002) were also analyzed using the Na₂O₂ sinter technique of Longerich et al. (1990), on 200 mg aliquots of powder, to circumvent problems associated with incomplete dissolution of refractory minerals hosting HFSE and REE, and/or their instability in analytes. The sinter data for Zr, Hf and Nb, where these elements occur in low concentrations (see Appendix 4, Table 10), were then combined with acid dissolution data to form a composite dataset. Analysis of acids, distilled deionized water and procedural blanks yielded levels of <10 ppb for Hf, Zr, Nb and REE. Detection limits, defined as 3σ of the procedural blank, for some critical elements are as follows (in ppm): Th (0.01), Nb (0.006), Hf (0.008), Zr (0.004), La (0.01) and Ce (0.009). Precision for most elements at the concentrations present in the international reference material SY2 is between 2 and 4% relative standard deviations.

Major- and trace-element analyses done between 1999 and 2008 were carried out by Activation Laboratories Ltd. (Actlabs) in Ancaster, Ontario. Sample preparation was by lithium metaborate/tetraborate fusion. Major and minor elements were analyzed by inductively coupled plasma-optical emission spectrometry (ICP-OES) and trace elements were analyzed by ICP-MS. These samples are marked in Appendix 4, Table 10. The standard-grade analytical package (4LITHO) was used for all intermediate-felsic samples, generally with >53% SiO₂. The research-grade package (4LITHORESEARCH) with enhanced detection limits was used for all mafic-ultramafic samples, generally with <53% SiO₂. Detection limits are listed in Table 22. Neodymium isotope analyses were performed at the Radiogenic Isotope Facility, University of Alberta in Edmonton.

Table 21: Method and precision of the analyses carried out by W.M. Ward Laboratory, 1985–1997.

Element	Range (%)	Method	Precision
SiO ₂	30–80	Colorimetric	1.50
Al ₂ O ₃	3–25	AAS	0.50
Fe ₂ O ₃ ⁽¹⁾	0.5–25	AAS	0.50
CaO	0.4–20	AAS	0.20
MgO	0.4–40	AAS	0.30
Na ₂ O	0.1–10	AAS	0.20
K ₂ O	0.1–10	AAS	0.20
TiO ₂	0.1–2.5	AAS	0.20
P ₂ O ₅	0.01–1	Colorimetric	0.03
MnO	0.01–2	AAS	0.03
LOI			0.05

Abbreviation: AAS, atomic absorption spectrometry

Table 22: Detection limits for the analyses carried out by Activation Laboratories Ltd., 1999–2008.

	Standard (%)	Research (%)
SiO ₂	0.01	
Al ₂ O ₃	0.01	
Fe ₂ O ₃ ^(T)	0.01	
CaO	0.01	
MgO	0.01	
Na ₂ O	0.01	
K ₂ O	0.01	
TiO ₂	0.001	
P ₂ O ₅	0.01	
MnO	0.001	
Total	0.01	
	(ppm)	(ppm)
Ni	20	
Cr	20	
V	2	
Rb	2	1
Sr	2	
Y	2	0.5
Zr	4	1
Nb	1	0.2
Mo	2	
Cs	0.5	0.1
Ba	3	
La	0.1	0.05
Ce	0.1	0.05
Pr	0.05	0.01
Nd	0.1	0.05
Sm	0.1	0.01
Eu	0.05	0.005
Gd	0.1	0.01
Tb	0.1	0.01
Dy	0.1	0.01
Ho	0.1	0.01
Er	0.1	0.01
Tm	0.05	0.005
Yb	0.1	0.01
Lu	0.04	0.002
Hf	0.2	0.1
Ta	0.1	0.01
Tl	0.1	0.05
Pb	5	
Bi	0.4	0.1
Th	0.1	0.05
U	0.1	0.01