



Alberta Kimberlite-Indicator Mineral Geochemical Compilation

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1 Introduction

Since the initial discovery of a kimberlitic diatreme in northern Alberta, government and exploration companies have collected a plethora of bedrock, till and stream-sediment heavy-mineral concentrate (HMC) samples throughout Alberta. Subsequently, kimberlite- or diamond indicator minerals (KIM), which include garnet, chrome diopside, ilmenite and chromite, have been analyzed by electron microprobe to determine their geochemical properties used to provide some basis for prioritizing exploration targets. [Table 1](#) summarizes some standard geochemical criteria used by exploration companies in search for diamondiferous kimberlite.

The Alberta Geological Survey (AGS) is the current custodian of Mineral Assessment Reports, which may contain the geochemical data reported by industry under regulatory conditions outlined by the Alberta Department of Resource Development. These geochemical data have been scanned into electronic format and were compiled with existing government microprobe data. In addition, numerous companies contributed non-assessment report KIM data to this study and we thank these companies for their invaluable contribution to further our understanding of Alberta geology.

This compilation is the first known update of Alberta KIM's since the 1996 AGS Bulletin 63 (The Diamond Potential of Alberta), which produced a diamond indicator mineral summary map based on the geochemistry from about 560 grains. The current KIM database is comprised of more than 20,000 geochemical analyses.

The results of the compilation are delivered on this CD-ROM with an interactive menu that allows the user to access:

- 1) the digital geochemical data in portable document format (PDF), Microsoft® Excel spreadsheets, or comma-delimited text files; the files are categorized by KIM grain-type (i.e., garnet, clinopyroxene, ilmenite, and chromite);
- 2) an updated KIM anomaly summary map of Alberta;
- 3) provincial scale maps with favorable KIM areas by grain type; and
- 4) a variety of scatter plots that show geochemical trends and variations across the province.

This compilation is intended to release the geochemical microprobe data from industry and government KIM studies, which are available to the public. To date, no attempt has been made at including the methodologies of the original survey, such as sample media and procedures, laboratory names, laboratory techniques, laboratory standards, and duplicates. This information may or may not be reported in the assessment report. Individuals may view mineral assessment reports at the AGS for complete survey details. The reports are also available for purchase from the Alberta Geological Survey Information Sales office.

The authors of this compilation acknowledge that there may be errors in the dataset as a result of scanning the original hard copy Mineral Assessment Reports. We hope this dataset will serve as an exploration tool for industry currently working within Alberta and as an informational package to introduce the diamond potential of Alberta to national and international companies.

Table 1: Kimberlite-indicator mineral classification. (Thorleifson et al., 1994)

Kimberlite-indicator minerals	Favourable chemistry for kimberlite	Kimberlite-indicator mineral sub-groups
Cr-Spinel	$>60\% \text{ Cr}_2\text{O}_3 + >12\% \text{ MgO}$	Diamond inclusion Cr-spinel
Ilmenite	$>\sim 6\% \text{ MgO}$	Mg-ilmenite
Pyroxene	$>0.50\% \text{ Cr}_2\text{O}_3$	Cr-diopside
Garnet	$>13\% \text{ MgO}$ and $>0.50\% \text{ Cr}_2\text{O}_3$	Cr-pyrope
	$>0.30\% \text{ TiO}_2 + >4.0\% \text{ Cr}_2\text{O}_3$	Group II (GII)*
	$>0.90\% \text{ TiO}_2$	G2
	$>0.30\% \text{ TiO}_2$	G1
	$>12.0\% \text{ Cr}_2\text{O}_3$	G12
	$\text{CaO} < 0.285(\text{Cr}_2\text{O}_3)+3.14$	G10
	$\text{CaO} < 0.285(\text{Cr}_2\text{O}_3)+5.14$	G7
	Remainder	G9
	$>4.0\% \text{ MgO} + >2.0\% \text{ CaO} + >0.20\% \text{ TiO}_2 + >19\% \text{ Al}_2\text{O}_3 + <0.5\% \text{ Cr}_2\text{O}_3$	Eclogitic garnet
	$>0.60\% \text{ TiO}_2$	G4
	$>16.0\% \text{ CaO}$	G8
	$>12.0\% \text{ CaO}$	G6
	Remainder	G3

*Following the nomenclature of Dawson and Stephens (1975)

2 References

- Dawson, J. B. and Stephens, W. E. 1975. Statistical classification of garnets from kimberlite and associated xenoliths. *Journal of Geology*, 1975, v. 83, pp. 589-607.
- Thorleifson, L.H., Garrett, R.G., and Matile, G.L.D. 1994. Prairie kimberlite study – indicator mineral geochemistry. Geological Survey of Canada, Open File Report 2875, one diskette.

3 Appendix 1 – Note on Filename extensions

Every file has an associated extension, a (typically) three letter code found after the last period of a filename. This code identifies what the type of file is, and tells the operating system which program or programs can access data in that file. The following are examples of filename extensions used in this report:

- .PDF
- .XLS
- .CSV

The extension PDF indicates that the file is in Adobe® portable document format, and is accessed using Adobe® Acrobat® Reader™. The extension XLS is used by Microsoft® Excel to access information in a formatted spreadsheet. CSV can be used by most spreadsheet and database software to store and retrieve data in a comma delimited text file.

The information in the Kimberlite–Indicator Mineral Database is stored as tables and is available in each of these formats, accessible through the “Download Database” button on the main page.