

GEOLOGY AND EXPLORATION OF THE ROSE LAMPROITE
SOUTHEAST KANSAS, U.S.A.

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Lamproite occurrences at Hill's Pond (Silver City) and Rose Dome in Woodson County, Kansas have been known since 1880 as geologic curiosities. In the 1950's these localities were first described as intrusive peridotites, and later as kimberlites. Recent studies document that these rocks have lamproite affinities (Merrill et al. 1977, Cullers et al. 1985, Mitchell, 1985).

Hill's Pond occurs as an elongate plug-like body with sill extensions to the south. The plug has dimensions of approximately 1700m by 250m, while the near surface sills are encountered over a 1400m by 2000m area. Petrographically the intrusion is a Ti-K-richterite diopside madupitic lamproite containing strongly zoned (8.0-1.0% Al_2O_3 ; 6-13% FeO_T) poikilitic groundmass Ti-phlogopite. Ti-poor chromites are the common opaque phases. As indicated by the petrology and mineral chemistry the intrusion history at Hill's Pond produced evolved lamproites of poor diamond-bearing potential.

The Rose lamproite occurrence is located approximately 7km northeast of Hill's Pond. Due to lack of outcrop and core samples this site was previously poorly studied. Based on a probable diatreme nature and initial mineralogical study the Rose lamproite was selected for detailed exploration for diamond.

The Rose lamproite occurs astride an elongate structural dome in an area of relatively flat lying Pennsylvanian sedimentary rocks. At the surface the lamproite is intrusive into the Stanton Limestone and the overlying Weston Shale. Some sill formation is apparent along this contact (Franks et al. 1971). K-Ar ages of phlogopite from Rose and Hill's Pond are 88-91 my (Zartman et al. 1967) which are geologically reasonable.

Orientation exploration studies were performed over the Hill's Pond and Rose lamproites. An aeromagnetic survey was flown with a line spacing of approximately 800m. Ground studies included magnetics, conductivity, soil geochemistry and heavy minerals. As the Rose lamproite generally does not outcrop, these indirect techniques were used for mapping with confirmation by shallow auger drilling. Sill and dike-like bodies were found over a 2km by 1km area and one centrally located diatreme was identified.

Ground geophysics detected the diatreme at Rose as a magnetic high and several of the near surface sills as conductivity highs. Soil geochemistry showed Ni and Nb anomalies corresponded well to the lamproite. Other useful elements include Ti, Ba, Zr, Cr and La. Heavy minerals in soils included chrome spinel, lesser phlogopite, pyrope, pyroxene, olivine, amphibole, crustal garnet, rutile?, priderite?, barite, chlorite and lithic fragments of lamproite. Heavy minerals displayed wider dispersion than the soil chemistry and the lamproite itself. Shallow auger drilling confirmed mapping, and geophysical and geochemical targets.

The Rose lamproites include rocks of highly fragmental diatreme facies, fragmental hypabyssal breccias and fine-grained magmatic hypabyssal types. Extensive alteration and weathering preclude satisfactory petrographic study, although pseudomorphs after olivine and relict

phlogopite phenocrysts can be seen in some samples. Despite alteration select subsurface samples show major oxide and trace element compositions similar to diamondiferous lamproites from elsewhere.

Spinels from heavy mineral concentrates are Ti-poor magnesian aluminous chromites, aluminous magnesian chromites and Fe_2O_3 -rich spinels representing members of the pleonaste-magnesiochromite-magnetite-magnesioferrite series. Garnets include Cr-pyrope, sub-calcic Cr-pyrope, almandines and spessartites.

The study indicates that the Rose lamproites are relatively unevolved as compared with the Hill's Pond lamproites and therefore are of greater diamond potential. Testing of bulk samples obtained from trenching of the diatrema however produced no diamonds.

The Rose and Hill's Pond lamproites define a province of Cretaceous ultrapotassic mantle-derived magmas emplaced along the southern margin of the North American craton. The diamondiferous Prairie Creek district of similar age is 450 km to the southeast along this margin. The Tuttle Creek kimberlite district, also of similar age, is 300 km north (on craton) along the Midcontinent Rift.

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REFERENCES

- CULLERS R.L., RAMAKRISHNAN S., BERENDSEN P. and GRIFFIN T. 1985. Geochemistry and petrogenesis of lamproites, Late Cretaceous age, Woodson County Kansas, U.S.A. *Geochimica et Cosmochimica Acta* 49, 1383 - 1402.
- FRANKS P.C., BICKFORD M.E. and WAGNER H.C. 1971. Metamorphism of Precambrian granitic xenoliths in a mica peridotite at Rose Dome, Woodson County, Kansas: Part 2, Petrologic and mineralogic studies. *Geological Society of America Bulletin* 82, 2869 - 2890.
- MERRILL R.B., BICKFORD M.E. and IRVING A.J. 1976. The Hill's Pond peridotite, Woodson County, Kansas: a richterite-bearing Cretaceous intrusive with kimberlite affinities. Extended Abstracts. Second International Kimberlite Conference. Santa Fe, New Mexico.
- MITCHELL R.H. 1985. A review of the mineralogy of lamproites. *Transactions Geological Society of South Africa*. In press.
- ZARTMAN R.E., BROCK M.R., HEYL A.V. and THOMAS H.H. 1967. K-Ar and Rb-Sr ages of some alkaline intrusive rocks from central and eastern United States. *American Journal of Science* 267, 297 - 309.