PRELIMINARY STUDY OF SOIL BACTERIAL POPULATIONS OVER AND ADJACENT TO THREE KIMBERLITE DIATREMES

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Geophysical methods are less sensitive for the purpose of locating small kimberlitic bodies. The quality of diamonds that may be contained in kimberlites apparently bears little relation to their size. Searching out smaller kimberlite pipes should be rewarding, therefore, for increasing diamond potential in view of the possibility that most of the larger kimberlites of the world seem to have already been found. Geochemical and botanical methods of prospecting (Alexander and Shrivastava, 1984; Litinskiy, 1964) have been shown to delineate even smaller diatremes but not without limitations.

Research activity in the field of organic matter, biological systems and mineral exploration is on the increase (Updegraff, 1983). Of all the living organisms, bacteria are by far the most versatile, making roughly 50% of the biomass. They survive at far greater depth than other organisms. It is logical that they will reflect the geochemical environment in which they live. Study of their kind and relative abundance over and around the mineralised ground therefore, should constitute an exploration tool. Geomicrobiological prospecting for oil and gas fields has been helpful in the Soviet Union and other places for a long time but its application for prospecting metallic deposits has only recently been attempted (Parduhn and Watterson et al., 1984; Watterson et al., 1984). The present work aims to suggest soil bacterial populations as an additional tool for locating even kimberlitic bodies that may be devoid of characteristic vegetation cover for one reason or the other.

A total of 53 soil samples collected in traverses over and adjacent to undisturbed portions of three kimberlitic pipes were analysed for their total of streptomycetes, total Bacillus species (ssp) and Bacillus cereus (159 data points) at the Geomicrobiology laboratory of the Exploration Geochemistry section, USGS, Denver, Colorado. The geometric mean of B. cereus counts in soil samples over a small kimberlite pipe with a thin soil cover near Boulder, Colorado was 13 times higher

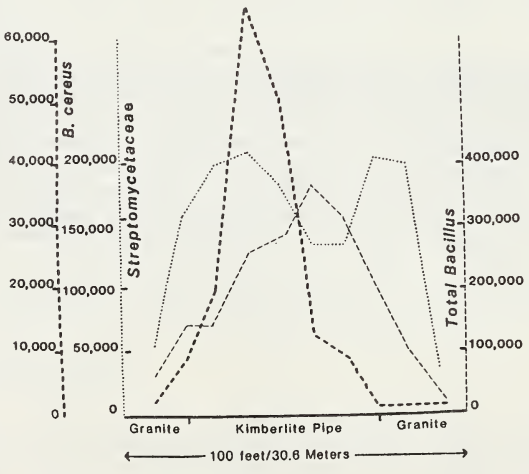

Fig. 1. Streptomycetes, Bacillus cereus and total Bacillus counts for each gram of soil across Green Mountain Kimberlite, Colorado, USA.

than the geometric mean of counts in soil over adjacent granitic rock (Fig. 1). Streptomycetes counts and total Bacillus spp. were also more than two standard deviations higher over the pipe. B. cereus was significantly enriched over Sloan-1 pipe near the Colorado-Wyoming border, northwest of Fort-Collins, Colorado, and total Bacillus counts were 11 times higher than over adjacent country rock; streptomycetes counts were more than two standard deviations higher over the pipe.

Counts of the three miocrobial groups in soil over and adjacent to the Hinota pipe of Central India were the same or even lower than in the sandy soil outside the pipe rock (Fig. 2). This finding appears consistent with the observed

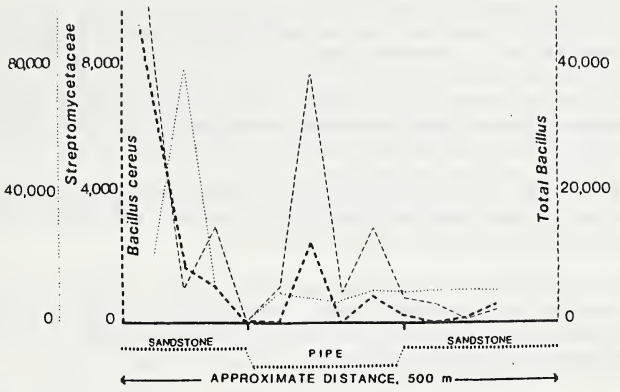

Fig. 2. Streptomycetes, Bacillus cereus and total Bacillus counts for each gram of soil across Hinota Kimberlite pipe, Central India.

erosion and considerable infilling of this pipe with the surrounding sandy soil. However, B. cereus and streptomycetes counts in termite mounds (apparently deriving their material from a much deeper source) over this pipe showed appreciable (7- and 34 times respectively) enrichments compared to those on adjacent sandstone.

Ecological reasons underlying these anomalies have not been investigated to date, but may be related in part to the increased availability of potassium, phosphate, and other inorganic nutrients thought to be responsible for observed botanical anomalies in kimberlitic derived soils in many parts of the world (Alexander, 1983).

Bacterial populations can be determined more quickly and inexpensively than elemental analyses. Pipe/background contrasts under the present study (Table 1) also appear to be reasonably good except for the Hinota pipe of Central India

Table 1. Kimberlite/background ratios for Total Bacillus, Bacillus cereus and streptomycetes

Bacteria	Green Mountain Colorado	Sloan-1 Colorado	Hinota, Central India	
			Pipe	Termite mound
Total Bacillus	1.8	11	1.1	0.5
Bacillus cereus	13.1	3.2	0.3	7.3
Streptomycetes	1.5	1.9	0.6	34

which has appreciable infilling of soils derived from other sources. It is believed that a more detailed geomicrobial approach to kimberlite prospecting in different lithologic and climatic settings would be a rewarding study, and has the potential for becoming a supplementary tool for diamond prospecting.

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