ARGYLE AK1 DIAMOND SIZE DISTRIBUTION; THE USE OF FINE DIAMONDS TO PREDICT THE OCCURRENCE OF COMMERCIAL SIZE DIAMONDS

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INTRODUCTION

In the detailed evaluation of diamondiferous diatremes, several problems are encountered when attempting to obtain samples for use in carats per tonne (ct/t) grade estimation.

- Samples must be large to obtain sufficient diamonds, which are therefore costly both in excavation and sample processing stages.

- Many samples have to be taken to assess the spatial variation in grade.

- Samples must be taken at depth in hard rock in such a manner that diamonds are not broken.

At AK1, samples for grade determination were obtained by taking large diameter cores (LDC's) of 200mm diameter. This is an expensive process costing over A$1000 per metre. The possibility of using fine diamonds (microdiamonds) - diamonds smaller than those recovered by normal plant processing - to predict the occurrence of larger, commercial size stones (macrodiamonds) was therefore investigated. The extremely high grade and small mean stone size of the Argyle pipe offered the opportunity of establishing a reliable statistical relationship between numbers of macrodiamonds and microdiamonds.

LOCATION AND GEOLOGY

AK1 is a diamondiferous Precambrian age olivine-lamproite diatreme of 50 hectares surface area located at 128° 23'E, 16° 43'S in the East Kimberley region of Western Australia. The pipe is 2km long, averages 250m in width and exhibits a complex series of disrupted and faulted pyroclastics. Two main tuff types are recognised; the "sandy tuff" forming the major part of the pipe consisting of lamproite lapilli set in a matrix of ash and quartz sand, and the "non-sandy tuff" situated in the 450m wide northern bowl of the pipe and representing a later stage quartz-free intrusion. Minor magmatic lamproite dykes occur predominantly in the south of the pipe. Its detailed geology is described by Atkinson et al. (1984).

METHOD

Initial sampling of AK1 indicated that highest grades occurred in the southern half of the pipe in the sandy tuff. Consequently, evaluation work centred on this area and LDC's were taken on a 50m square grid to a maximum depth of 200m. The cores were divided into 20m sample lengths and processed through a 10tph HMS plant using 12mm and 6mm crushes and a 0.5mm lower screen size. Due to the high grade at AK1, averaging 6.8ct/t in the grid drilled area, sufficient diamonds were recovered per sample to approximate the target population. This contrasts with most economic diamondiferous pipes where grades are much lower, typically 0.1 - 0.5ct/t, and where only a limited number of diamonds, if any, are recovered per sample.

The AK1 recovered (macrodiamond) size distribution was 3 parameter lognormal with a mean of 0.032 carats per stone (ct/st), and showed little variation between samples. It was noted that a constant ratio in terms of stone numbers existed between any two sieve sizes within the recovered size range, and it was argued that if a similar, constant ratio existed between even smaller diamonds and the macrodiamonds, a method could be established to predict the occurrence of commercial size diamonds from microdiamonds.

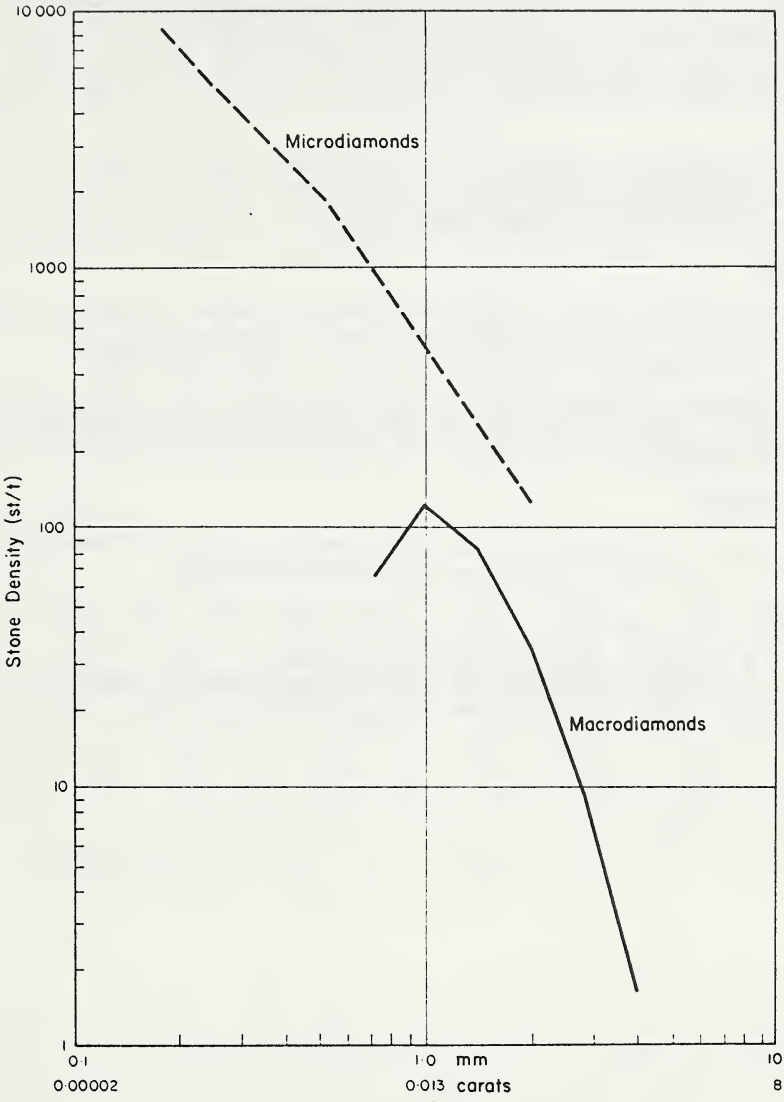

Fig. 1. Stone density plot of microdiamonds and macrodiamonds for 1 tonne of 10ct/t grade lamproite