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## FTIR FEATURES IN ARGYLE, DIAVIK AND MUROWA DIAMONDS

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A suite of over 300 rough diamonds from each of the Argyle and Diavik deposits and of over 100 diamonds from Murowa were selected in three size groups ranging from sieve +5 (~0.06 ct), over sieve +11 to 2 and 3 ct. Their FTIR spectra were recorded and analysed using an Excel program that corrected for multi-path-lengths and which performed a curve fit that ignored off-scale readings, thereby allowing analyses of stones previously deemed too thick for useful interpretation.

Generally the older Argyle diamonds are characterised by relatively low levels of nitrogen in highly aggregated states, whereas the younger Diavik diamonds have high levels of nitrogen with low levels of aggregation. But between the different sizes within either of the deposits, clear distinctions were found in the nitrogen, hydrogen and platelet profiles.

Figures 1a and 1b show the relationships between the aggregation level and the nitrogen content for the two deposits.

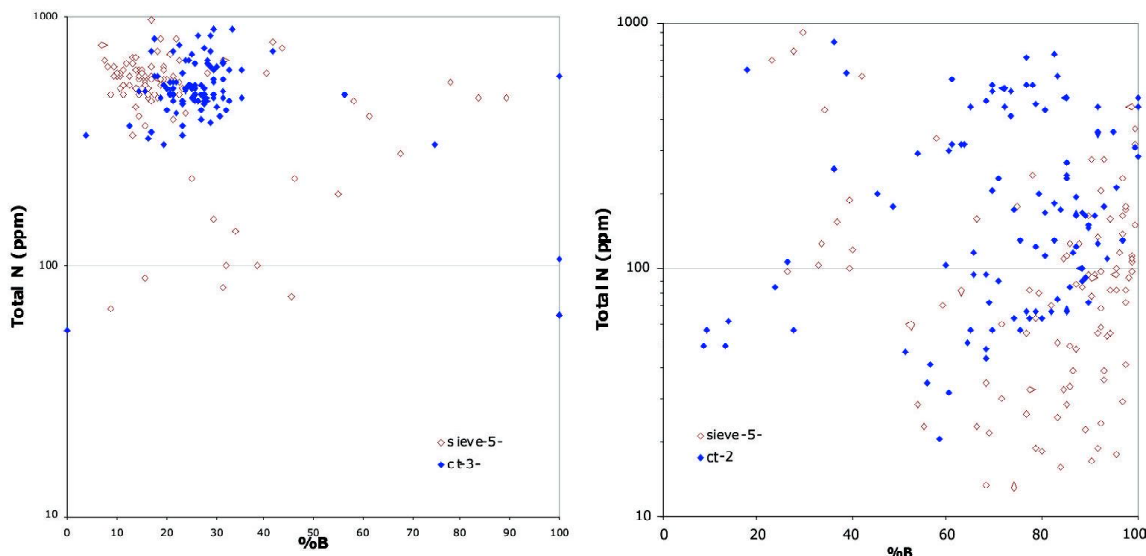


Fig 1a and 1b: The nitrogen profiles for Diavik (left) and Argyle (right).



It is clear from Fig 1a that all Diavik diamonds tend to have a similar level of total nitrogen irrespective of size, but that the %B for the 3+ ct cluster is almost twice that of the smaller sized stones. Whereas for the Argyle diamonds, the larger size tends to have higher nitrogen levels and a lower degree of aggregation (Fig.1b). For Murowa diamonds the larger size had similar nitrogen levels to the smaller size, but the aggregation was less.

Neither of these plots conform to the temperature-time isochron lines commonly applied to such data, unless it is interpreted that the different sizes experienced different temperatures or mantle residence times, hence being different populations. This feature of non-conformance to a temperature-time isochron is prevalent in the Murowa population when different colours are considered among the +5 sieve class, as seen in Figure 2.

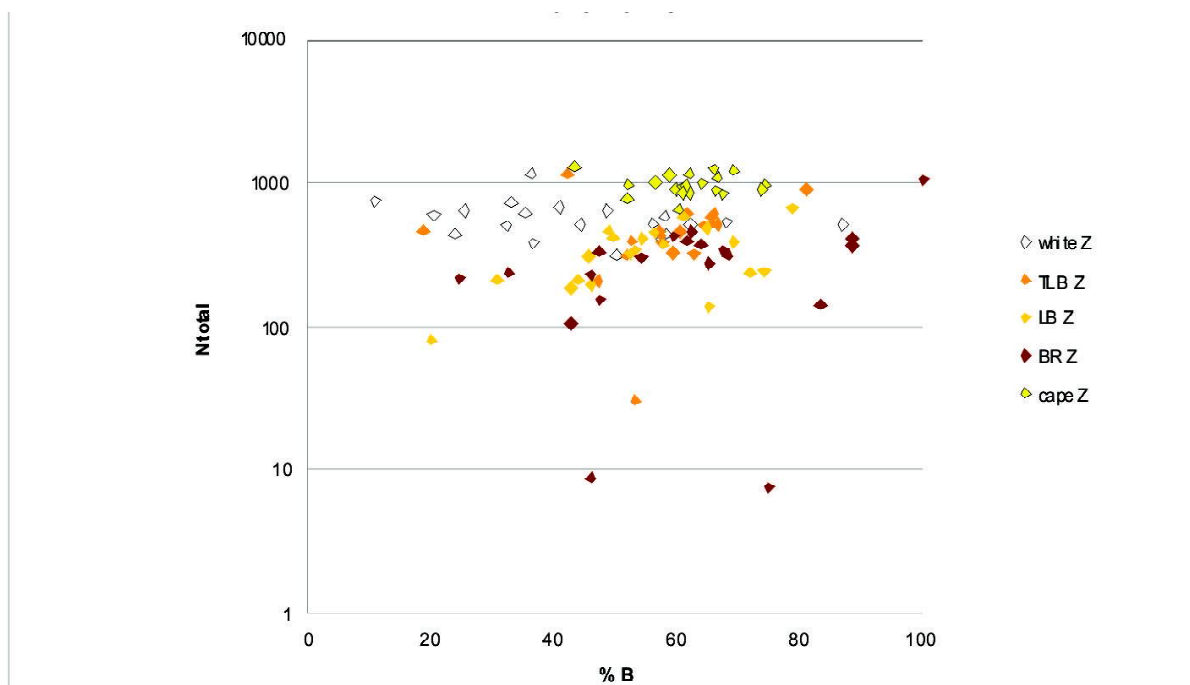


Fig 2: The N level and degree of aggregation for Murowa +5 stones shows white and yellow stones not exhibiting a dependency between N levels and degree of aggregation.

It is notable that some Diavik and Argyle stones had no or low B aggregates (type IaA) and some had no A aggregates (type IaB), despite having similar N contents within their respective deposit.

For the Argyle and Diavik deposits, the height of the platelet peak and 3107 cm<sup>-1</sup> hydrogen line showed a marked contrast between the large and small sizes, especially with the Diavik suite as seen in figure 3a.

In both these instances the larger size generally has higher levels of platelets and lower levels of H (3107 cm<sup>-1</sup>). For Murowa, the larger size had lower levels of both H (3107 cm<sup>-1</sup>) and platelets. In the case of Diavik, the higher platelet level could be associated with the higher aggregation state and for Murowa the lower aggregation state, however this argument is not consistent with the Argyle situation for which the larger goods have larger platelets and a lower aggregation state.

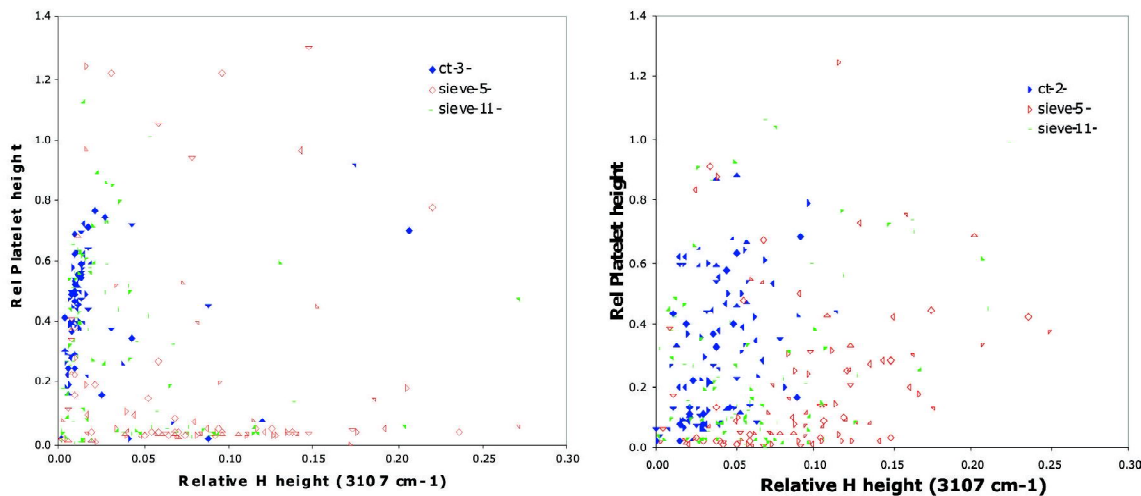


Fig 3a and 3b: The distribution of peak heights of platelets and hydrogen (3107 cm<sup>-1</sup>) for Diavik (left) and Argyle (right).

One interpretation might be that hydrogen inhibits the growth of natural diamonds and/or hinders the formation of platelets. An alternative explanation for the aggregation differences might be that the smaller diamonds result from a shorter growth period which in the case of Diavik occurred towards the end of the growth period of the larger diamonds, and in the case of Argyle – towards the beginning. Lattice stiffening from

nitrogen, and aggregation facilitation from vacancies produced by plastic deformation could further contribute to the observations.

This study reveals the importance of considering stone size and colour when conducting analyses based on FTIR spectra, and the caution that must be applied to interpretations thereof, particularly where temperature-time conditions are concerned.