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**GEOCHEMICAL COMPARISON OF K-T BOUNDARIES FROM THE
NORTHERN AND SOUTHERN HEMISPHERES; M. TREDOUX, B.TH.**

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The extinctions which mark the Cretaceous-Tertiary (K-T) boundary have been ascribed to a meteorite impact [1]. The major evidence quoted in support of this model is the enrichment of Ir (and the other platinum-group elements (PGE)) in the boundary clays [1-4], because these elements are enriched in meteorites (>10 ppm) and rare in common crustal rocks (<1 ppb) [5]. This argumentation does not take into account that the available PGE database for crustal rocks is very sparse and that terrestrial PGE geochemistry is consequently not well understood. The recent observation that hot-spot volcanism (eg. Kilauea, Hawaii) can produce aerosols that are very enriched in siderophile elements (eg. Ir, Au, Ni, Co) [6] has caused many workers in this field [e.g. 7] to argue that the possible terrestrial component of the siderophile element enrichment in the K-T clays has not been adequately identified.

In this study, closely spaced (cm-scale) traverses through the K-T boundary at Stevns Klint (Denmark), Woodside Creek (New Zealand) and a new southern hemisphere site at Richards Bay (South Africa) (see Fig.1) have been subjected to trace element and isotopic (C, O, Sr) investigation. Intercomparison between these data-sets, and correlation with the broad K-T database available in the literature, indicate that the chemistry of the boundary clays is not globally constant. Variations are more common than similarities, both of absolute concentrations and interelement ratios. For example, the chondrite normalized PGE patterns of Stevns Klint are not like those of Woodside Creek (compare Figs. 2a and b), with the Pt/Os ratios showing the biggest variation. These differences in PGE patterns are difficult to explain by secondary alteration of a layer that was originally chemically homogeneous, especially for elements of such dubious crustal mobility as Os and Ir [5]. Our data also show that enhanced PGE concentrations, with similar trends to those of the boundary layers, occur in the Cretaceous sediments below the actual boundary at Stevns Klint and all three the New Zealand localities. This confirms the observations of others [7] that the geochemistry of the boundary layers apparently does not record an unique component.

It is suggested that terrestrial processes, eg. an extended period of Late Cretaceous volcanism [8] can offer a satisfactory explanation for the features of the K-T geochemical anomaly. Such models would probably be more consistent with the observed stepwise, or gradual, palaeontological changes across this boundary, than the "instant" catastrophe predicted by the impact theory.

References:

1. Alvarez L.W. et al., Science 208, 1095-1108 (1980).
2. Kyte F.T. and Wasson J.T., Nature 288, 651-656 (1980).
3. Smit J. and ten Kate W.G.H.Z., Cret. Res. 3, 307-332 (1982).
4. Ganapathy R., Science 209, 921-923 (1980).
5. Crocket J.H., Handbook of Geochemistry II-5, Springer Verlag (1978)
6. Zoller W.H. et al., Science 222, 1118-1121 (1980).
7. Hallam A., Science 238, 1237-1242 (1987).
8. McLean D.M., Cret. Res 6, 235-259 (1985).

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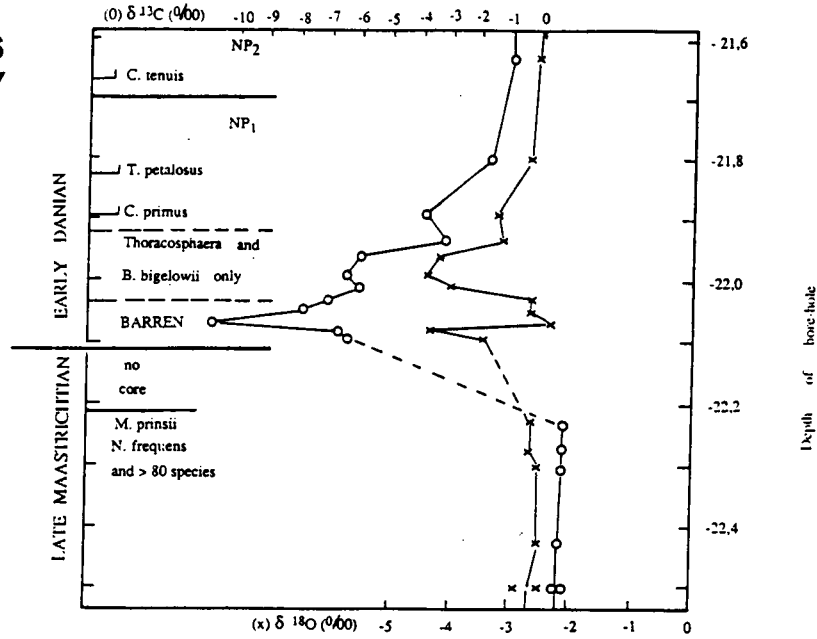


Fig. 1 : Nannofossil stratigraphy across the K-T boundary site at Richards Bay, South Africa. Also plotted are the carbon and oxygen isotopic ratios; values in permille, relative to PDB.

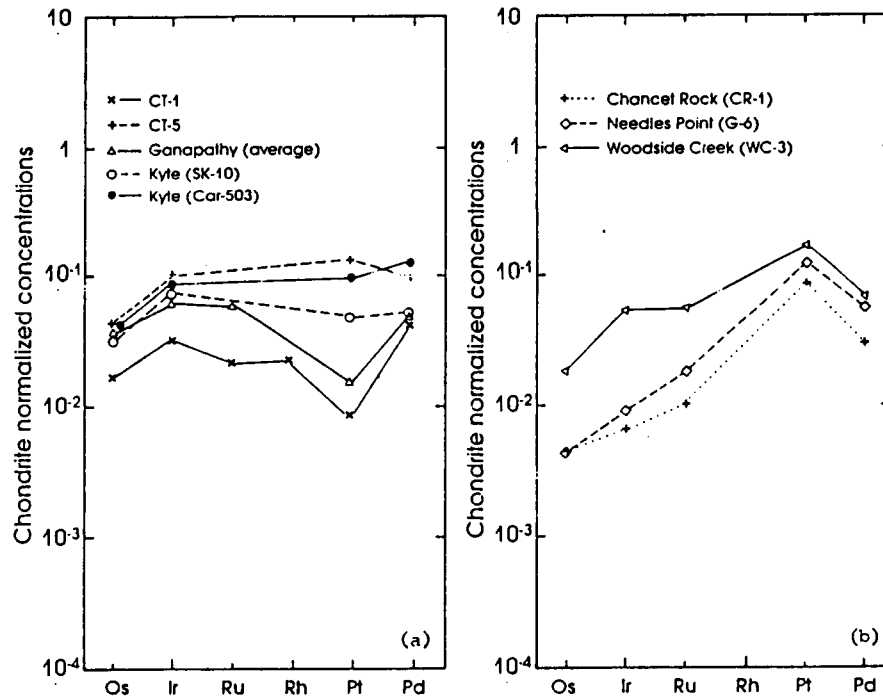


Fig. 2 : PGE plots of (a) K-T boundary clays from the northern hemisphere (4 samples from Stevns Klint, 1 from Caravaca [2]); (b) 3 southern hemisphere K-T localities.