

EVIDENCE FOR MULTIPLE EXTRATERRESTRIAL IMPACTS  
AT THE CRETACEOUS-TERTIARY TRANSITION IN ISRAEL

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The K/T transition strata in southern Israel were examined in two sections, 1.5 km apart, for extraterrestrial signatures. The sections of about seven m thick chalks and shales, are well bedded, show good lateral continuity without erosional signs and exhibit normal foraminiferal succession. Three different zones with high anomalies of Ir and Au, together with microspherules and shocked quartz grains, occur in both sections at almost the same levels.

Two iridium anomaly zones (up to 26 ppb Ir, Fig. 1) were found within the Late Maastrichtian Abathomphalus mayaroensis zone. The third iridium anomaly zone with maximal 14 ppb Ir starts 80 cm above the K/T boundary (within the Early Paleocene Morozovella pseudobulloides zone, just above the Globigerina eugubina zone). Gold was found in several samples in native flakes and globules of 1 - 25 micron size. The anomalies of Co, Ni, As and Cr, as well as high concentrations of Fe, agree well with the Ir zones. Wolfram and Bassanite were observed about 50 cm below the boundary in zone Ir II. Yellow-brown-green, spherical and translucent microspherules of 100 -150 microns in diameter (Fig. 2) are abundant mainly in the Maastrichtian Ir layers. These granules appear amorphous in X-ray diffraction method. Most of them are composed of Mg-Fe-Al-silicates with high Fe concentration and some of sanidine composition (K-Al-feldspate). Their form, habit, chemistry and distribution suggest that they are extraterrestrial products - microtektites. Very few quartz grains (Fig. 3), about 50 - 100 microns in size, found in Ir I and II zones, show two to three intersecting planar sets, generated by shock through impact.

Our findings of multiple Ir zones from the K/T transition beds reinforce the theory of comet showers or meteoritic storms (1,2), explaining the stepwise biological mass extinctions in the Late Maastrichtian (3) and faunal instability during the Early Paleocene (4). Calculations of the maximal extent of the Ir zones in our sections, based on sedimentation rates, refer to a perturbation period of more than one million years.

References: (1) Alvarez, W. (1986), Towards a theory of impact crises, *Eos*, 67, 649-658. (2) Hut, P., Alvarez, W., Elder, W.P., Hansen, T., Kauffman, E.G., Keller, G., Shoemaker, E.M. & Weissman, P.R. (1987), Comet showers as a cause of mass extinctions, *Nature*, 329, 118-126. (3) Kauffman, E.G. (1984), The fabric of Cretaceous marine extinctions, in: *Catastrophes and earth history - The new uniformitarianism*, Berggren, W.A. & van Couvering, G., eds., Princeton Univ. Press, 151-246. (4) Gerstel, J., Thunell, R. & Ehrlich, R. (1987), Danian faunal succession: Planktonic foraminiferal response to a changing marine environment, *Geology*, 15, 665-668.

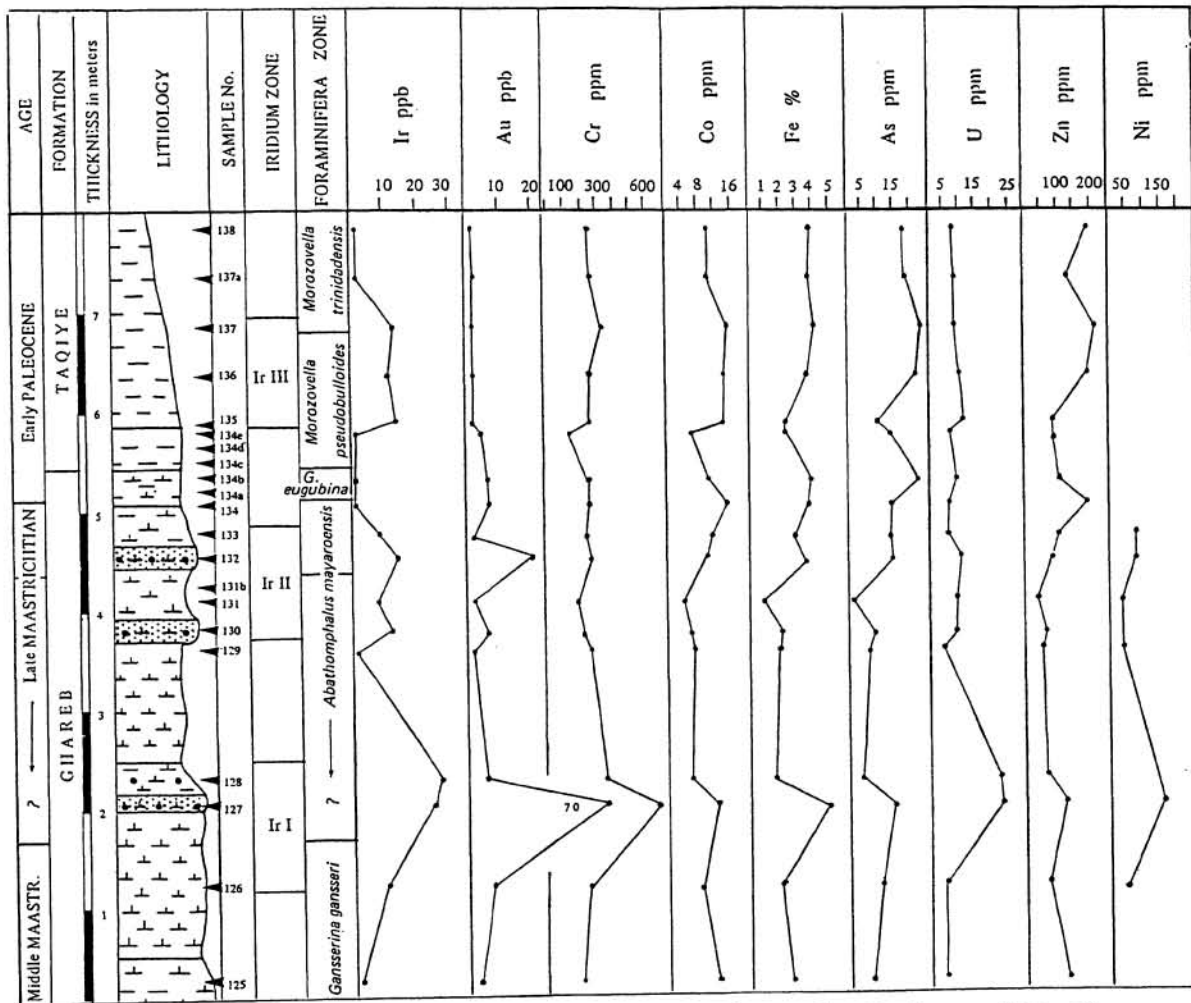


Fig. 1: Foraminiferal zonation, Ir zones and geochemical results of HaMakhthesh HaGadol section, southern Israel.

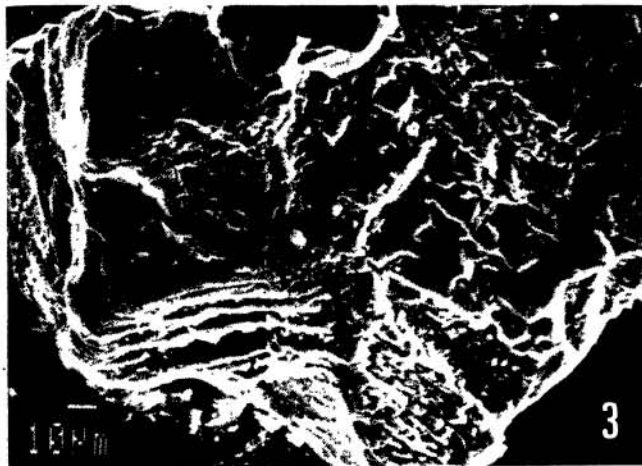
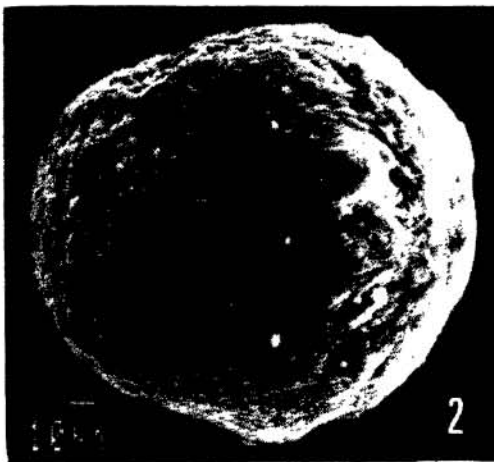


Fig. 2: SEM-photograph of microspherule of Mg-Fe-Al-silicate composition.

Fig. 3: SEM-photograph of shocked quartz grain, showing intersecting planar sets