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POSSIBLE WORLD-WIDE MIDDLE MIOCENE IRIDIUM ANOMALY AND ITS RELATIONSHIP TO PERIODICITY OF IMPACTS AND EXTINCTIONS, F. Asaro, W. Alvarez*, H.V. Michel, L.W. Alvarez, M.H. Anders*, A. Montanari*, and J.P. Kennett**; Lawrence Berkeley Laboratory, University of California, Berkeley, CA 94720; *Department of Geology and Geophysics, U.C. Berkeley, Berkeley, CA 94720; **Department of Geological Sciences, U.C. Santa Barbara, Santa Barbara, CA 93106.

In a study of one million years of Middle Miocene sediment deposition in ODP Hole 689B in the Weddell Sea near Antarctica, a single iridium (Ir) anomaly of $(44\pm10)\times10^{-12}$ gram Ir per gram rock (ppt) has been observed in core 6H, section 3, 50-60 cm, after background contributions associated with manganese precipitates and clay are subtracted. ODP Hole 689B is 10,000 km away from another site, DSDP Hole 588B in the Tasman Sea north of New Zealand, where a single Ir anomaly of 144 ± 7 ppt over a background of 11 ppt (core 25, section 1, 20-30 cm) was found in an earlier study of 3 million years of deposition. From chemical measurements the latter deposition was thought to be impact-related (1,2). Ir measurements were made, following neutron activation, with the Iridium Coincidence Spectrometer (1,2).

The age vs depth calibration curves given in the DSDP and ODP preliminary reports (3,4) indicate the ages of the Ir anomalies are identical, 11.7 million years, but the absolute and relative uncertainties in the curves are not known. Based on the newest age data the age estimate is 10 million years (5).

As the Ir was deposited at the two sites at about the same time (within our ability to measure) and they are one quarter of the way around the world from each other it seems likely that the deposition was world-wide. The impact of a large asteroid or comet could produce the wide distribution, and this data is supportive of the impact relationship deduced for DSDP 588B from the chemical evidence. If the surface densities of Ir at the two sites are representative of the world-wide average, the diameter of a Cl type asteroid containing the necessary Ir would be 3 ± 1 km, which is large enough to cause world-wide darkness (6), and hence extinctions (7), although the latter point has been disputed (8). This would be the third world-wide stratigraphic horizon of impact-related Ir enriched rocks that has been found with the ages being 65-66.7 (K-T boundary), 37-39.4 (Late Eocene) and 10-11.7 (Middle Miocene) million years. This spacing suggests a periodicity of 27-28 million years for the impact of large extraterrestrial bodies in agreement with those reported for extinctions (9) and crater ages (10), although both of the latter have been disputed.

Another stratigraphic horizon of Ir-enriched rocks has been observed in rocks about 91-92 million years old from North America (11,12,13), Italy (14) and Poland (15). Some of the rocks have a mantle signature (13) but the possibility of an impact on the ocean bottom as the source of the anomaly cannot be ruled out. An impact-related horizon has been observed in 2.3 million year old rocks distributed over 600 km (16). The minimum size of the bolide was reported as 0.5 km which may be borderline for producing world-wide darkness (6). Anomalous Ir abundances have been observed at the Callovian-Oxfordian boundary in Spain and Poland (17). The origin of the Ir has not yet been well-determined and the chronological age is uncertain by many millions of years. Precambrian impact-related Ir deposits have been found in rocks about 3.5 billion years old in South Africa and possibly Australia (18). The age of these rocks is too great to check the correlation with the observed periodicity.

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