THE K/T BOUNDARY AT BELOC, HAITI: EVIDENCE FOR A COSMIC EVENT.

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The K/T boundary biological crisis is supposed to have been produced by the impact of a huge asteroid (1-5). This hypothesis is not accepted by all the scientific community. One of the arguments against this scenario is the absence of a suitable crater and the low amount of ejecta in most K-T sections. At Beloc, Haiti, the presence right at the paleontological K/T boundary of a thick globule layer, interpreted as an ejecta, suggests that the place of the hypothesized K-T impact is located in the Caribbean area (6). The Beloc section offers the opportunity to study in detail the deposition sequence and to identify the different ingredients of the K/T event.

Sampling of the Beloc section. Owing to recent landsliding, the standard site described by Maurrasse (7) was not examined during our visit to Beloc in july 1990. Two other well-exposed nearby sites outcropping along the road from Carrefour to Jacmel have been sampled. In the following they are referred to as B1 (stop 7 of Maurrasse (8)) and B2 (100 m south west of stop 8 of Maurrasse (8)). The total thickness of the globule layer is ≈ 50 cm at B1 and ≈20 cm at B2. At both sites a grading of the globule size is clearly visible. The stratigraphy of the globule layer reveals the existence of at least two main flows. At B2 the reverse size grading, observed in the basal flow, suggests that some reworking occurred.

Biostratigraphy. Microplankton confirms that the globule layer is in close coincidence with the paleontological boundary. Two distinct associations dominated by cretaceous and tertiary taxa are observed respectively below (<-35cm) and above (>+60 cm) the base of the globule layer. Strangely, nannoplankton is only represented by cretaceous taxa in all samples examined in this study (from -2m to +4m, see also Perch-Nielsen (9)).

Mineralogy. B1 and B2 show the same mineralogical sequence. The top and the base of the globule layer have a bleached colour and contain smectite and a significant fraction of harmotome and clinoptilolite. The medium part of the bed consists in a pure smectite resulting from the alteration of the original glass globules. Glass relics are abundant in B2 only. Terrestrial Ti-rich magnetites are abundant in Cretaceous and Tertiary limestones and very scarce in the globule layer.

Search for iridium and cosmic debris. We have carefully looked for Ir and Ni-rich magnetites. Both ingredients are specific markers of the K-T boundary. They are systematically found in cosmic debris having been heated and oxydized in the atmosphere. Their close association, at the K-T boundary (10-14) or sediments of other ages (15), constitutes the most convincing signature of an infall of extraterrestrial material (see Robin et al. this conference). At Beloc anomalous Ir concentrations and Ni-rich magnetites are found at both sites but with very different distributions (fig 1 and 2). In B1, Ir concentrations are low or not significant in the first 10-15 cm. Then, we observe a regular increase up to the top of the globule layer with a slight accident at the lithological discontinuity between the two main flows (+25 cm). The maximum value of 1.2 ng/g is found in the limestone immediately overlying the globule bed. Ni-rich magnetites have approximately the same distribution but with a very sharp drop in the uppermost samples. In B2, we observe a well developped double structure. The maximum Ir concentration is observed at the base of the globule bed together with a maximum in the magnetite concentration. A second Ir maximum is observed at the top of the globule bed but, here, magnetites are missing.

Interpretation. In the two sites Ir is clearly associated with Ni-rich magnetites. This demonstrates the extraterrestrial origin of the event. In addition, at site B1, the

least disturbed one, these two ingredients appear higher in the section than globules. In order to explain this shift, we tentatively propose the following interpretation of the sedimentary sequence. The drastic drop of terrestrial magnetites (two orders of magnitude at least) and carbonate show that the event was extremely brief consisting in the infall ofa big amount of molten material. This could result from an impact occurring in the Caribbean area. However, this impact did not contribute much to the total Ir infall as demonstrated by the low Ir concentration in the globule bed. This suggests that this crater is a local importance feature produced by a low mass body. Shortly after, a significant amount of extraterrestrial matter was accreted all over the world in a likely finely divised state. This accretion step which produced the global Ir and Ni-rich magnetite anomalies appears not directly linked with the Caribbean impact but might be better explained by the fragmentation of the initial impactor (comet?) before it collided the Earth (16). Only the biggest fragment(s) might have produced cratering.

As far as B2 is concerned, the same ingredients are present but the inverse globule size grading together with the occurrence of Ni-rich magnetites and Ir at the base of the globule bed show that the different components were not deposited in the right order. Redeposition seems a reasonable explanation.

Conclusion. The presence of Ir and Ni-rich magnetites at the K/T boundary of Beloc demonstrates that an extraterrestrial event did occur. This association cannot be explained by a volcanic eruption. The globule layer marking the boundary might be the ejecta produced by a closeby impact, which alone cannot explain the worlwide distribution of Ir and Ni-rich magnetites. However, multiple beds, discontinuities and inverse size grading in the globule layer do not permit to get a definite conclusion. Further studies are required.

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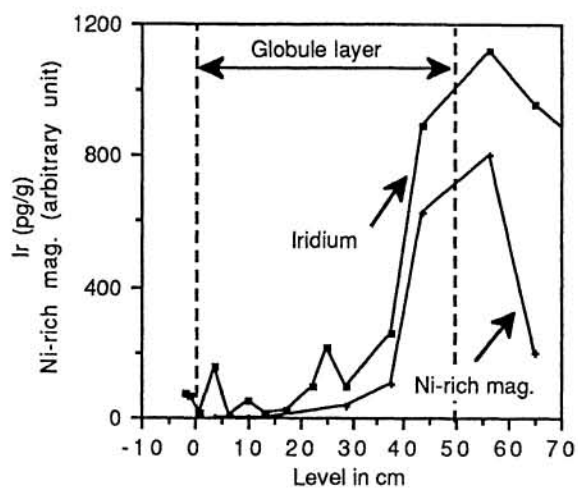

Fig. 1: site B1

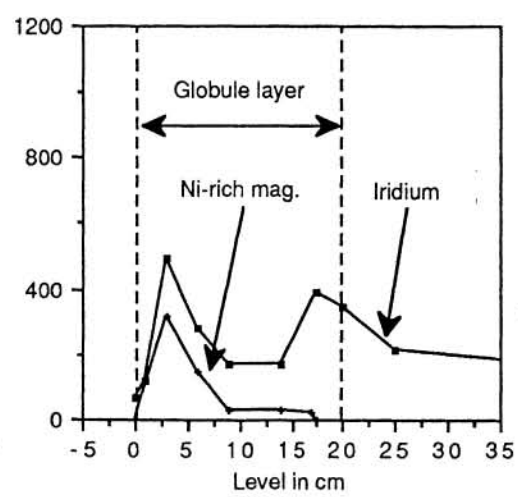

Fig. 2: site B2