# "FLINDERSITE" BEARING IMPACT EJECTA LAYER FROM SOUTH AUSTRALIA;

V. A. GOSTIN & M. ZBIK, Department of Geology & Geophysics, University of Adelaide, Adelaide, South Australia 5005.

A thin (up to several centimeters) layer of coarse, feldspathic clasts and sand has been found in the Precambrian Bunyeroo Formation in central and northern Flinders Ranges. Such a characteristic and persistent marker bed was interpreted by Gostin et al [1,2] as an impact ejecta layer derived from bolide impact. The remnants of a huge impact structure have been found by Williams [3] in the Gawler Ranges, 300 km away from this ejecta layer. Coarse impact-metamorphosed clasts of acid volcanics that occur in the ejecta layer have been called "FLINDERSITES" [4]. Based on similarities between "Flindersites" and the Gawler Range Volcanics, a genetic link between this impact structure and the distal impactites has been established.

A sample of the impact debris layer several cm thick was collected for investigation from Bunyeroo Gorge in the central Flinders Ranges. The lowest layer (L-1) is a coarse clast-bearing [Flindersite] horizon. Mineralogy of this layer is determined by composition of the Flindersite clasts. The clay fraction of this layer consists of vermiculite and kaolinite, perhaps formed from the alteration and weathering of glassy components (Fig. 1). The dark red Flindersite clast, containing plagioclase phenocrysts surrounded by a felsic matrix, had sunk into the mudstone host rock (sample L-3). According to Gostin et al [1] this layer was deposited by vertical fall of ejecta through the water column shortly after impact.

The overlying sandstone layer (L-2) is high porous and more persistant compared to layer L-1, and represents finer impact debris that took longer to settle through the atmosphere and water column. A thin greenish-gray mudstone layer separates layers L-1 and L-2, and in composition is similar to host sediment L-3. The clay fraction of sample L-2 and L-3 (see Fig. 1) is rich in micas (illite) and clinochlorite which indicates that these layers had probably settled simultanously. However the clinochlorite content in L-2 is significantly lower than in the host mudstone layer. Both layers L-1 and L-2 contain numerous grains displaying impact-produced features. These include several quartz grains displaying one or two sets of decorated PDF (planar deformation features, Fig. 2) and clasts with mixed melt developing along grain boundaries. Complete or partial isotropization of feldspar crystals (maskelynite formation) has occurred. Albite incrusted spherules and shard-like clasts described in [2] are present in both layers and in the intervening mudstone layer. They consist of secondary minerals which probably replaced primary glass of microtektite origin [Fig. 3].

Using basic geophysical principles and the results of our analyses, leads to a modified scheme of ejecta layer formation: **1**- Due to the velocity of seismic waves in igneous rocks, a huge earthquake put sea-floor sediments into suspension about a minute after asteroidal impact in the Gawler Ranges. **2**- Several minutes after this earthquake, coarse, impact-metamorphosed dacite rocks quickly dropped through the turbid watercolumn. Due to inhomogenity of the ejecta curtain, the debris covered the sea-floor in patches. **3**- The mud still in suspension settled on the sea- floor, covering the coarse ejecta. **4**- At an indetermined time after impact, but probably when significant sediments were still in suspension, the finer impact debris settled through the atmosphere and water column. **5**- After completing the sedimentation process, further sediment reworking occurred by turbidity currents. Since no debris finer than 0.1 mm in diameter occurs at Bunyeroo Gorge, this material was probably carried away by currents and deposited elsewhere.

Trace and minor element abundances in the above described layers [Fig.4], confirm the similarities between the impact ejecta layers, and the significant differences between these and the host mudstone. Moreover the diagrams show enrichment of impact ejecta layers in Cr and Ni,

**IMPACT EJECTA LAYER FROM SOUTH AUSTRALIA;** GOSTIN V. A. & ZBIK M.

especially in the clay fraction. Because these elements are not present in target rocks in such amounts, and because they follow the Ir anomaly [2], it is possible to investigate the type of impactor from studying the elemental ratios in the clay fraction of ejecta layers. Perhaps former impact glasses that were contaminated by impactor elements retained some elemental abundances of the impactor even after transformation of the glasses into clay minerals.

REFERENCES: [1]- V.A.Gostin et al. (1986) Science Vol. 233, pp. 198-200. [2]- V.A.Gostin et al. (1989) Nature Vol. 340, No. 6234, pp. 542-544. [3]- G.E.Williams (1986) Science Vol. 233, pp. 200-203. [4]- V.A.Gostin & M.Zbik (1994) 25th, LPSC Houston.

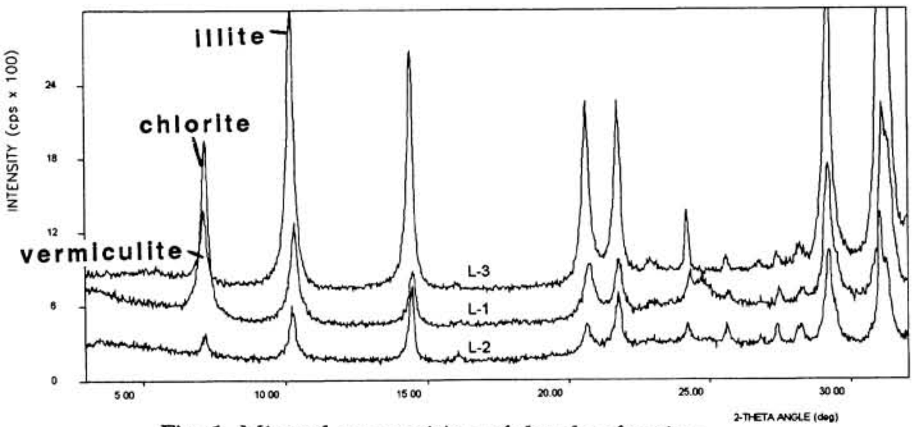


Fig. 1 Mineral composition of the clay fraction.

Fig.2 PDF in quartz grain from sandstone layer.

Fig. 3 Albite spherules from the thin layer between L-1 & L-2.

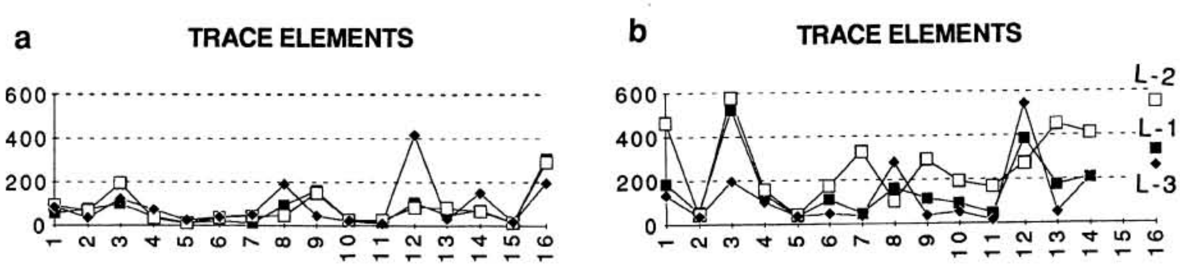


Fig.4 Trace and minor elements in: a- whole sample & b- clay fraction.
1-Ce, 2-Co, 3-Cr, 4-Ni, 5-Ga, 6-La, 7-Pb, 8-Rb, 9-Sr, 10-Th, 11-U, 12-V, 13-Y, 14-Zn, 15-Nb, 16-Zr.