A FULLY FLANGED BUTTON TEKTITE (AUSTRALITE) WEIGHING OVER 11 GRAMS FROM THE ETADUNNA STATION, SOUTH AUSTRALIA. M. Hurtig, Dipl.-Min. (lausitzer.moldavite@gmx.de).

Introduction: Tektites are naturally occurring, SiO_2-rich glasses with very low water contents formed by the shock melting and hypervelocity ejection of silica-rich sediments by cosmic impacts on the Earth's surface. These holohyaline objects, up to several centimeters in size, were shaped and solidified during a ballistic flight [1, 2].

Ablated tektites, also referred to as distal tektites [3], are only known from Java, Australia and the surrounding ocean areas in the Australasian tektite strewn field (age: 788.1 ± 3 ka; [4]). During climb to higher (less dense and predominantly colder) layers of the atmosphere (no complete exit!) the initially still molten distal tektites suffered (minimal) plastic deformation before solidification [3]. During descent, due to continued hypervelocity (> 5 km/sec; [5]), stable trajectory, and constant orientation, strong compression and heating of the air occurred, which led to re-melting at the front (anterior) of these tektites. This secondary melt flowed to the backside (posterior) and formed flow ridges (on the anterior) and eventually flanges (Fig. 1). Depending on primary shape (slightly flattened sphere, prolate spheroid, dumbbell, or teardrop), corresponding flanged shapes were formed. The classic example, and yet extremely rare in perfect preservation, is a flanged button tektite (from here in the text: f/b; plural: f/bs) formed from a flattened sphere. Due to aero-thermal stability criteria during flight they typically have masses of under 4 to 6 grams only (keyword "spallation"; for further information see [3, 6]).

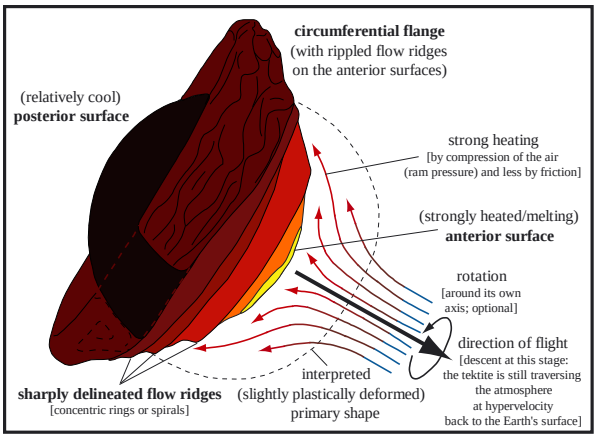

Fig. 1: Flanged button tektite formation.

Sample description: The fully f/b described hereafter (Fig. 2) was found in the mid 1970s by a member of Bryan Oldfield's family (of 7) on a large clay pan flat in between sandhills near the Birdsville track on the family owned cattle station "Etadunna", South Australia (pers. comm. Greg Oldfield, son of Bryan O.).

Fig. 2: The fully flanged button tektite from the Etadunna Station (20.5 mm diameter Australian $2 coin as a scale).

Fig. 3: Side view of the same tektite as in Fig. 2 (the primary hemisphere protruding far beyond the level of the flange).

Its dimensions and mass are well above the average. The maximum diameter, measured precisely with a digital caliper, is 29.0 mm, but only 27.1 mm at a 90-degree angle to it. Strictly speaking, it is a flanged very broad oval, with little variation in diameter. The depth (thickness) is 18.4 mm, with the primary hemisphere on the posterior protruding far beyond the level of the flange (Fig. 3). The flange, on the other hand, is in a normal range (approx. width of 2.0 to 3.0 mm). With a mass of 11.46 grams, it is currently the heaviest known fully f/b. The mass was determined with an (uncalibrated) NEVA precision balance (Fig. 4).

Fig. 4: The fully flanged button tektite from the Etadunna Station weighs 11.46 grams.

Furthermore, the more or less 0.6 mm wide groove between the flange and the primary hemisphere on the posterior still contains about 45 small quartz sand grains (grain size: 0.5 to 1 mm), for which a mass of approx. 0.02 grams can be assumed. Therefore, the mass of the f/b must be corrected down to approx. 11.44 grams, which does not significantly change the record value. Until now, there were only unverified accounts that fully f/bs with a mass of more than 10 grams exist [7, 8].

The surface on the anterior of the piece described herein is heavily abraded (due to transport and / or sand blasting), so that flow ridges are only faintly visible near the flange. The entire surface, including the posterior, is also slightly etched (due to neutral to acidic groundwaters), which is reflected in small to very small dimples / pits. Such surface features are typical for tektites found in desert areas of South Australia. A conspicuous feature of the f/b is an imperfection (indentation / grooves) on one side of the hemisphere on the posterior (Fig. 5).

Fig. 5: Puzzling imperfection on one side of the hemisphere on the posterior of the fully flanged button tektite from the Etadunna Station.

One explanation for this may be internal chemical differences (schlieren), which were dissolved to different degrees due to different chemical resistance. Another (more probable) cause for this unevenness may be that the f/b contains a larger internal (gas) bubble. Hollow f/bs are well known and more common in the heavier specimens. Whether this is the case can be verified non-destructively by determining the specific gravity or by x-ray computed tomography (compare to [9]). However, such investigations cannot be carried out at present, as the f/b is not available to the author. The weight, the abnormal dimensions, especially the depth (thickness) of the specimen with prominent posterior primary hemisphere protruding far beyond the level of the flange, and the surface imperfections on the posterior of the fully f/b may be indicative of the presence of an internal bubble. Such an inclusion, and associated reduction in internal stresses, may provide satisfactory explanation as to why such a large f/b exists.

It should be noted that some excellent aboriginal artefacts (including stone spearheads) have been found in the same area. It cannot be ruled out that this conspicuously large f/b was transported there by Aboriginal people and originally came from somewhere else. However, there is no evidence that the piece was worked by Aboriginal people and the unevenness of the posterior surface, overall wear, and sculpture appear natural. The find location, along the prominent South Australian to Victorian Australasian tektite ejecta ray [1], requires no further explanation and the occurrence is highly consistent with being natural.

Further known heavy f/bs: The heaviest fully f/b described and illustrated in the literature so far is an excellently preserved specimen weighing 9.34 grams (diameter: 25 mm; depth: 15 mm) from Port Campbell, Victoria [10, 11].

A hollow f/b indicator (a little less under half of the flange is missing) with an incredible weight of 12.53 grams (originally approx. 14 grams; diameter: 32.4 mm; depth: 23.9 mm) is known from Hordern Vale, Victoria [12, 13]. An almost identical specimen was found near Port Campbell, Victoria. Both of these hollow tektites are stored in the Museums Victoria Collections (pers. comm. H. Ralph Uhlherr).

Possibly the South Australian Museum in Adelaide also keeps a very large f/b (further details not known; pers. comm. Greg Oldfield).

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