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SMALLEST RECORDED AUSTRALITE, WITH NOTES ON OTHER SMALL AUSTRALITES

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Abstract

The smallest recorded complete Australian tektite, recently discovered 9 km NNE of Princtown, Western Victoria, is minute, oval, shallow bowl-shaped australite weighing only 0·0132 gm, with a specific gravity of 2·430. It is practically a complete form and similar to other small australites in that no central core region has survived the passage through the atmosphere without undergoing melting. Three other complete australites have also been found in the Port Campbell-Princetown region of Western Victoria, the weight of each specimen being noteworthy in respect to other small australites previously recorded. All the small bowl-shaped australites are well-preserved, exhibiting the secondary effects of aerodynamic processes which have acted upon the small primary spheroids of tektite glass during their entry through the earth's atmosphere.

Introduction

Approximately 50,000 australites have so far been brought to scientific notice, in papers dealing with the classification of either individual collections or specimens from particular localities, or specifically describing certain australites on the basis of uniqueness or form or size.

It is understandable that many papers have described large australites, but, unfortunately, there has been an almost complete neglect in the recording of smaller specimens. For the purpose of this paper, an upper limit of 100 mg was set as the weight of a small australite. A thorough search of the available literature has revealed that the seven complete australites described in this paper are the only ones below this limit which have been documented. Three have already been described elsewhere (Baker and Cappadona, 1972; Baker, 1946, 1963) but the other four, including the smallest, are described here for the first time.

With the exception of Australite 4 (Table 1), which is lodged in the National Museum of Victoria, all other australites referred to remain in the private collection of W. J. Cappadona, of Dandenong, Victoria.

General

The weight, specific gravity and dimensions of the seven small australites are presented in Table 1, together with information on the year of discovery of the specimens and their location. The dimensions listed have been approximated for ease of comparison. The range in weights of the australites is from 13·2 mg to 97·0 mg. The specific gravity values vary within the range of 2·430 to 2·405 with an average value of 2·415.

The smallest known recorded australite is an oval, shallow bowl-shaped form and was discovered by one of the authors (WJC) in September, 1975, approximately 9 km NNE of Princetown on the Western Victorian coast. It was found resting on its edge in a rain-washed gutter of greyish, leached, sandy clay on Fordes Road (track), which is a closer-settlement road running off the main Princetown to Cobden road. The specimen had obviously been dislodged from its original resting place by heavy rain which had fallen over the previous two days. It could not have been transported any great distance, as the gutter in which it was found originated only 1 m from a dense vegetation cover on undisturbed top-soil.

The actual dimensions of the smallest australite are length 4·3 mm, width 3·8 mm, depth 0·2 mm, and thickness of glass 0·4 mm. If the plan aspect of this specimen is assumed to be elliptical, then, based on the average thickness, an estimate of the loss in weight due to removal of a small circumferential fragment is less than 2% of the total.

While etching and pitting after impact have obviously reduced, to varying extents, the original masses of the small australites, the loss is not considered to exceed 5%. (See next section.)

An interesting feature is the chronological order in which the small australites were found. Prior to 1970, the only small australite to be recorded was specimen 4, which was discovered by George Baker in 1937. The other six have been found within the last five years and three of these weigh less than specimen 4.

It is also interesting to note that specimens 1, 2, 3, 5 and 7 were all found in the same general area, 7 to 10 km NNE of Princetown. This is despite the fact that one of the authors (WJC) devoted a greater proportion of his time searching in similar australite-bearing subsoils elsewhere, to reveal only one other small specimen.

Features of the australites

No. 1

The smallest australite is a shallow oval bowl, the surfaces of which have been very deeply etched. The small chip removed from the margin has a rounded outline on the anterior surface and may represent a bubble pit, as one other spherical cavity occurs on this surface close to the margin (Pl. 10, fig. 1). The flow line pattern on the anterior surface has largely been obscured by pitting. The posterior surface shows flow lines concentric with the margin. There is no clearly defined core. A large bubble cavity nearly 1 mm across occurs in the marginal area (Pl. 10, fig. 1).

No. 2

The specimen is a slightly imperfect oval in plan. The anterior surface is strongly convex, more so in end-on elevation than from the side (see Baker and Cappadona, 1972). The posterior surface is concave. The complex flow line pattern is a result of differential etching of streaky, rather inhomogeneous tektite glass during burial (Baker and Cappadona, 1972). Etch pits are rare and generally small, with the exception of two deeper craters, up to 1 mm across, on the posterior surface (Pl. 10, fig. 2).

No. 3

The specimen is a shallow oval bowl-shaped form. The posterior surface is gently concave and marked by three large bubble cavities in the marginal area. The central region is 'apple-shaped' and is surrounded by a set of concentric flow lines. The entire posterior surface is strongly pitted such that no trace of flow lines remain in the marginal area. On the anterior surface, heavy etch pitting has reduced the original flow lines to radial-like traces (Pl. 10, fig. 3).

No. 4

This oval, tray-like form without a central core has been described by Baker (1946). 'The flat anterior surface curves at the edges and the posterior surface is slightly concave; both surfaces have strongly marked, contorted flow lines, and a bubble cavity, 1 mm across, forms a small hole through the specimen.' (Pl. 10, fig. 4.)

No. 5

This specimen is a shallow bowl, almost circular in outine. The anterior surface is strongly marked with flow lines centred about the central dome. Bubble pits are abundant. The posterior surface is shallow and concave and also strongly marked by flow lines, which tend to form a knot-like arrangement in the central portion of the surface (Pl. 10, fig. 5). There are several quite deep etch pits and a few bubble cavities.

No. 6

This is the best preserved of the seven small australites. It has an irregular ovoid outline and is deeply bowled. The strongly convex anterior surface has a flow line pattern which passes directly over the crown on the surface, but at a slight angle to the long axis of the ovoid outline. The flow lines tend to fan out on either side of the dome, which is off-centre (Pl. 10, fig. 6). The posterior surface is deeply concave. A distinct central region has an uneven surface and a quadrilateral outline, with its long axis parallel to that of the whole australite. The flow line pattern is complex but continuous across the central portion and the marginal area. A large bubble pit occurs within the central region and another on the margin (Pl. 10, fig. 6). Several smaller pits mark the anterior surface.

No. 7

This is a dish-like oval, shallow bowl. Both the posterior and anterior surfaces are heavily pitted, with several etch pits reaching 1 mm across. Only faint traces of strongly curved flow lines have survived the etching on the posterior surface. There is no central core evident on the posterior surface (Pl. 10, fig. 7).

Discussion

Although there have been only seven small (i.e. less than 100 mg) australites described out of 50,000, it is likely that they are not as rare as this proportion suggests. Their small size obviously mitigates against their discovery by normal visual observation owing to the limitations of human eyesight and to the amount of sustained concentration required.

It is interesting to contrast these small australites with the glass microbeads (so-called microtektites) which are being recovered from oceanic sediments. It has been pointed out in a previous paper (Baker and Cappadona, 1972) that the glass microbeads are fundamentally primary forms and do not exhibit the secondary effects of aerodynamic sculpturing, a feature common to all australites. The effect of the aerodynamic processes which have acted upon the primary spheroid of tektite glass during passage through the Earth's atmosphere is clearly evident even in the smallest australite (see Pl. 10, fig. 1).

The name 'Tektite' was introduced by Professor F. E. Suess of Vienna in 1900 and was derived from the Greek word 'tektos' meaning molten. This name was coined to describe specific objects which had been aerodynamically sculptured during hypersonic flight through the Earth's atmosphere, and which duly assumed a secondary form.

It is indeed unfortunate that Professor Suess's definition has been extended to include glass microbeads, the form of which bears no relation to the classical connotation of the word 'tektite'.

It is known that the burning of certain Australian timbers rich in opal phytoliths, or the burning of haystacks (Baker, 1968) will produce glass microbeads comparable to recorded 'microtektites' (Glass, 1974). From a physical standpoint, such glass microbeads are formed by the irregularly shaped combustion products assuming primary forms governed by surface tension considerations during their semi-viscous phase of solidification. Solidification takes place at relatively low bead velocities, governed by thermal updraughts and, consequently, no secondary effects are evident in their final form.

In contrast to glass microbeads where the final forms are the result of a cooling process at low velocities, it must be remembered that the secondary forms of australites are the result of a heating process at high velocities.

Having regard to the contrary nature of the formation mechanisms of glass microbeads, it is the authors' opinion that glass microbeads do not warrant inclusion in the study of the tektite phenomena.

Acknowledgement

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Description of Plate 10

Photographs of small australites listed in Table 1

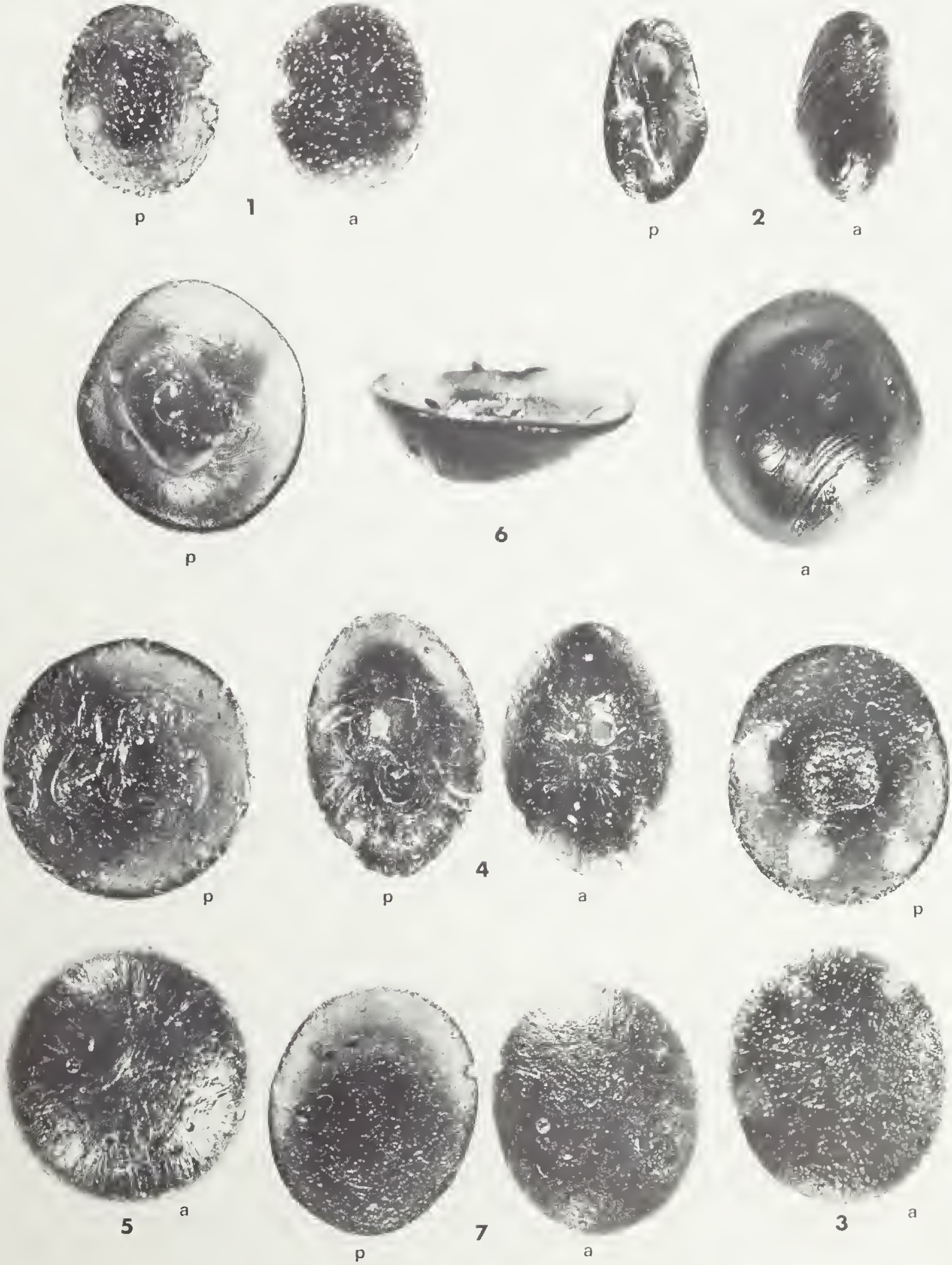
Figure 1.—Australite No. 1, posterior (p) and anterior (a) surfaces*.
Figure 2.—Australite No. 2, p. and a.
Figure 3.—Australite No. 3, p. and a.
Figure 4.—Australite No. 4, p. and a.
Figure 5.—Australite No. 5, p. and a.
Figure 6.—Australite No. 6, p., a. and side elevation.
Figure 7.—Australite No. 7, p. and a.

* See Table 1 for dimensions of australites.

TABLE 1

Small australites in order of increasing weight.

	Weight (mg)	Specific Gravity	Length (mm)	Width (mm)	Depth (mm)	Thickness (mm)	Year of Find	Location of Find	Reference (where applicable)
1	13·2	2·430	4·5	4	0·25	0·25-0·5	1975	9 km NNE of Princetown	
2	26·0	2·410	5·0	3	2·00	0·5	1971	10 km NNE of Princetown	Baker & Cappadona (1972)
3	57·7	2·405	7·0	6	0·25	0·5	1974	10 km NNE of Princetown	
4	64·5	2·406	9·0	6	1·00	0·5	1937	10 km E of Port Campbell	Baker (1946) Baker (1963) (Nat. Museum E 7842)
5	67·1	2·420	6·5	6	0·50	1·00-1·5	1973	9 km NNE of Princetown	
6	96·9	2·425	8·0	7	1·00	0·25-0·5	1975	20 km NE of Princetown	
7	97·0	2·410	8·5	7	1·00	0·25-0·5	1970	7 km NNE of Princetown	Baker & Cappadona (1972)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