SHORT COMMUNICATIONS

NOTES ON A FRAGMENT CORE AUSTRALITE

An unusual australite, having a fragment core, was recently discovered near Princetown, Western Victoria. The specimen is essentially complete and exhibits a triangular prismatic core with surrounding flange. The striking feature of the specimen is the core-flange interface which approximates three straight edges, indicating that the flange generation during entry through earth's atmosphere has taken place on a fragment of australite glass.

To the author's knowledge, the possibility of fragmentation of australites during flight has received no attention in literature. This is surprising considering the many australites known to be stressed and the force encountered during flight at hypersonic speeds (Baker 1946, 1958, 1959).

Stress within the mass of australite glass, with the application of external forces, may not be the only mechanism by which fragmentation is possible. For instance, the australite concentration within many strewnfields is very high, particularly in certain areas of Western Victoria, which implies that the probability of a collision between two masses of australiate glass in flight, with resultant fragmentation, is also proportionately high.

By either mechanism, fragments of australite glass can be generated which themselves will be subject to the effects of the aerodynamic shaping process. If fragmentation occurs during the heating phase of flight, then the fragments produced have a limited time in which to form any further secondary effects. Australites so-formed will, in the majority of cases, therefore assume a shape which cannot be readily discribed by a standard classification.

The australite discussed in this paper is such a form. It was discovered by the author in August 1978, 10 km NNE of Princetown, Western Victoria. The specimen was found resting on its anterior surface in an eroded roadside gutter consisting of leached, sandy clay. Heavy rain on the day prior to discovery is thought to have dislodged the specimen from its original resting place.

DESCRIPTION OF SPECIMEN

The weight of the fragment core australite is 0.0484 gm and the specific gravity was determined to be 2.41 using distilled water at 20°C.

The specimen is essentially complete although a small circumferential chip has been removed from a portion of the surrounding flange. Having regard to the flange thickness in that section, the loss of weight due to the removal of the chip has been estimated to be less than 2% of the specimen's weight.

The anterior surface of the specimen, when viewed in plan aspect, is approximately ovoid in shape and is consistent with the anticipated features of an australite of similar mass and physical size. Minute bubble craters are evident on the surface together with shallow etched flow lines.

The posterior surface of the australite, when viewed in plan aspect, reveals several striking features. The prismatic core fragment has deeply etched flow lines which extend from the apex of the fragment, along the core faces and across the core-flange separation zone into the flange. Considerable contortion of the flow lines is evident in the separation zone at the vertices of the core, indicating that flange generation has taken place from the fragment.

Four bubble cavities are present on the surface of the prismatic core fragment, the largest being 0.4 mm in diameter. An examination of the specimen in transmitted light reveals an internal bubble cavity within the core of approximately 0.5 mm diameter. Smaller bubble cavities are also evident in the flange. A close examination of the fracture responsible for the removal of the circumferential chip has revealed three partial bubble cavities which probably weakened the flange material in that section.

DISCUSSION

Complete australites so far brought to scientific notice, of weight comparable to the specimen described, are either disc, plate or bowl-shaped (Baker 1963, Baker & Cappadona 1972, Birch & Cappadona 1977). Australites of this type have no central core portion or, in some cases, a core portion which is insignificant in relation to the volume of flange material. Such core portions are invariably round or eliptical in outline.

In contrast, the specimen described here shows a disproportionately small flange in comparison to the central core mass which is essentially straight-sided in outline. On the basis of the core dimensions and the total weight of the specimen, it has been estimated that the core portion contributes some 70% of the specimen's total weight. This suggests that fragmentation of the parent body has taken place towards the latter stages of flight during the heating phase and that the generation of secondary effects has been limited by the remaining sculpturing time.

An important point to note in relation to the fragmentation of parent bodies and the aerodynamic sculpturing of the resulting fragments is that of flight orientation. Given that a fragment is produced in flight, regular secondary effects will only be evident on those fragments which can maintain a reasonably steady flight orientation. This implies a certain degree of symmetry of the fragment shape in order to prevent tumbling in flight (which would not produce any systematic development of a flange or similar features). The australite described had a symmetrical shape, a triangular prism, one face of which has been oriented in the direction of the flight path. Stable orientation during flight has been maintained by the symmetrical trailing surfaces which meet at a central apex.

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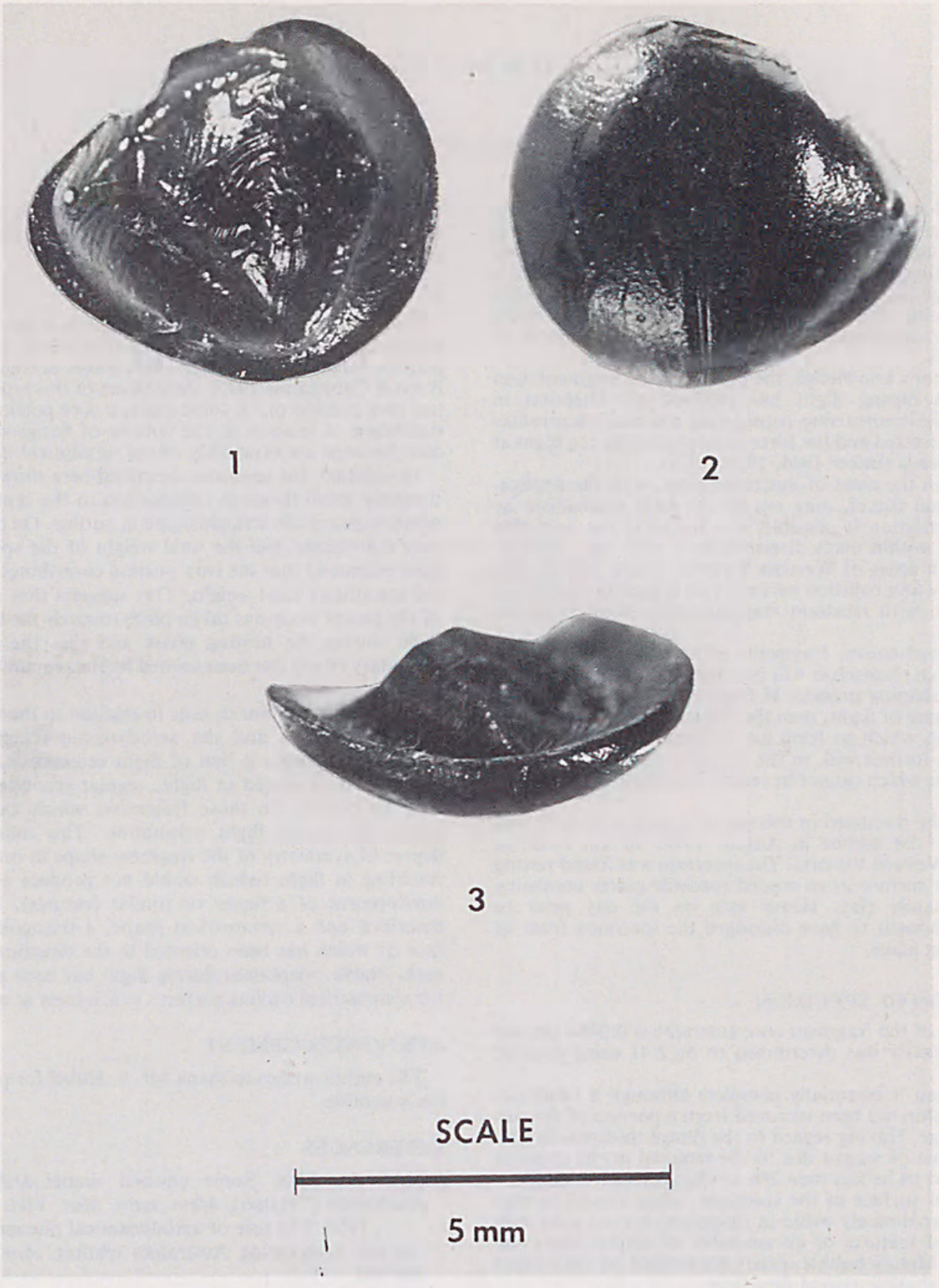

FIG. 1—Plan view of the posterior surface of australite.

FIG. 2—Plan view of the anterior surface of australite.

FIG. 3—Oblique view of australite.