NOTES ON A SPECIMEN OF BASALT-GLASS (*TACHYLYTE*) FROM NEAR MACQUARIE PLAINS TASMANIA, WITH REMARKS ON OBSIDIAN "BUTTONS."

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The absence of any reference in the records of this Society to the class of volcanic products to which basalt-glass belongs may justify a brief account of the history and character of the specimen now exhibited. It was originally about two and a half inches long and two inches thick, irregularly angular in shape. The colour is a dark olive-green, but a weathered face is bright blue; the fracture is conchoidal.

This specimen was obtained by me many years ago from a heap of basalt and scoriæ, excavated from a temporary road-cutting on the right bank of the Derwent between Macquarie Plains and Fenton Forest. Near the same spot I found, on a block of basalt, thin bands of a dull black glass, bearing some resemblance to the glassy selvages of basalt dykes, which have often been described as constituting the chief sources of obsidian and basalt-glass. The basalt of this part of the district is probably of late tertiary age.

In the early days of geology, the terms "obsidian," "pitchstone," "volcanic glass," etc., were often used indiscriminately for different varieties of glassy lava without reference to the essential conditions of the rocks of which they formed a part. With the advance of the science of petrology it soon came to be recognised that they may be divided into two principal classes, representing respectively the acidic and basic types of volcanic rocks. These are readily distinguished by chemical analysis, and by the test of their density or specific gravity; but a further test of structure was required, and this has of late years been admirably supplied by microscopical examination, without which no test of a volcanic rock is now considered complete. The name "obsidian" is now restricted to glassy varieties of rhyolitic and trachytic rocks, while basalt-glass is usually classed as *tachylyte*—a term first introduced by Breithaupt in 1826, indicating its ready fusibility before the blowpipe.

The specimen from Macquarie Plains has this quality, and it is distinctly magnetic when pulverised, another characteristic of *tachylyte*. A small piece was sent to Mr. Twelvetrees for comparison with the specimens of obsidian which have been lately examined in Launceston, and he reports the specific gravity as 2·74, while the maximum for obsidian was

2·47. These results are sufficient to determine the class and name, and there can be little doubt that this determination will be corroborated by analysis and microscopical examination.

Another form of the same substance, from the volcano of Kilanea, in the Sandwich Islands, and known as "Pele's hair," is exhibited for comparison. This condition is produced by jets of liquid lava coming in contact with strong gusts of wind, which instantly cool them, and carry the product away in the form of spun glass.

Obsidian Buttons.

As a supplement to the valuable paper contributed by Messrs. W. H. Twelvetrees, F.G.S., and W. F. Petterd, C.M.Z.S., on the subject of obsidian "buttons," the following particulars of the history of their occurrence in Australia may be of some interest:—

In Darwin's Geological Observations on the Volcanic Islands visited during the voyage of H.M.S. Beagle, 1832-1836, mention is made of a "volcanic bomb" found in the interior of Australia, and presented to him by Sir Thomas Mitchell. Incidental reference is made to this circumstance by various writers, but unfortunately there is no copy of the original work, either in the Library of the Royal Society, or in the Public Library, so that no quotations can be given from the actual observations of the distinguished author. In a paper read before the Geological Society in 1855,* ten years after the publication of Darwin's book, the Rev. W. B. Clarke refers to Darwin's description of "a volcanic bomb of green obsidian, from the plain between the Rivers Darling and Murray," and cites several instances of the discovery of similar specimens which had recently come under his own observations. Mr. Clarke says:—"Sir T. L. Mitchell's specimen would seem either to have drifted from a very long distance, or, which is more likely, from the known habits of the aboriginals, to have been dropped by one of them, who probably found it in the trap-hills of the Lachlan, to the north-eastward. This specimen was unique in Australia until recently.

"During the last two years several similar specimens have been found in the auriferous detritus of the western and northern gold-fields.

"The first which I met with was found in the cradle of a gold-washer on the Turon River, who dug it from a depth of 30 feet below the surface. This was a small, irregular, roundish

* "On the Occurrence of Obsidian Bombs in the Auriferous Alluvia of New South Wales. By the Rev. W. B. Clarke, M.A., F.G.S."—Quarterly Journal of the Geographical Society, March, 1835.

substance, 0·6 inch in diameter, having a specific gravity of 2·7 at a temperature of 66 degrees. It was undivided, and more like those examples described by M. Beudant than the figure given by Mr. Darwin. A similar specimen, but of a rude elliptical form, half an inch in diameter in the major axis, and having a specific gravity of 2·57 at a temperature of 63 degrees, was found in the washing stuff of the Uralla, or Rocky River.

"From the same locality were derived two other specimens, which I have examined. These are perfectly round, having diameters respectively, including the rim, of half an inch and about three-quarters of an inch. These, except in the shape and in the extension of the cells over the rim, as well as in the nucleus, agree with Mr. Darwin's figure. Their colour is also bottle-green, and they are translucent, the surface appearing black, as in Mr. Darwin's specimen. But this blackness does not arise from any difference in the composition. It is merely the effect of greater opacity. The external concentric rings are evident in all three. The specific gravity of those from the Uralla is respectively 2·42 and 2·51, at a temperature of 63 degrees. The smaller very much resembles a button without the shank, and from this appearance the diggers call them 'button-stones.' They appear as if they had been cast in a mould, but there is no reason to doubt the imputed origin."

The latter part of Mr. Clarke's description clearly identifies the Uralla specimens with those described by Messrs. Twelvetrees and Petterd. The high specific gravity of the Turon specimen places it with basalt-glass rather than true obsidian.

Mr. Clarke states that the alluvium of the Uralla is in granite country, but that a plateau in which the river rises has ranges which are created by basalt, and he infers "that the bombs had their origin in the outburst of the trap."

In the following year, Mr. Clarke reports† the discovery of two additional specimens. One of them was found at the Supply Rivulet, River Tamar, Tasmania, by Dr. Milligan. The other, "like a bung in shape, an inch high, and $1\frac{2}{10}$ of an inch thick in the upper part," was found near the River Wannon, in Victoria. No other particulars are given.

Mr. G. H. F. Ulrich, now Professor in the University of Dunedin, while connected with the geological survey of Victoria, prepared for the Melbourne International Exhibition of 1866, a paper on "The Mineral Species of Victoria," from which the following remarks on obsidian are quoted:—

"Button-shaped and spheroidal pieces of this mineral, from a quarter of an inch to several inches in diameter—the larger

† "Additional Notice of the Occurrence of Volcanic Bombs in Australasia. By the Rev. W. B. Clarke, M.A., F.G.S. (Abstract)." Quarterly Journal of the Geological Society, December, 1856.

ones sometimes hollow inside—are found abundantly distributed over the surface of the basaltic plains round Mount Elephant, Mount Eeles, etc.; also, strangely enough, over the tertiary mud plains of the Wimmera, far removed from any known basaltic craters or points of eruption. Small, button-shaped pieces have also been found in the post-pliocene gold drift of Spring Creek, near Daylesford."

The specific gravity of a Wimmera specimen which was examined by Mr. C. Newbury is given as 2·47, with a silica percentage of 73·7, which definitely identifies it with obsidian.

How these singular objects found their way to some of the localities in Tasmania, where their occurrence in undisturbed quartz drift far away from any known volcanic source has been reported, is still a mystery. Those which have passed through my hands could not have travelled far with the drift itself, for the long-continued grinding action, which has reduced quartz crystals, topazes, and angular pieces of quartz rock to smooth rounded pebbles, would have been fatal to the preservation of these "buttons," which, though hard enough to withstand ordinary "weathering," are exceedingly brittle. That they had their origin from sub-aerial jets of liquid lava is almost certain, though it may be doubted whether the well-marked, sharp, concentric rings on some of the specimens are entirely due to their rotatory movement while falling from a great height. As to the difference in form of some of the specimens, this would be materially affected by the degree of resistance in the body on which they fell, and by the force of impact. Supposing that they fell while the gravel and shingle drifts were in course of formation, these would be at the bottom of old river channels, under a greater or less depth of water, which would receive them as the drops of lead falling from the top of a shot tower are received in the tank at its base. But some might fall on mud-banks or soft earth, and the spheroidal or button-shaped drop, while in a viscous state, might be drawn out into that ellipsoidal form which has been noticed in some of the specimens. The subsequent accumulation of fresh supplies of drift material might bury these interesting strangers without materially disturbing them; so that they would appear to be synchronous with the formation of the pebbles themselves. It should be noted that though the "buttons" have often been found in gold or tin bearing drifts, they have no special connection with those particular deposits, and that they are found in them because such drifts are the only ones that are minutely examined by the working miner.

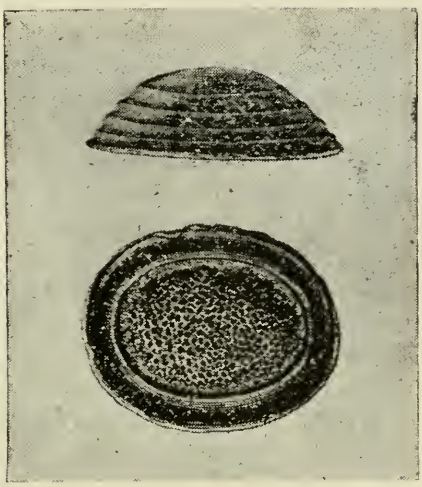
That the aborigines of Australia are largely responsible for the distribution of the buttons over the mud-plains of Victoria and Riverina seems highly probable; but no such

explanation can be given in reference to some of the places where they have been found in Tasmania. The theory that they may have come from lunar volcanoes, or even from distant terrestrial volcanic centres such as those of New Zealand, should not be seriously considered until all other hypotheses on the subject have been exhausted.

Since the above paper was written, I have received from Sydney a copy of the passage in Darwin's Geological Observations on Volcanic Islands, to which reference was made in connection with the discovery reported by him of a "volcanic bomb" in the interior of Australia. The following extract completes the early history of obsidian "buttons" in Australasia:—

"Sir Thomas Mitchell has given me what at first appears to be the half of a much flattened oval ball of obsidian; it has a singular artificial-like appearance, which is well represented (of the natural size) in the accompanying woodcut.

"It was found, in its present state, on a great sandy plain between the Rivers Darling and Murray, in Australia, and at the distance of several hundred miles from any known volcanic region. The external saucer consists of compact obsidian of a bottle-green colour, and is filled with finely-cellular black lava, much less transparent and glassy than the obsidian. The external surface is marked with four or five not quite perfect ridges, which are represented rather too distinctly in the woodcut."



Copy of woodcut of Volcanic Bomb from Australia referred to by Mr. Darwin.