

THE SURFACE STRUCTURE AND COMPOSITION OF 60017,43 (Shadow Rock)

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60017 is a surface fragment of Shadow Rock located at Station 13 of the Appollo 16 landing site.<sup>1</sup> It may be described as a partially melted, devitrified glassy breccia. 60017,43 constitutes an exposed surface fragment of 60017. The fragment has a somewhat low absolute density of 2.78 g/cc. as might be expected of a partially melted breccia. This density compares well with that of another partially melted breccia 15015,29.<sup>2</sup> The immediate external surface shows as a considerable degree of porosity [Figure 2]. It is presumably this porosity which gives rise to the surface area of 0.22 m<sup>2</sup>/g as obtained by nitrogen adsorption at -176°C. As was the case with 15015,29, the porosity exists primarily in the immediate external surface, and has arisen through substantial gas evolution through a semi-molten matrix.<sup>3</sup> Based on the low surface area of the fragment however, the porosity would appear to be primarily due to the formation of macropores.

Surface analyses were carried out using a Phi Model 545 SAM system [Auger Spectra] and a Hewlett-Packard HP5950B [ESCA Spectra]. A typical Auger Spectrum, taken from the rough external surface of 60017,43, is shown and may be compared with data supplied by Gold *et al.* in their recent publication.<sup>4</sup> The use of a cylindrical mirror analyser (as opposed to a retarding grid) plus a slightly higher electron beam potential (3 KeV), have resulted in somewhat more detailed information. Thus in addition to the oxygen, calcium, and iron reported by Gold *et al.* the spectrum in Figure 3 indicates the presence of sulphur, potassium, carbon, magnesium, aluminum and silicon. Of these the carbon and possibly part of the sulphur are surface contaminants. Titanium would not appear to be present at or above the 1% level in Figure 3, however other spectra do indicate its presence at about the minimum detectable level. Comparison with the bulk composition,<sup>5</sup> indicates that while surface and bulk do differ they do show a correspondence. One of the primary differences would appear to be a surface enrichment of volatiles, in this case of potassium. Details of depth profiling using Auger spectroscopy and of ESCA results will be presented in a subsequent publication.

REFERENCES

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## Surface Characterization of 60017,43

D.A. Cadenhead

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D.A. Cadenhead



Figure 1

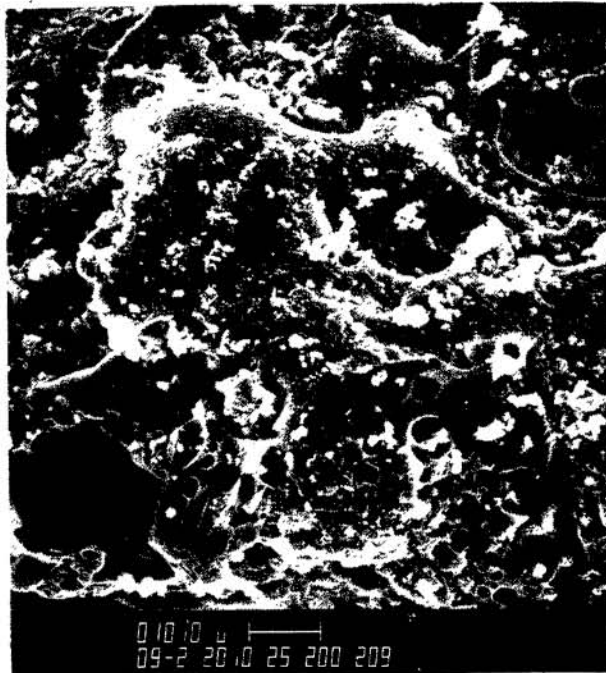


Figure 2

