SOME PETROLOGIC COMPARISONS BETWEEN ALHA81005 AND LUNAR HIGHLAND SOIL BRECCIAS. Ursula B. Marvin, Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, Massachusetts, 02138.

Speciman ALHA81005 appeared unique when it was discovered on the middle western ice field of the Allan Hills region on the final snowmobile traverse of the 1981-82 season. The field photograph shows a small rounded breccia, about 3 cm across, with conspicuous white clasts under a thin fusion crust. Six other meteorites were found in the same ice field during helicopter reconaissance flights early in the 1979-79 season. None of the other specimens resemble 81005, which remains the only one of its kind found in Antarctica or elsewhere in the world.

Preliminary examinations of two thin sections (81005,3 and ,22) show that the rock is a heterogeneous mixture of mineral and rock fragments, colorless glass spherules, and masses of devitrified glass embedded in a dark, glassy matrix. Some portions of the matrix are flow banded and/or crowded with minute (2-4μm) vesicles. The clast and matrix compositions fall well within the range of lunar highlands materials but differ from those of familiar achondritic meteorites. The glass spherules are reminiscent of those found in lunar soils and regolith breccias.

Plagioclase is by far the most abundant component of the rock. It occurs as mineral fragments and in lithic clasts ranging from cataclastic and granulitic anorthosites to anorthositic gabbros and troctolites with granulitic, ophitic, and cumulate textures. Plagioclase is also an abundant constituent of the colorless glasses, the devitrified glasses, and the brown matrix glasses. Most of the plagioclase is Ca-rich (An 92-98; Av. An 97). Only two small plagioclase clasts among several dozen analyzed ran as low as An 75, Ab 24, Or 0.98. Most of the glasses, both colorless and brown, plot within the plagioclase field of the pseudoternary liquidus diagram of Walker, et al (1973) although a few mafic glasses fall within the olivine or spinel fields. The fusion crust is almost pure feldspar glass with a maximum of 2 Wt.% each of FeO and MgO.

Pyroxenes and olivines occur as monomineralic clasts up to 0.15mm across and as mafic components of polymineralic clasts. Lamellae of augite and pigeonite are measureable in numerous grains. The augites range from En 31-50, Fs 15-30, Wo 30-40; the pigeonites from En 43-81, Fs 52-17, Wo 1-10. Sparse ferroaugites are present with compositions averaging En 25, Fs 33, Wo 42. Most olivines range between Fo 60-86, but two grains were found averaging Fo 37. The Wt.% MnO/FeO values measured in the pyroxenes and olivines show an affinity diagnostic of a lunar origin (see Figure 1). The pyroxenes follow the line previously determined for the ratios in lunar pyroxenes; they plot below the fields determined for achondritic pyroxenes. Within 81005 the pyroxenes and olivines fall (as expected) above and below the trend established for lunar bulk rocks.

Two prominent lithic clasts in section 81005,22 can serve as examples of distinctly lunar materials. The largest clast in the section is a 3mm gabbroic anorthosite in which large plagioclase crystals have been crushed and partially randomized optically. The mode is 87% plagioclase (An 97, Or 0.1) and 13% pyroxenes (En 44, Fs 18, Wo 38 and En 64, Fa 34, Wo 2). Anorthosites of this general character are unknown in achondrites but are common among Apollo highlands samples. The second clast is a 2mm anorthositic gabbro with a relict cumulate texture in which chains of pyroxene and olivine grains lie among plagioclases, most of which have acquired a granulitic texture although the fabric includes two larger-than-average clasts of twinned feldspar. This clast resembles some of the cumulate eucrites, but similar textures and compositions (60% plagioclase, An 96-98; 35% pyroxene En 38-45, Fs 30-44, Wo 32-11; 15% olivine, Fo 38) occur among lunar rocks and the MnO/FeO values are characteristically lunar.

Antarctic meteorite ALHA81005 was propelled to the ice sheet from the surface of the moon.

References: Stolper E.M., McSween H.Y. Jr., and Hays J.F. (1979) GCA 43 589-602). Walker D., Grove T.L., Longhi J., Stolper E.M., and Hays J.F. (1973) EPSL 20, 325-336.

Figure 1. MnO-FeO values of pyroxenes and olivines in ALHA81005 as compared with those of lunar and achondritic pyroxenes and lunar whole rock analyses. (After Stolper et al, 1979).