N92-10905

PRELIMINARY GEOLOGIC MAPPING OF ARSIA MONS, MARS

James R. Zimbelman, Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution, Washington, DC 20560

Geologic mapping of the Tharsis Montes at a scale of 1:500,000 was recently initiated as part of the Mars Geologic Mapping Program of NASA. Detailed mapping of the three large shield volcanoes and their surroundings will help to clarify the sequence of events which led to the formation of these features, as well as provide a basis for comparing the complex histories of the three related yet distinctive volcanic centers.

Preliminary mapping of Arsia Mons at a scale of 1:2M (see Fig. 1) was carried out in preparation for detailed mapping (1). The main shield construct of Arsia Mons is approximately 300 km in diameter along the axis of the Tharsis Montes (N40E azimuth), but the shield may be nearly twice as broad perpendicular to this trend. Lavas may have flowed around older portions of the volcano as they moved downslope, away from the Tharsis Montes axis. A 100-km-diameter caldera with a flooded floor (unit c) tops the volcano. The main construct (unit s_3) has numerous graben and aligned collapse pits that are generally circumferential to the caldera; the widest graben are near the summit on the western flank while the eastern flank has narrow graben that are at least 100 km from the caldera rim. "Parasitic calderas" embay the southern and north-northeastern flanks (2) and were the source for the latest plains emanating from Arsia Mons (unit p_a) and covering earlier Tharsis plains (unit p). The lower portions of the western flank, below an elevation of 15 km, are deeply eroded and undulatory (unit s_2), terminating along an irregular scarp which forms the contact with a smooth lower shield material (unit s_1).

The lobate aureole deposit northwest of the construct has at least four mappable textural units; knobby (unit k), lobate (unit l), ridged (unit r), and smooth (unit s) terrains. The lobate unit may consist of flow fronts, from lava flows and/or debris flows, emanating from the basal scarp for shield unit s_2. The ridged terrain has been interpreted to result from emplacement of a gravity-driven landslide (3) or as recessional morraines (4). The ridged terrain grades into knobby terrain, with lines of knobs leading directly into large adjacent ridges at some locations (-7°, 129°). The smooth unit is superposed on all other aureole units, as well as several large graben or depressions. Subtle lobate margins and lineations in the smooth unit suggest a possible pyroclastic origin, which could have emanated from large graben near the upslope edge of the aureole (located at -7°, 124° and -6°, 123°). An alternative interpretation is that the smooth unit formerly covered the entire aureole surface and is in the process of being eroded away, exposing the other aureole units below.

REFERENCES: 1) J.R. Zimbelman, LPS XXII, 1551-1552, 1991. 2) L.S. Crumpler and J.C. Aubele, Icarus 34, 496-511, 1978. 3) M.H. Carr et al., J. Geophys. Res. 82, 3985-4015, 1977. 4) B.K. Lucchitta, Icarus 45, 264-303, 1981. [Supported by NASA grant NAGW-1390]

Figure 1. Simplified geologic map of Arsia Mons (see text).