SEARCH FOR MARS LANDER/ROVER/SAMPLE-RETURN SITES - A STATUS REVIEW; Harold Masursky, A.L. Dial, Jr., E.C. Morris, M.E. Strobell, D.J. Applebee, and M.G. Chapman, U.S. Geological Survey, Flagstaff, AZ 86001

Ten Mars sites have been under study in the USA for four years (fig. 1). They are Chasma Boreale (North Pole), Planum Australe (South Pole), Olympus Rupes, Mangala Valles, Memnonia Sulci, Candor Chasma, Kasei Valles, Nilosyrtis Mensae, Elysium Montes, and Apollinaris Patera. Seven sites are being studied by the USSR; their prime sites are located at the east mouth of Kasei Valles and near Uranius Patera. Thirteen geologic maps of the first six USA sites are compiled and in review. Maps of the Mangala East and West sites at 1:1/2 million scale and a 1:2 million-scale map show evidence of three episodes of small-channel formation interspersed with episodes of volcanism and tectonism that span the period from 3.5 to 0.6 b.y. ago.

E. C. Morris has recently recompiled his geologic map of southeastern Olympus Mons (Morris, 1982) on a new base. Special computer enhancements of higher resolution Viking images allow more detailed delineation of the distribution of four basaltic units that form the volcanic construct and of an adjacent basaltic plains unit. Traverses for sampling are planned that will minimize travel over rough-surfaced flow units.

Detailed geologic mapping in the northern part of the Kasei Valles area, using specially enhanced images, shows the channel of an older, broad-valley, fluvial stage cut by a more deeply incised younger channel. Small fluvial channels formed on the sides of the main channel and deposited alluvial fan material on the valley floor; then lava flows of probable basaltic composition buried the floor of the inner channel, partly covering the alluvial fan deposits.

False-color enhancements of images in the north and south polar areas are used to plan traverses so that the lander/rover can collect samples from subjacent layered deposits and overlying materials of the layered ice cap. The proposal is to obtain and correlate 1-m-deep cores of these units at successive stations so that we can recover a continuous section of the layered deposits and the layered ice and dust of the ice cap. We anticipate that study of the ice and dust layers in these cores will reveal as much about Mars' global geologic history and climatic changes as we have learned about Earth from study of cores from the Greenland and Antarctic ice caps and deep sea cores. Viking bistatic radar data acquired near the proposed north polar landing site show it to be one of the smoothest areas on the planet (Simpson et al., 1982). This observation seems reasonable, because the polar layered deposits cover all rough impact ejecta and lava flow surfaces.

Earlier work at the Memnonia site by Scott and Tanaka (1982) shows an area containing materials of ancient cratered terrain, probable basaltic lava flows of intermediate age, and young, possibly silicic, welded tuffs. Geologic data are being recompiled on a new base map of the area. Geologic materials that range widely in age and composition should be available at this site. Geologic relations are more clear cut at Memnonia than at the Mangala site, but evidence of fluvial channeling episodes is not present.

The tectonic and geologic history of Mars, both ancient and modern, can be elucidated by sampling volcanic and fluvial geologic units at equatorial sites and layered deposits at polar sites. The evidence appears clear for multiple episodes of fluvial channeling, including some that are quite recent; this evidence contrasts with the theses of Baker and Partridge (1986) and many others that all channels are ancient. Verification of this hypothesis by Mars Observer will be an important step forward in our perception of Mars' history.

References

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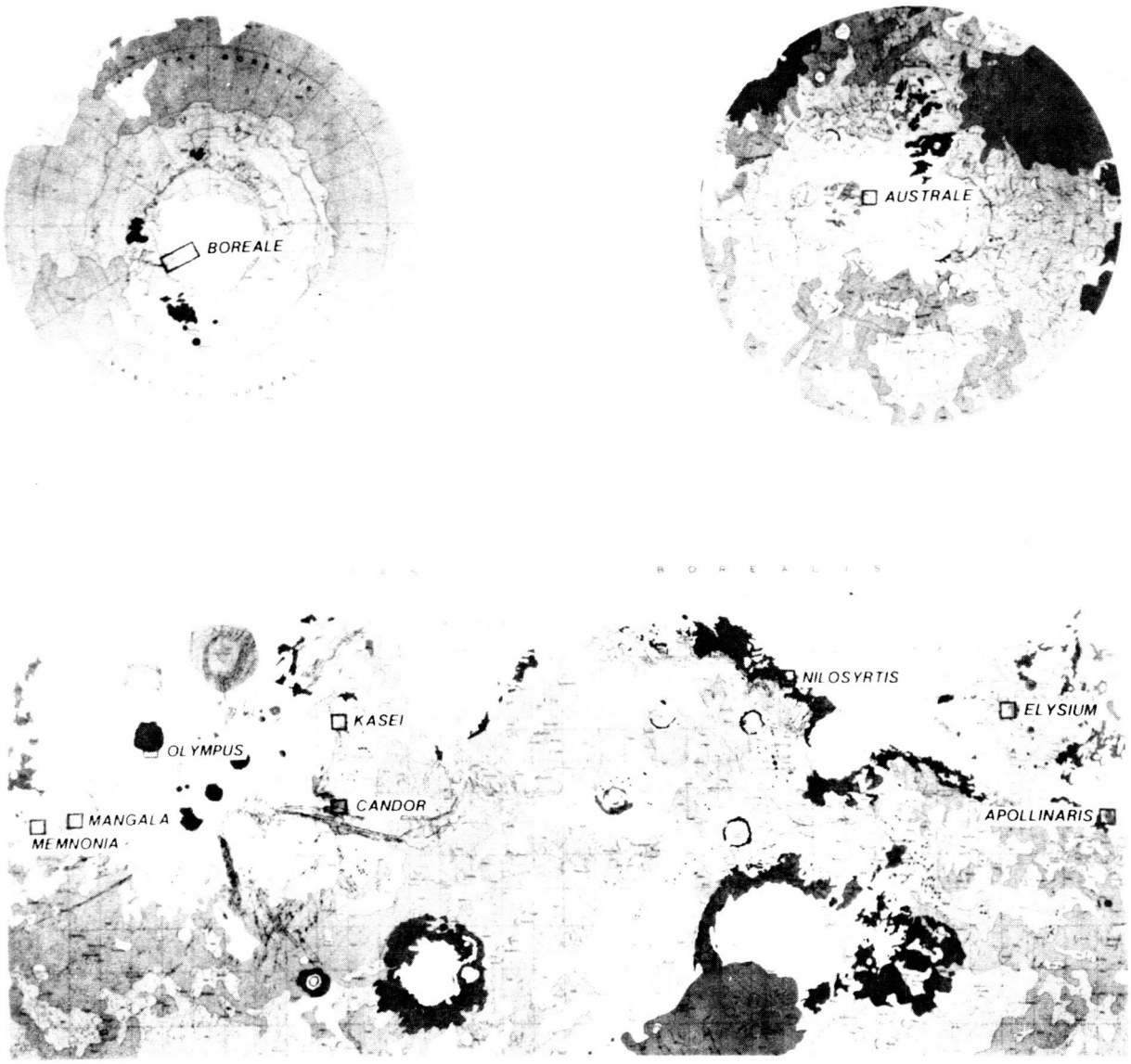

Figure 1. Geologic map of Mars showing the location of candidate landing sites for a future lander/rover/return-sample mission.