Voyager 1 encounter with Jupiter and Io

The Voyager 1 encounter with the jovian system in March 1979 generated a wealth of new information about Jupiter's atmosphere, satellites, and magnetosphere. One of the most spectacular discoveries was the evidence of active volcanism on the satellite Io. Eight active volcanoes were discovered, indicating a level of activity higher than found on any other body in our Solar System.

This special issue of Nature presents a set of Voyager papers devoted to many of these discoveries. Principally, they cover the first detailed analyses of the jovian meterology and the properties of Io. The Voyager papers are supplemented by Earth-based studies which relate directly to the spacecraft observations.

The results from the Voyager mission reported in this issue of Nature represent a significant increase in our knowledge of the jovian system. Frequently in the discussions, comparisons are made between features and processes in the jovian atmosphere, magnetosphere, and on Io with their terrestrial counterparts indicating the importance of comparative planetology. The success of the Voyager mission to Jupiter, indicated by these papers, will provide a new perspective for planetary studies.

Garry E. Hunt

Preliminary geological mapping of Io

Harold Masursky*, G. G. Schaber*, L. A. Soderblom* & R. G. Strom†

* United States Geological Survey, Flagstaff, Arizona 86001
† Lunar and Planetary Laboratory, University of Arizona, Tucson, Arizona 86001

Terrain units and their global distribution on Io are summarised. A map of the complex region of Io is also presented.

VOYAGER 1 obtained moderate resolution (1–5 km per television line pair) images of about one-third of Io and images at lower resolution (5–20 km per television line pair) of an additional third of the surface[1]. The low resolution images were obtained using several colour filters (0.35–0.6 μm) which discriminate a myriad of coloured surface units. The moderate resolution pictures are single-colour black and white and they show geomorphic features formed dominantly by volcanic processes[2]. The absence of impact craters implies an extreme youthfulness for the surface that is consistent with the discovery of active volcanism on Io[1,3-5]. This article presents a preliminary summary of terrain units and their global distribution on Io. The global map also provides a context for the accompanying articles that discuss topical aspects of Io's geology, including volcanic plumes[4], the nature of volcanism implied from surface expression of landforms[2], curious layered terrains that are apparently eroded[6], and a model for the volcanic eruptive processes[7].

This paper also presents the first attempt to map units in a complex region of Io that shows interlayered flows, volcanic collapse pits, scarps, faults, and layered terrains. The maps were compiled using photogeological mapping techniques developed for mapping active terrestrial volcanic fields; the relative chronology of surface units was determined from overlap and transection relations between surface units. A conventional planetary mapping technique that uses measurements of superimposed impact crater populations to establish relative chronologies for surface units could not be used because no impact craters have been identified on Io's very young surface. The detailed maps presented here (*Plate 5a*, p. 786) show that moderate resolutions obtained by Voyager 1 were sufficient to show such geological relations clearly.

Global map units

The most widespread terrain unit on the surface of Io is comprised of plains deposits that lie between the volcanic vents. In Fig. 1 these plains are divided into four general categories based on colour data where available (none between 0° and 80° longitude); the colour differences are also shown on the cover. The first plains unit consists of white to bluish-white regions of very bright material which may be surface deposits of SO_2 frost[8-11] or the orthorhombic crystal form of sulphur[12]. The second plains unit includes materials of intermediate albedo that show a variety of red, orange, and yellow hues; various forms of sulphur may be present on the surface in these areas as sublimates or sulphurous alteration[1,12-14]. The third plains unit includes brownish hues (black and brown) that are limited

0028-0836/79/350725—05$01.00