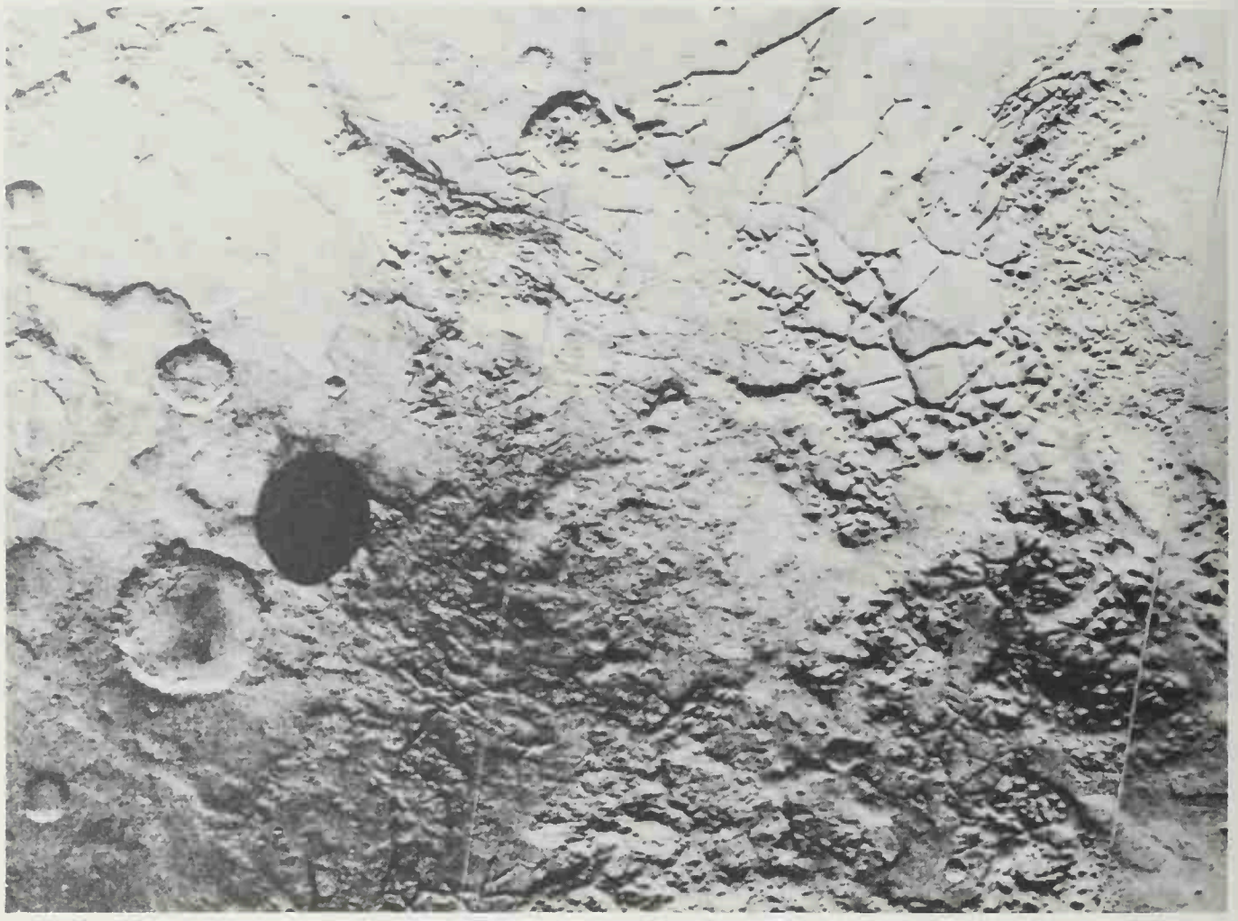

Phobos over the Margaritifer Sinus region of Mars, from Viking Orbiter 1 when about 13 700 km above Mars and 6 700 km from the satellite, which appears dark due to its very low albedo. Chaotic terrain can be seen near the head of Ares Vallis, which is a major channel running into the Chryse Basin.

detected any larger life forms, each Lander carried equipment to perform three types of biological test on soil samples. Basically the experiments were designed to establish whether there was an exchange of gases within the atmosphere and to detect the production of gaseous carbon compounds or complex organic (carbon-based) substances. Some of the results can just possibly be taken to indicate biological activity, but the general opinion is that the observed changes have been caused by unexpected but purely chemical reactions.

Satellites

Prior to the Mariner and Viking Orbiter observations little was known about the satellites of Mars apart from their orbital periods and distances from the planet. Phobos, the larger, orbits the planet in 7·65 hours at a distance of 9 350 km (2·75 Mars radii). Although the orbit is direct, the same as Mars' rotation, the period is so much shorter that it would appear to rise in the west and set in the east. The second moon, Deimos, orbits in 30·3 hours at 23 490 km (6·9 Mars radii) and would appear to take about 60 hours to cross the sky.

The spacecraft pictures show that both satellites are irregular bodies which are shaped like potatoes, with approximate diameters of 27, 21 and 19 km for Phobos and 15, 12 and 11 km for Deimos. Tidal forces acting on these irregular bodies have pulled both satellites into synchronous rotation so that the same faces are always turned towards Mars.

Both objects are seen to be covered in craters, with the largest on each being Stickney (diameter 10 km) on Phobos, and Voltaire (diameter 2 km) on Deimos. The craters show uplifted rims but no ejecta blankets or central peaks, as is to be expected when the very low surface gravity is taken into account. The sharpness of some of the features suggests that both bodies are solid, rather than loose blocks bound together by gravitational forces. Other results indicate that they are covered with rubble generated by meteoric impacts.

A suggestion that they might be formed of basalt has been disproved by tracking of Viking Orbiter 2, which has shown that Phobos has a very low density close to 2 000 kg per m^3. This, together with studies of the spectral characteristics of the surface materials, indicate that the satellites may closely resemble a certain type of meteorite known as a carbonaceous chondrite, which will be discussed later (see p. 150). Indeed, they may well be remnants of the material from which Mars itself was originally formed. Phobos exhibits some remarkable parallel grooves (page 131; top right). These have been shown to be associated with Stickney, suggesting that they are fracture lines produced by the impact which formed the crater. Future investigations may enable some of the outstanding problems about these tiny bodies to be settled, but certainly they show many features which are expected to apply to bodies such as the minor planets.

Jupiter

Ever since Galileo Galilei turned his primitive telescope towards Jupiter in 1609 and noted its four major satellites, the planet has been under constant