# NO. 195 A MODEL OF THE EASTERN PORTION OF SCHRÖTER'S VALLEY

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ABSTRACT

A relief model of the eastern portion of Schröter's Valley has been completed using Lunar Orbiter, Apollo 15, and Earth-based photography. The main results derived from this study are as follows: (1) the head of the Valley (the "Cobra head") is not a simple crater, but rather a slightly-widened section of the Valley emanating from a shield, (2) the east side of the "Cobra head" is a very high peak (2.3 km above the surrounding plains) forming part of a broad shield with an average slope of 12°, and (3) both sides of the Valley display a raised rim in the region measured. These and other observations indicate the Valley was formed by fluid processes, probably lava, and that *the Valley may therefore be a lava drainage channel*, the drained lava presumably underlying the more recent Oceanus Procellarum basalts.

Orbiter V medium- and high-resolution photographs yielded much detail of the Schröter's Valley region of the lunar surface which has made possible the production of a relief model of the entire Valley and its surroundings. This paper describes the first part of a two-part study. The dimensions of the Valley are about half of those of the Grand Canyon in Arizona (3 to 11 km width compared to 6 to 30 km, with the greatest depths 0.8 km compared to 1.6 km, and the total length 160 km compared to 300 or 400 km). Thus, it might be more appropriate to call this Valley a "Canyon". Slopes of the walls often average 30°-40°.

We present results on the eastern half of the Valley based on a carefully composed 3-dimensional scale model. This has been constructed from Orbiter IV and V records and telescopic views (Table I). At a scale of 1:60,000, the model contains information accurate to 100 meters or better (vertically and laterally) for more than 90% of the region modeled. Accuracy was determined by the scale of the model rather than by the resolution of the Orbiter records. Apollo 15 views,

TABLE I

Photographic Records Referred to in Constructing the Model: Indicating the Range of Illuminations Available.

| Designation | Sun Altitude | Sun Azimuth |
|---|---|---|
| Orbiter V M202-206, H202-206 | 14°0 | 5°1 S. of E. |
| Orbiter IV 138 | 4.1 | 1.2 S. of E. |
| " " 144 | 9.6 | 3.7 S. of E. |
| " " 150 | 15.0 | 6.5 S. of E. |
| " " 151 | 15.2 | 6.5 S. of E. |
| " " 157 | 20.6 | 9.4 S. of E. |
| " " 158 | 20.8 | 9.4 S. of E. |
| " " 162 | 26.0 | 12.3 S. of E. |
| " " 169 | 31.4 | 15.6 S. of E. |
| " " 174 | 36.7 | 19.3 S. of E. |
| " " 182 | 41.8 | 23.4 S. of E. |
| " " 188 | 46.7 | 28.2 S. of E. |
| Mt. Wilson 226 | 12.5 | 6.3 S. of W. |
| " " 231 | 1.3 | 1.4 S. of W. |
| Lick 120" | 64.8 | 72.2 S. of W. |
| Catalina 61" 269 | 11.5 | 5.3 S. of E. |
| " " 471 | 4.6 | 3.4 S. of E. |
| " " 1651 | 2.0 | 1.4 S. of E. |
| " " 2391 | 13.1 | 4.8 S. of W. |
| " " 2928 | 18.2 | 7.9 S. of W. |
| " " 3063 | 2.5 | 0.4 S. of E. |
| " " 3105 | 3.4 | 1.4 S. of E. |
| " " 3239 | 25.5 | 12.2 S. of E. |

recently made available, have been studied after the completion of the model to verify and interpret the area. Advantage was taken of the stereoscopic effects from some of the Orbiter and Apollo records. The method described earlier for integrating information from several sources under simulated illuminations was used (Turner 1970).

The model reveals three characteristics not obvious from the study of any one photograph: (1) The "Cobra head", or southern extremity of the Valley, is not a simple crater, although it appears to be in Orbiter V photographs and in the model when photographed under illumination simulating Orbiter V conditions (Figs. 1 & 2). (2) The east side of the "Cobra head" is a very high peak, forming part of a broad shield-like structure, probably the highest point in the Aristarchus uplift (A-A$^1$, Fig. 3). This is supported by Apollo 15 metric camera stereoscopic comparison. These records also show that specific peaks in this structure have a high albedo (Fig. 4). (3) Both sides of the Valley display a raised rim in the region measured (E-E$^1$, F-F$^1$, Figs.3 & 5).

The above characteristics were first noted in the Fall of 1970 and are best illustrated by topographic maps taken from the model (Figs. 6 & 7). The maps reveal that the Valley begins as a depression in the side of the large shield, at least 18 km in diameter (Fig. 8). The "Cobra head" is definitely not a bowl-shaped depression but rather a slightly-widened section of the Valley originating on the side of the shield. Cross sections of the Valley illustrate this well (C-C$^1$, E-E$^1$, F-F$^1$, Fig. 3). The Valley maintains a width of about 5 km throughout its length, although it is slightly expanded at the "head" and narrows somewhat at the "tail" (Fig. 4). Sections taken down the Valley (from the "Cobra head" through the plains), a distance of 45 km, show a continuous decrease in elevation of 2.7 km (D-D$^1$, G-G$^1$, Fig. 3), an average of 6%.

The peak immediately to the east of the head of the Valley is very high. It attains an elevation of 2.3 ± 0.1 km above the lowest spot in the plains 10 km due north at 49°04'30"W/24°42'N. This yields an average slope of over 12° (B-B$^1$, Fig. 3). Slopes reach 32° on the flanks of the shield and 46° at the steepest part of the peak (A-A$^{-1}$, Fig. 3). Although the precise elevations of the peak above Oceanus Procellarum cannot be determined until the last half of the model is completed, it is fairly certain that the peak is about 4.5 km higher than the mare at its intersection with the rille.

The topographic map, cross sections, and relief contour map show that *the Valley has raised rims*, in some places attaining elevations of 400 meters above the surrounding plains (Figs. 5 & 9). These are probably natural levees analogous to those found on terrestrial lava drainage channels. Observations of the meanders in the Valley further west show spurs which are opposite to rounded meander banks (Fig. 4). This type of morphology is not characteristic of faulting. The presence of possible natural levees and spurs indicate that the main Valley was the result of fluid processes. Since the Apollo results indicate the absence of a permafrost layer and rock formation under anhydrous conditions, the fluid was probably lava and the Valley therefore a lava drainage channel (Kovach 1972; Charles, *et al.* 1971).

Lineaments were plotted throughout the region from an Orbiter V photograph (Fig. 1). These were mapped in four general areas (Figs. 10 & 11); (1) The

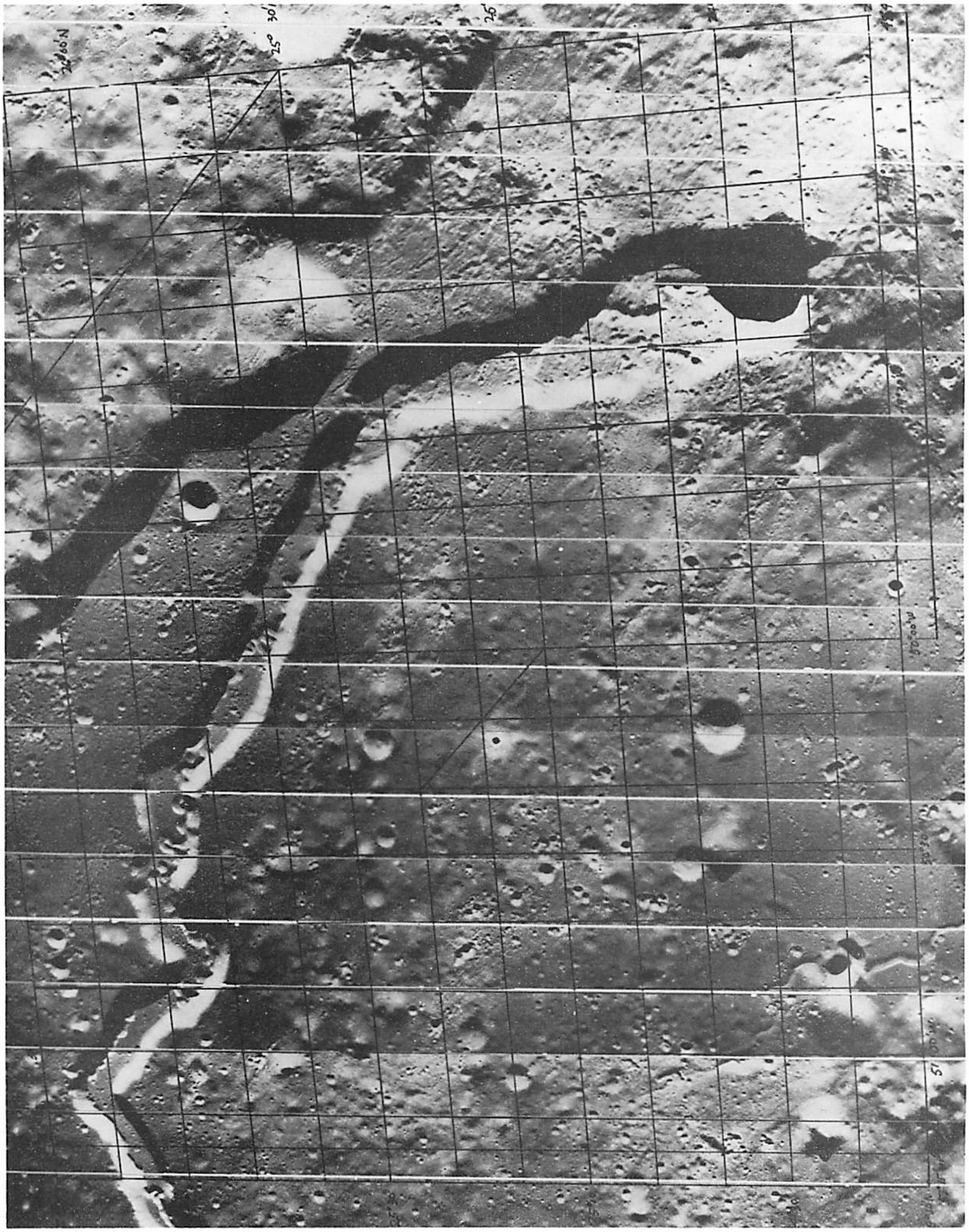

Figure 1 Orbiter V view of eastern portion of Schröter's Valley

(East up)

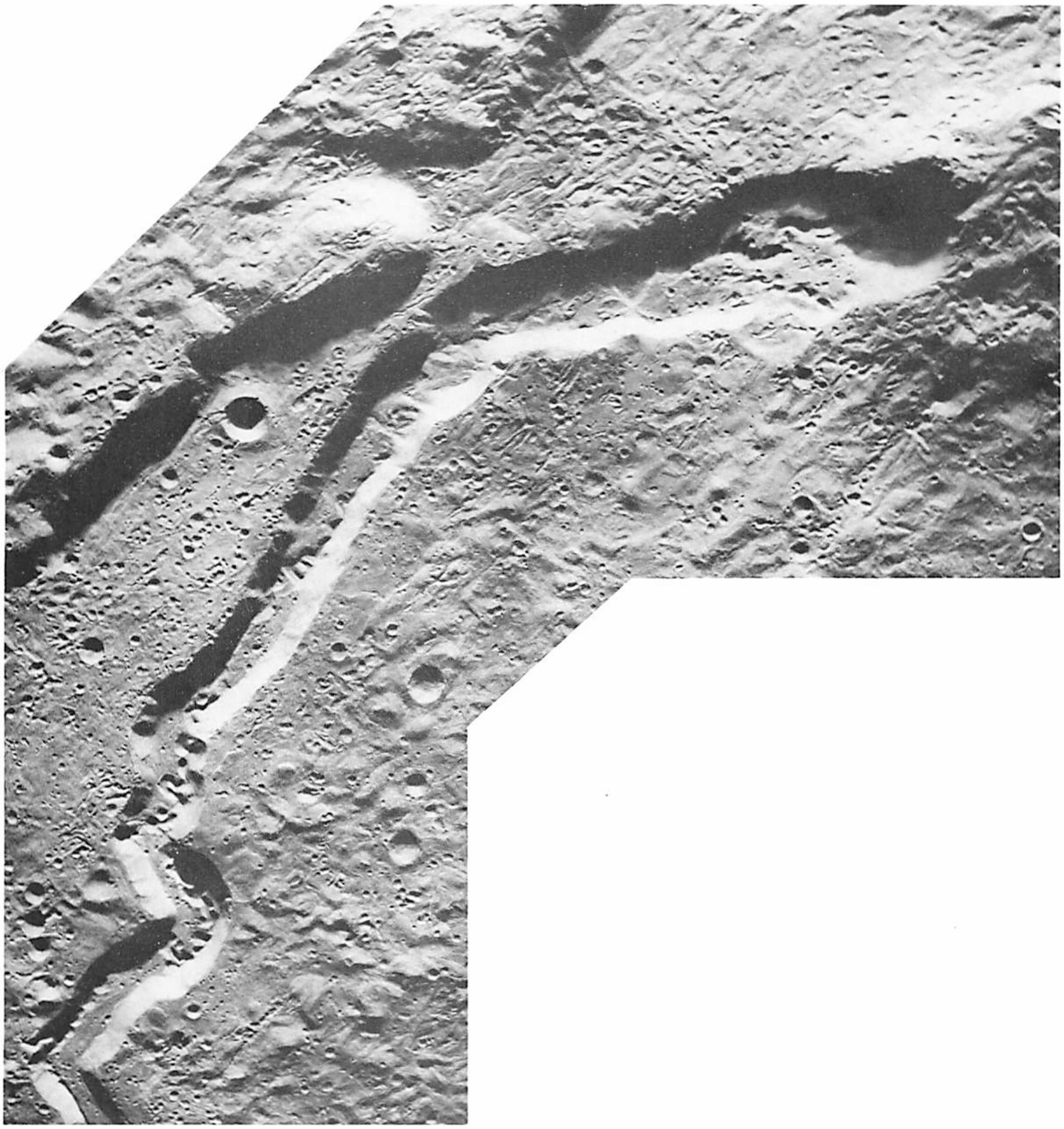

Figure 2 Relief model of the eastern portion of Schröter's Valley
(Orbiter V illumination)

(East up)

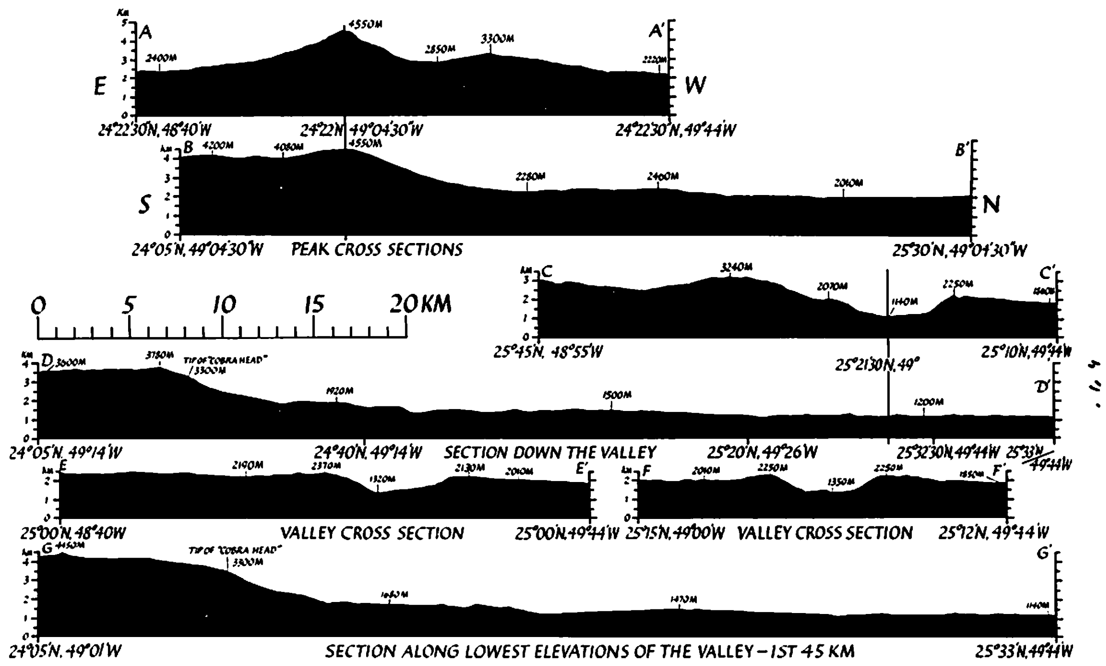

Figure 3 Schröter's Valley "Cobra Head" cross sections

northern highlands; (2) The shield; (3) The plains and SW hills; and (4) the Valley walls and floor. In three areas a strong NW trend is present. This trend to a great extent probably represents strings of secondary impacts from Aristarchus. However, many of the NW trending lineaments are major scarps and ridges which cannot be accounted for by Aristarchus ejecta. Also, the main portion of the NW trend in the shield area is not radial to Aristarchus (see Fig. 11). Therefore, at least part of this trend may be tectonic in origin. A NE trend is present in the northern highlands and shield but not in the other mapped areas. These two major trends are probably related to the global NW and NE lineament systems (Strom 1969). The apparent absence of a NE trend in the plains - and possibly a NW trend if the Aristarchus secondaries are removed - may reflect an age difference between the shield-highlands and the adjacent plains. The plains may represent more recent lava flows which have largely obliterated the lineaments. The linear portions of the Valley wall and floor are more or less randomly distributed which suggests they are not tectonically controlled in the small portion mapped. Detailed mapping of the remainder of the Valley should help clarify this question.

Another characteristic of this area is an apparent difference in surface texture. The Valley floor and a portion of the surrounding plain are generally smoother, more heavily pitted with small craters, and more level than other por-

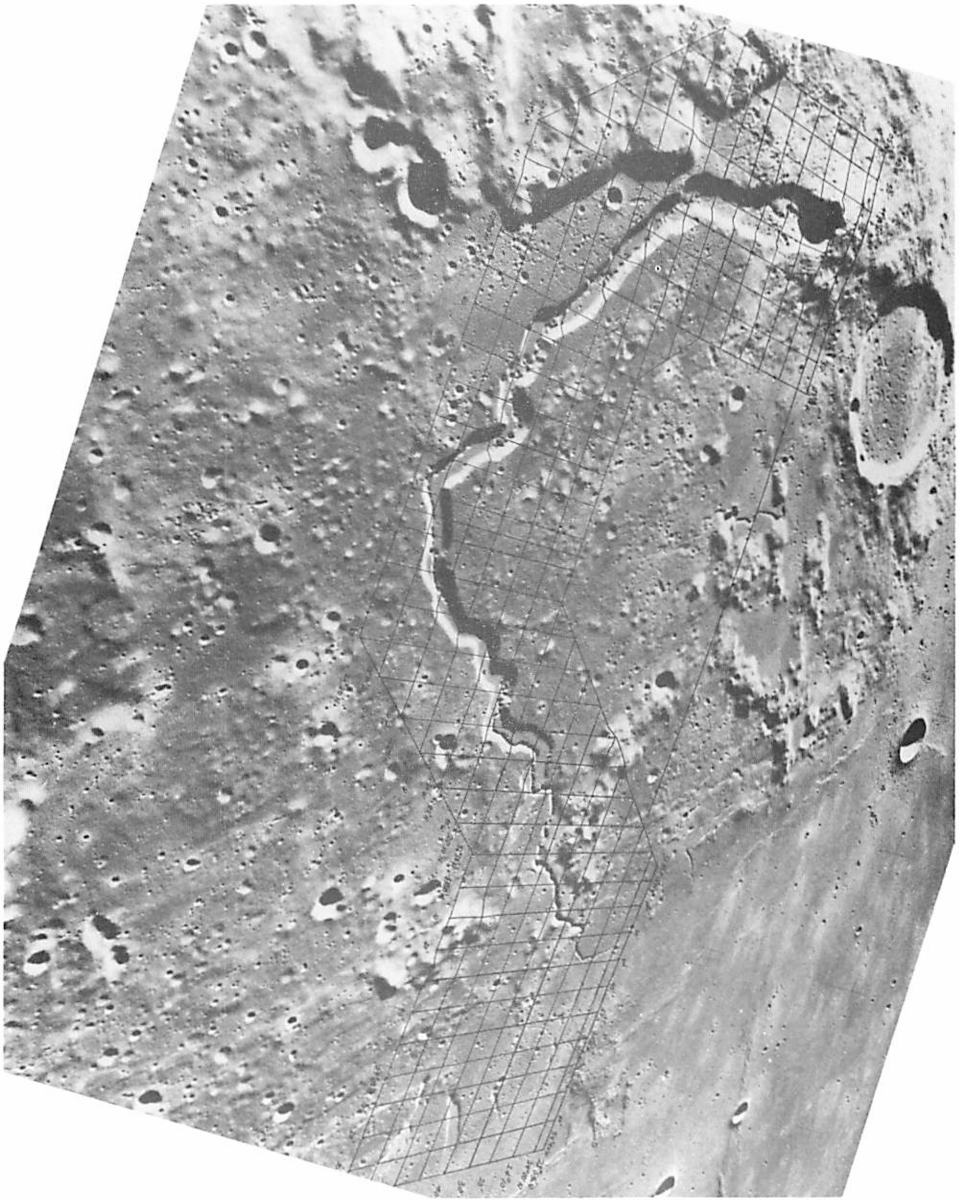

Figure 4 Apollo 15 view of Schröter's Valley - with coordinates

(East up)

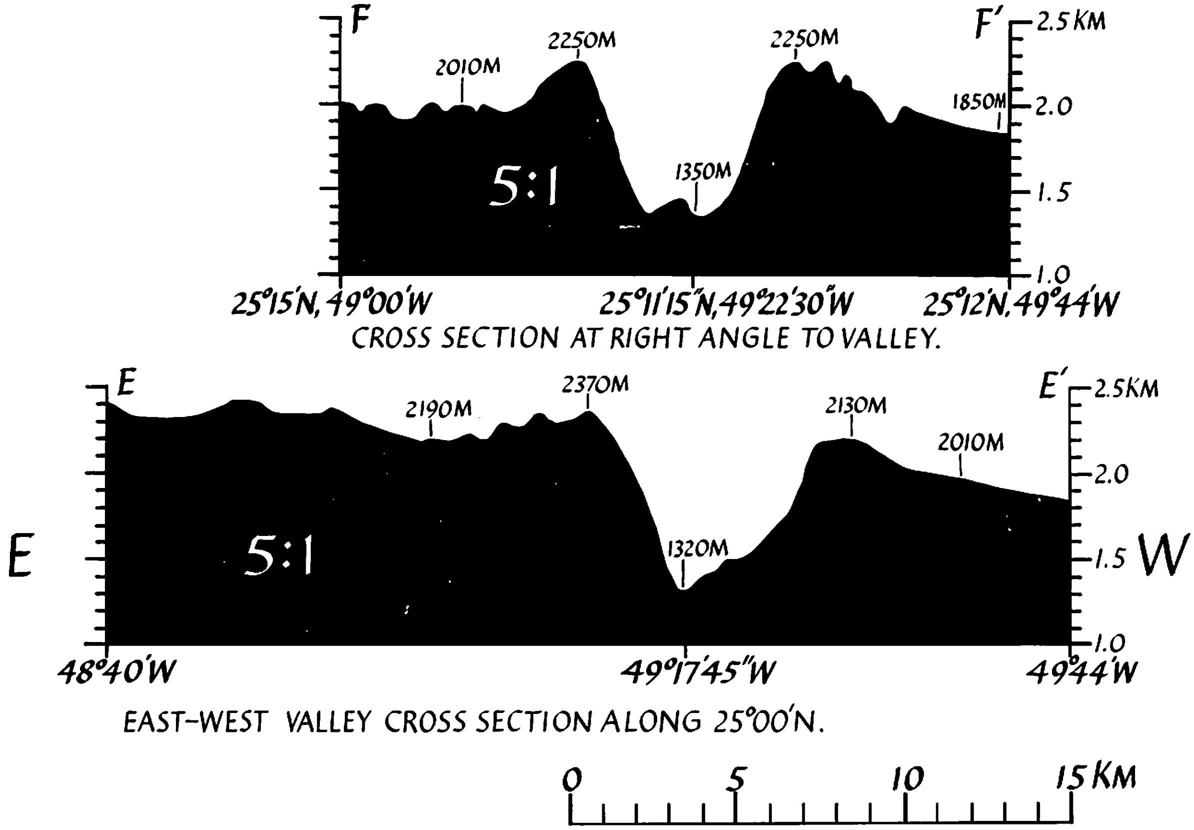


Figure 5 Cross Sections of Schröter's Valley, 5:1 vertical exaggeration

tions of the Aristarchus plateau, i.e. more mare-like in appearance. The rough highlands and the hills protruding above the plains have a powdery, softened character with fewer small, sharp pits. This again suggests that the plains may be mare-type lava flows (Fig. 4).

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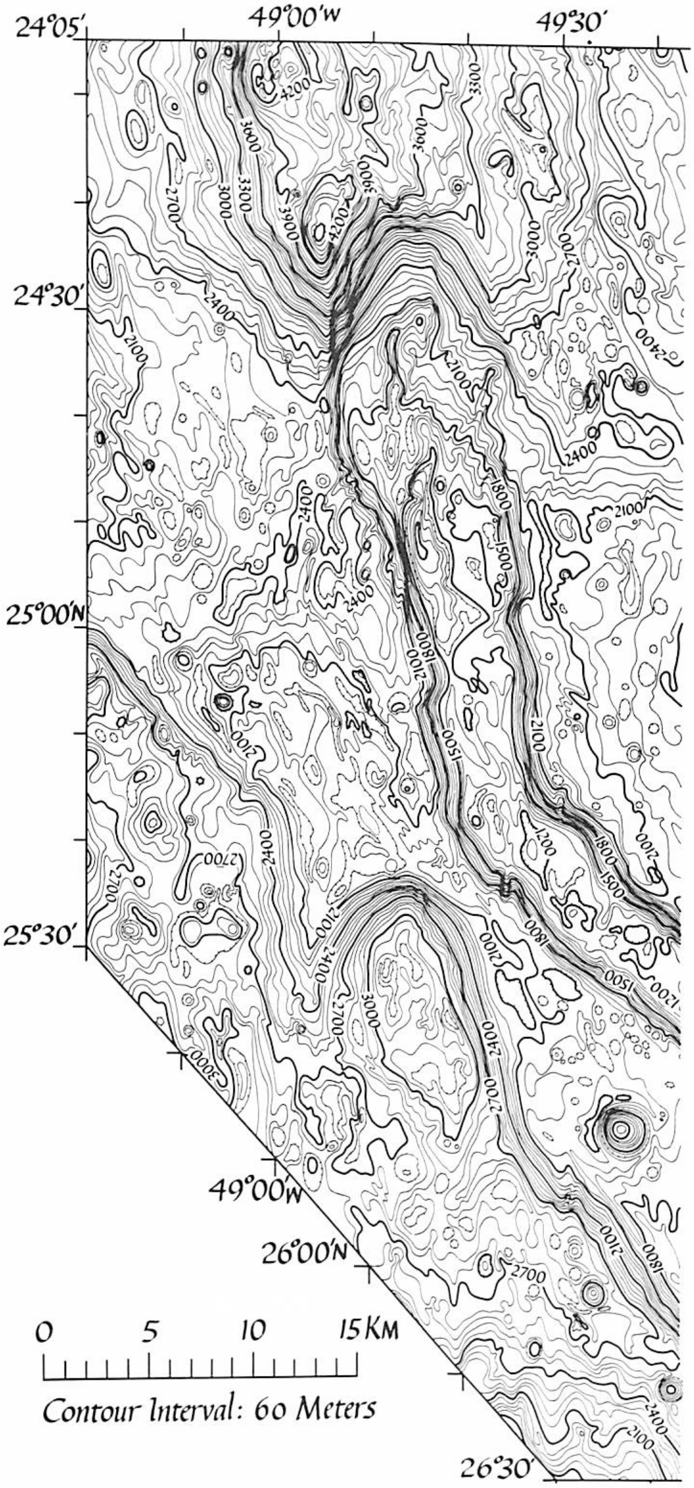


Figure 6 Schröter's Valley contour map made from model

(South up)

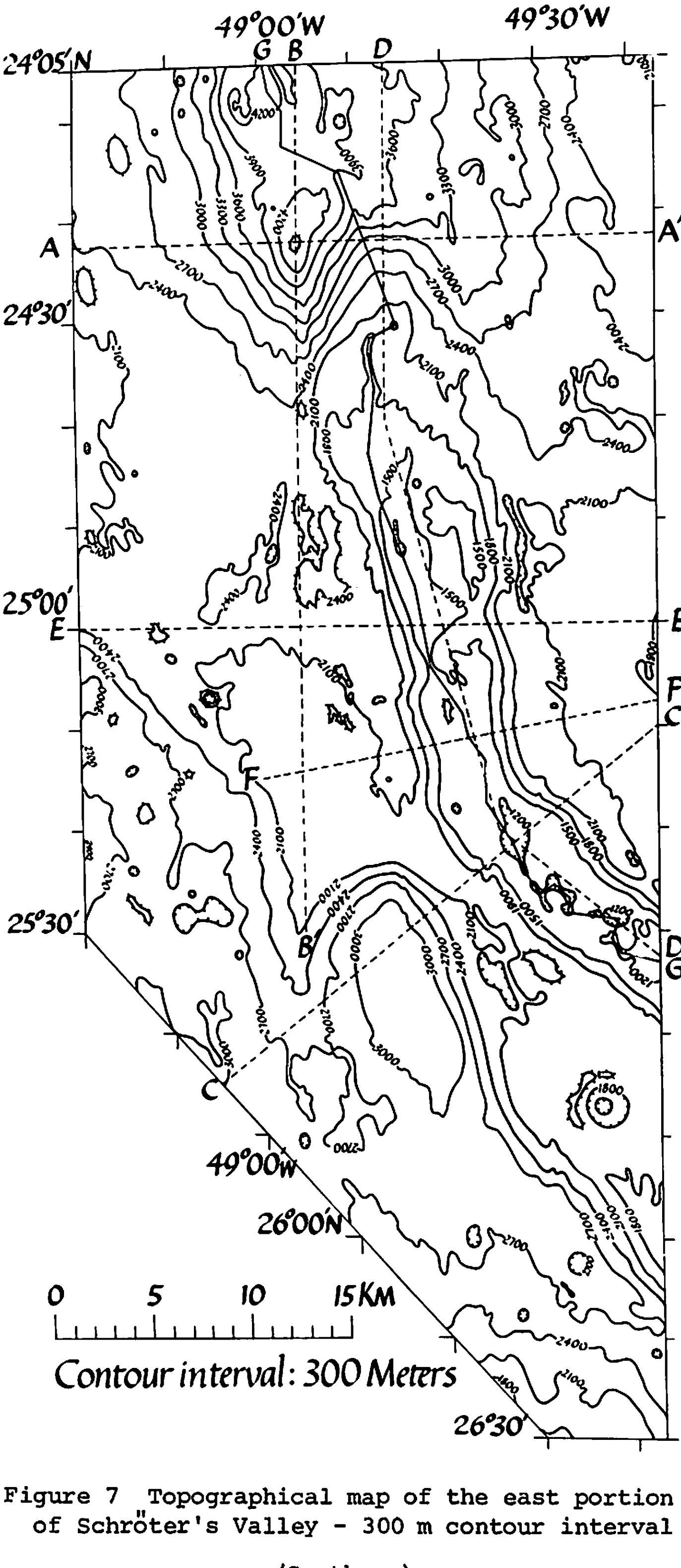


Figure 7 Topographical map of the east portion of Schröter's Valley - 300 m contour interval

(South up)

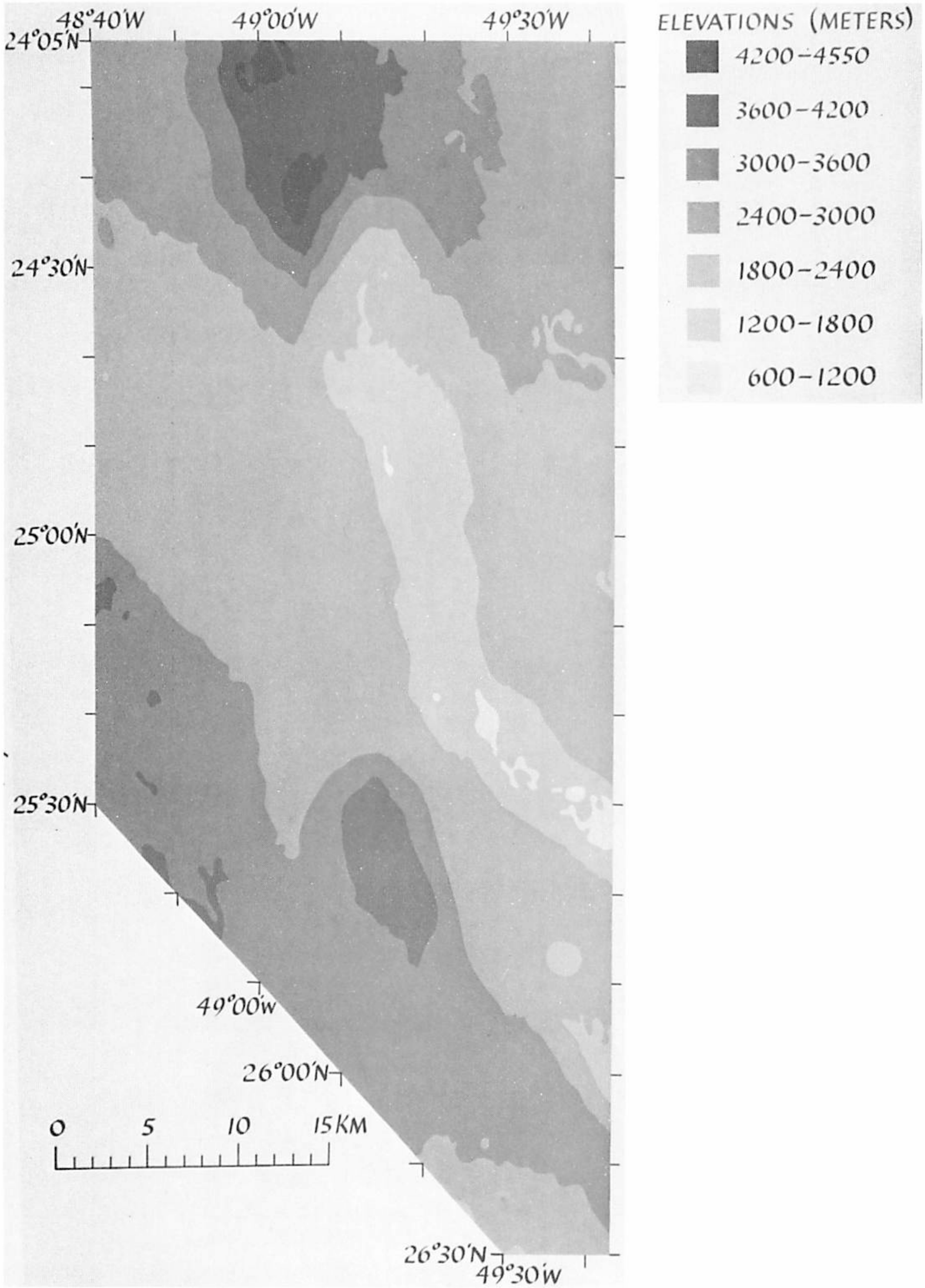


Figure 8 Equal height map of Schröter's Valley from model

(South up)

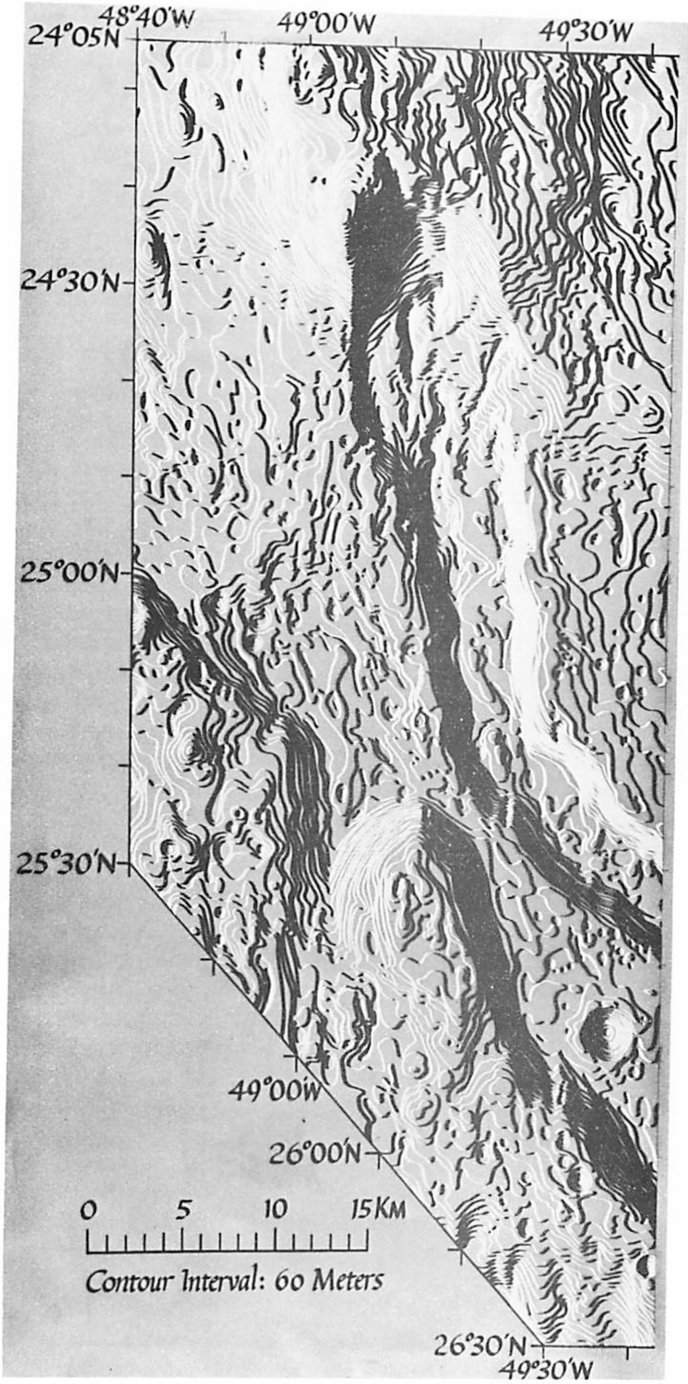


Figure 9 Relief contour map from Schröter's Valley Model I

(South up)

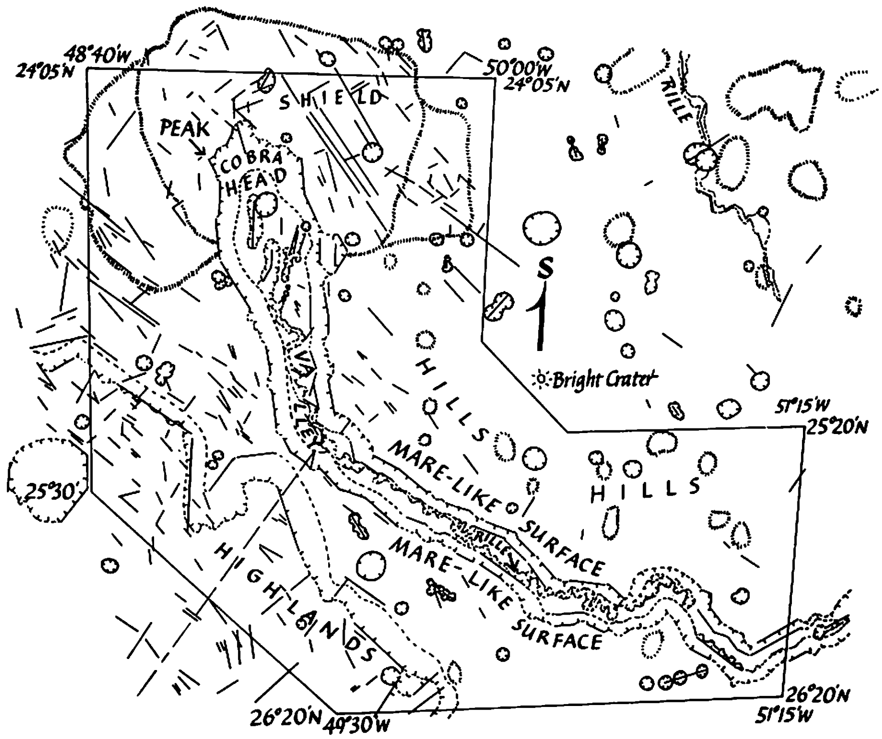


Figure 10 Identification of features and lineaments in the Schröter's Valley area

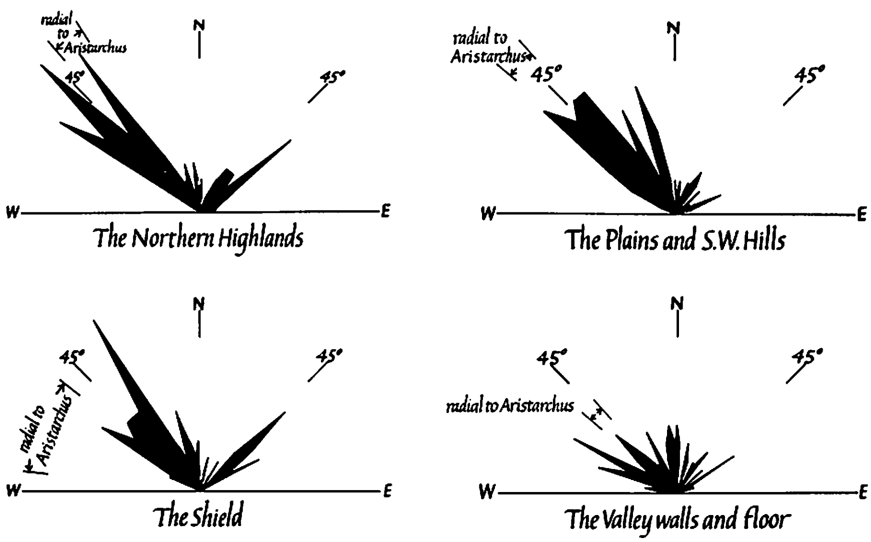


Figure 11 Lineaments in the Schröter's Valley area

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