

MULTI-COLORED LUNAR SURFACE FEATURES DOCUMENTED IN COLOR-BALANCED APOLLO 17 HASSELBLAD ORBITAL PHOTOGRAPHS. Ronald A. Wells¹, and Harrison H. Schmitt²; ¹Tranquillity Enterprises, s.p., 445 Fairway Drive, Abingdon, VA 24211-3634 (ron.wells42@comcast.net); ²Dept. of Engineering Physics, Univ. of Wisconsin-Madison, P.O. Box 90730, Albuquerque, NM 87199-0730, (hhschmitt@earthlink.net).

Introduction: We have discussed elsewhere the true colors and nature of the green and orange volcanic ashes documented in the Apollos 15 and 17 prime Ektachrome SO-368 films [1, 2]. These developed color reversal films were never adequately processed to yield photographic prints or much later digital scans of the true colors of the orange soil observed at Shorty Crater by Astronauts Schmitt and Cernan (Apollo 17) and the green soil at Spur Crater by Astronauts Scott and Irwin (Apollo 15).

Fig. 1 shows the digital scan of AS17-137-20990 as it was originally produced at JSC in Houston [3].

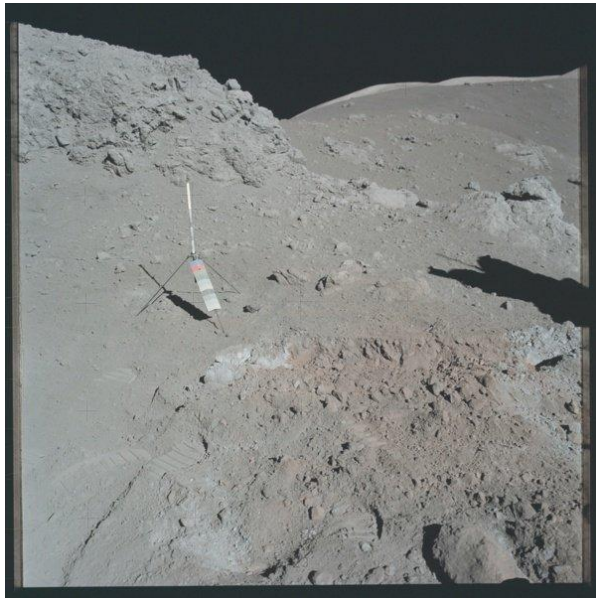


Fig. 1. The JSC digital scan of the prime SO-368 film available for downloading from [3]. (NASA photo).

A similar view of the trench dug through the orange soil by Schmitt appeared on the cover of [4]. However, Schmitt has maintained for decades that these views were inconsistent with his *in situ* observations.

Utilizing the software programs Adobe Lightroom and Corel Photo-Paint, the color contrasts in the image can be balanced, then split into 3 color channels, red, orange, and yellow. Each channel is fully saturated, and then the saturation is decreased by varying amounts; the channels re-assembled; and the combination inspected by Schmitt until a stage is reached that agreed with his observations. After 8 iterations, Schmitt was satisfied that his observations had been reproduced. The result is shown in **Fig. 2**.

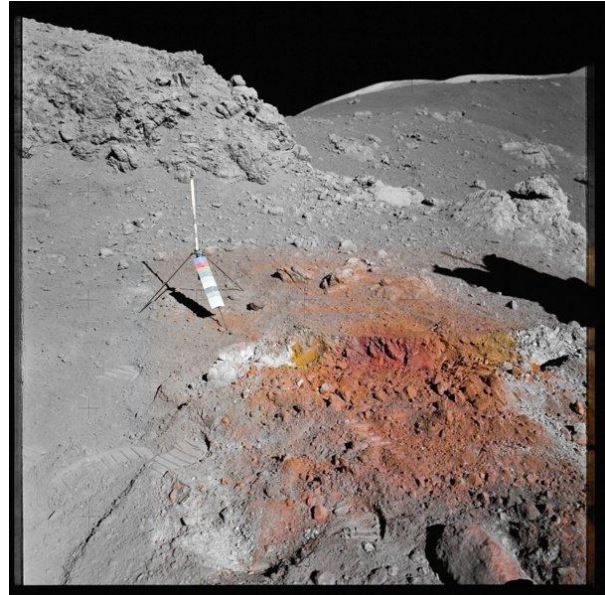


Fig. 2. The color-balanced version of **Fig. 1** showing a red central trench with yellow walls on either side, transitioning to a light grey sediment at the ends. (Copyright © by Tranquillity Enterprises, s.p.)

Green soil was also documented at Spur Crater in 4 photos of a returned rock sample. **Fig. 3** is the result of color-balancing one of the four, AS15-86-11666.

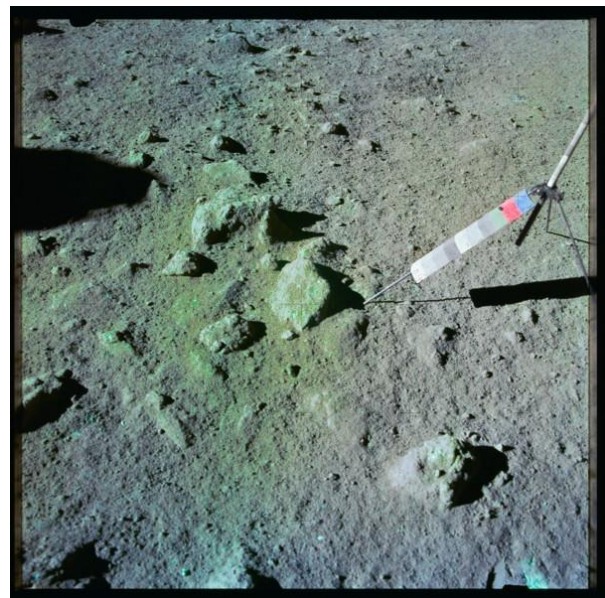


Fig. 3. The green volcanic ash near rock sample 15426 (Copyright © by Tranquillity Enterprises, s.p.).

Photomicrographs of the soil samples, of course, showed orange, reddish, and yellow glass beads in the one case, and green glass beads in the other.

Apollo 17 Orbital Observations: During the final 2 days of the mission, Schmitt made photos and observations of colors in other areas of the Moon [5]. **Fig. 4**



Fig. 4. Dike-intruded crater bounded by orange-red volcanic ash. Note small red craters in the black ejecta flow. (Copyright © by Tranquillity Enterprises, s.p.).

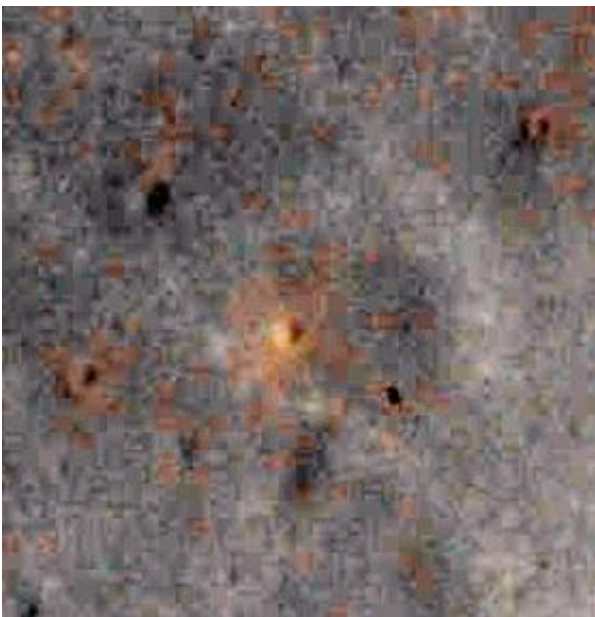


Fig. 5. Nearby craters with discernible orange ejecta blankets are surrounded by smaller orangish craters. (Copyright © by Tranquillity Enterprises, s.p.).

shows a remarkable crater near Sulpicius Gallus with an exposed intruded dike in the wall bounded by red

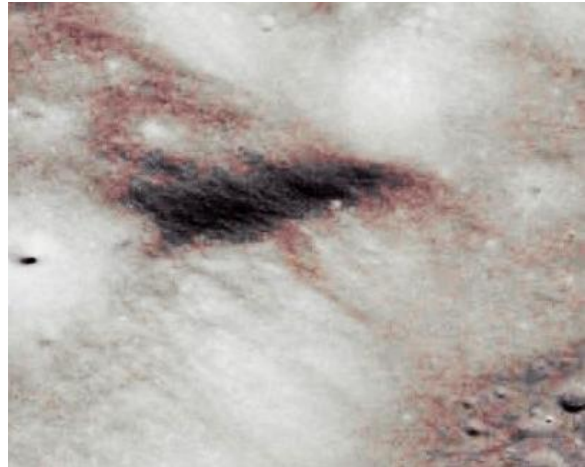


Fig. 6. A black volcanic ash depression in the Haemus Mts., into and across which red ash is seen flowing in channels to spill over the edge down the slopes to the mare below. (Copyright © by Tranquillity Enterprises, s.p.).

streaks. Several small craters scattered through the black ash tongue from the crater have red aureoles.

Fig. 5 shows a number of small craters with orange blankets. Further west, the Haemus Mts. are covered with many red and black ash deposits. A particularly intriguing example is shown in **Fig. 6**. (**Figs. 4,5** derivative crops from NASA photo AS17-149-22881; **Fig. 6** derivative crop from NASA photo AS17-153-23571).

Conclusions: The Apollo 17 color-balanced orbital images indicate that the conclusions of Schmitt [6] that the dynamics of pyroclastic eruptions produced color variations in various chemically identical ash deposits sampled at Shorty Crater can be extended to the Sulpicius Gallus region. As at Shorty Crater, these eruptions may be separated by tens of millions of years. Unlike at Taurus-Littrow, however, the stratigraphic overlay of black ash on red/orange ash, as shown by the red/orange ejecta around impact craters that penetrate black ash deposits, indicate that the more volatile-rich, explosive and more rapidly cooled eruptions were early in the Sulpicius Gallus eruption cycle rather than late as in the Shorty Crater deposit.

References: [1] Wells, R. A. and Schmitt, H. H., *GSA 2018 Annual Meeting*, paper 166-11 (317759); Schmitt, H. H., *GSA 2018 Annual Meeting*, paper 166-12 (319860).; [2] Schmitt, H. H., *Apollo 17: Diary of the 12th Man*, Chapter 11, "It's Orange!", <https://www.americasuncommonsense.com/>; [3] Teague, K. *Project Apollo Archive*, <https://www.flickr.com/photos/projectapolloarchive/albums>. [4] *Apollo 17 Preliminary Science Report* (NASA SP-330, 1973), also Fig. 4.34, p. 4-18. [5] Schmitt, H. H. *Geology*, 2: 55-6 (1974). [6] Schmitt, H. H. *LPSC 48 #2732* (2017).