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No Transform Faults on the Moon

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Abstract. Our studies on cca 3000 Lunar Orbiter photographs which cover 95% of the Lunar surface, resulted in the conclusion that there exist no transform faults on the Moon. According to the primordial surface of the Moon, it is very probable, that there have never been transform faults as the San Andreas fault or other comparable horizontal slidings on the Earth. Those lunar phenomena observed, – appearing as horizontal sliding, – have been resulted by strain release.

Key words: Lunar Tectonism – Transform Faults – Lineaments – Bysplitting.

The plate tectonic theory deduces the mega-tectonical processes of the Earth from the horizontal shifts of the lithospheric plates which appear often as transform or transcurrent faults (see e.g. Dewey *et al.*, 1973).

We have examined about 3000 photographs of Lunar Orbiters in order to demonstrate transform faults by horizontal shifts. The pictures cover about 95 percent of the surface of the Moon (Anderson and Miller, 1971). Fig. 1. illustrates the method of our examination. Some linear lunar features (wrinkle ridge, graben, fissure, rille) will be interrupted and moved away if at least one part of the underlying crust is affected by horizontal sliding.

It may be expected that the lunar surface preserves intensely the shifted pieces of the lineaments because of the lacking of the essential erosional and depositing processes.

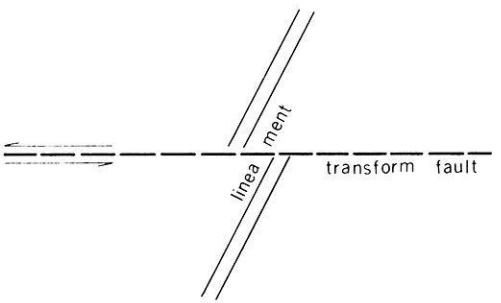

Fig. 1. The transform fault pulls apart a lineament (graben, wrinkle ridge, ray, rille)

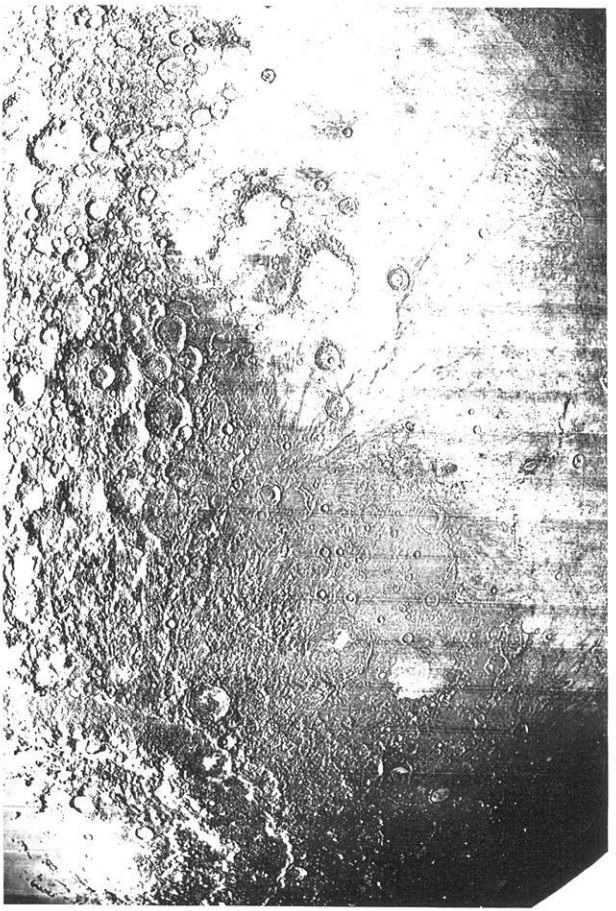

Fig. 2. The western hemisphere of the Moon taken by Lunar Orbiter 4. (MR 182). In the left lower corner is the Orientale Basin. The rays of the fresh crater Byrgius cross the picture

Perhaps the ray system of the large craters are the youngest representatives among the linear formations, which are about some 100 million years old. The fractures due to the cooling of the basalt flows on the maria are $3—4.10^9$ years old. The radial and concentric fault and fracture systems of the multi-ringed basins are the oldest (Abelson, 1970; Hartmann, 1970; Hinners, 1971; Kopal, 1969; Van Doorn, 1969). Therefore concerning the lunar transform phenomena, the method above mentioned makes it possible to glance back for a long time interval.

The conclusion of our examination is negative. By the use of the method described it was not possible to demonstrate any formation which

Fig. 3. A lunar panorama with straight wrinkle ridges on the eastern region of Mare Serenitatis taken by Lunar Orbiter 3. (MR 161).

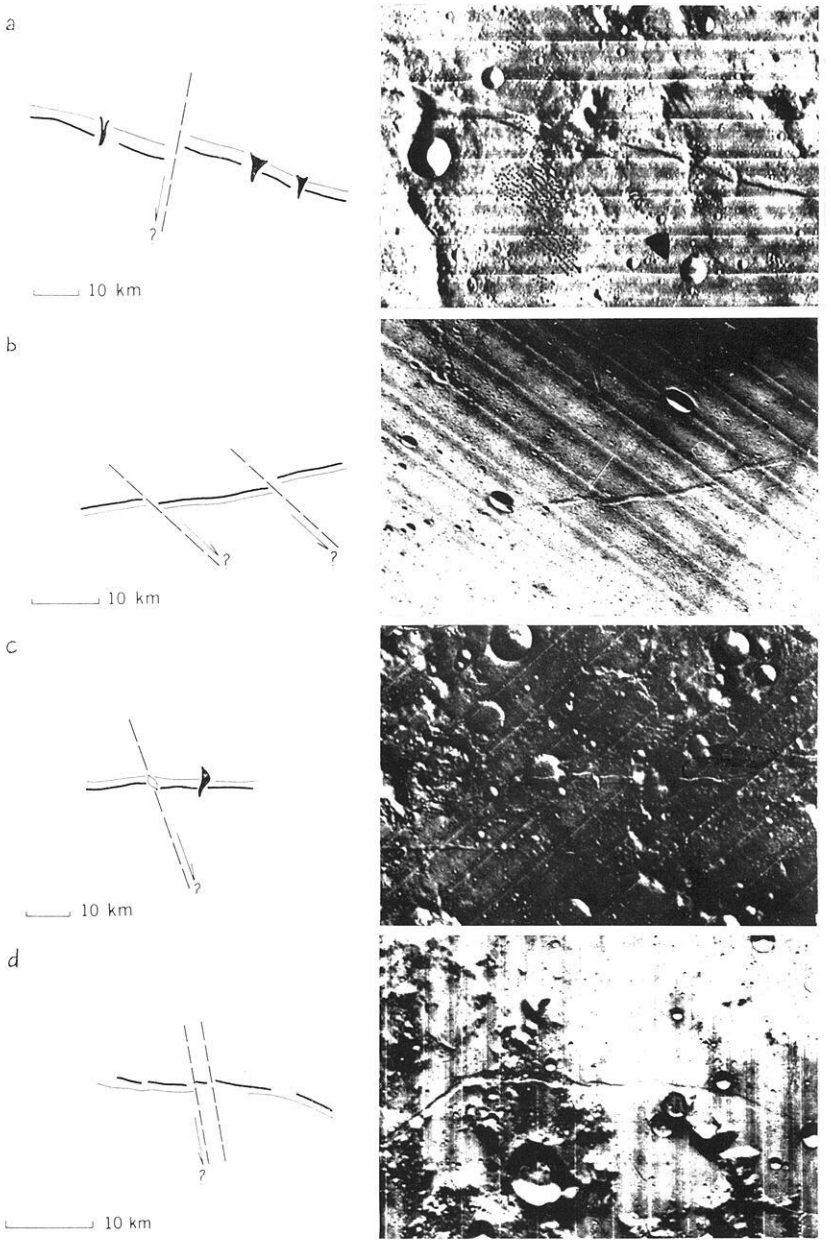

Fig. 4a–d. The observed "transform"-like features on the Moon. The estimated "transform"-movings in kms are assigned in the bracketts. The breaking of the linear structures is shaped as more as possible not by horizontal sliding but these features have taken shape originally in broken form. a The Rima Ariadaeus, LO IV. HR. 90 (4 km). b A fissure running towards the western coast of Mare Fecunditatis, LO V. MR 42 (1.5 km). c A rille crossing Capella M, NE of crater Capella, LO IV. HR. 72 (1 km). d A fission in the Lacus Somniorum, NE of Posidonius, LO IV. HR 79 (1 km)

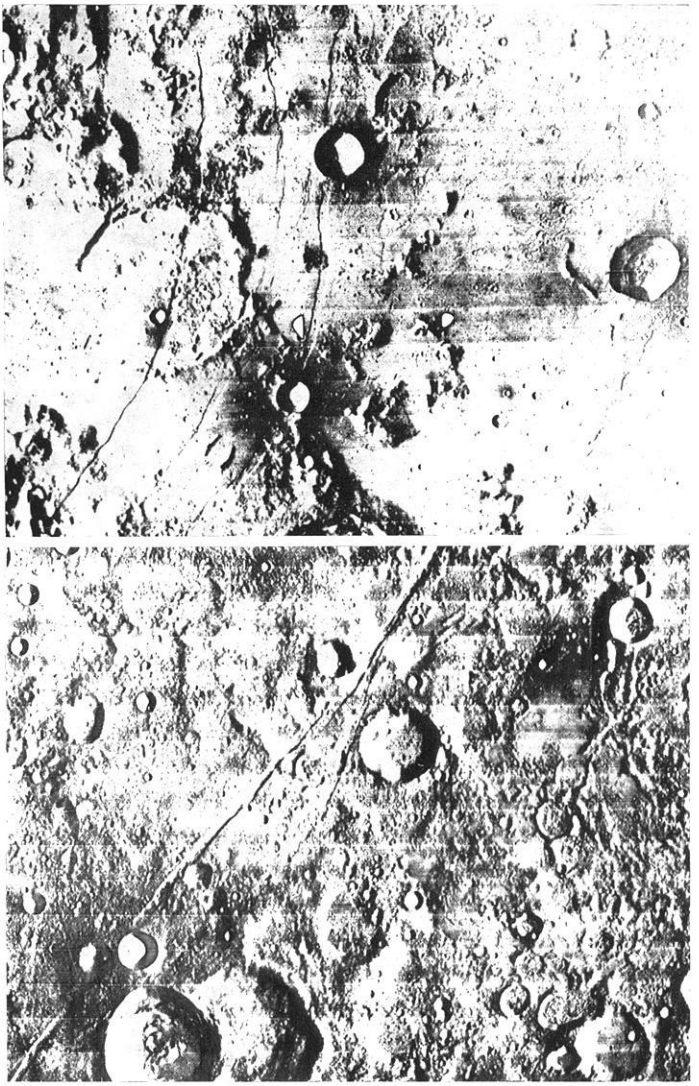

Fig. 5. Bysplitting of a) Campanus-Hippalus system concentric with the Humorum Basin and b) Sirsalis fissures

were unambiguously altered by transform faults. The sometimes beyond thousand kilometers extended straight rays of some fresh craters (Fig. 2) and the same long straight or arced wrinkle ridges (Fig. 3) support the possibility of our suggestion, that the Moon was not effected by as great transform phenomena as the San Andreas fault on the Earth demonstrates.

The linear features shown on Fig. 4. are those which might be affected by transform overburden. There we have indicated the characteristics and scale of the supposed displacements. We have found all these, and although these forms are suggested to be transforms, their origin can be explained without assuming horizontal crust sliding but by the help of other observable lunar features. That is these linear elements probably have been formed thus broken as the result of the play of inner forces not yet known exactly.

The formations of Fig. 4 can be explained most simply by the rima-bysplitting which is a very frequent phenomenon on the Moon. They might have developed in the following way: the fissions which resulted by the strain release started at two different points and instead of joining they passed by one another and extinguished (Fig. 5a, 5b). Hidden obstacles under the surface also might cause bysplitting. Later the regolith has obliterated these deceased ends by one another and therefore the bysplitting is inivisble on many places like on our four examples. The Fig. 4b shows our only observation where not only one breaking occured but where an about 20 kms long section of a fissure has been moved away almost perpendicularly to the line of the fission.

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