INVERTED CHANNELS ON EARTH ANALOGS FOR INVERTED TOPOGRAPHY ON MARS. Abdallah S. Zaki, Department of Geography, Ain Shams University, Abbasseya, Postal Code 11566, Cairo, Egypt.(abdallah.sami@art.asu.edu.eg)

Introduction: The evolution of inverted topography on Earth and Mars relies on several mechanisms, including surface armoring, eskers, lava flows, and cementation of valley floor via subsurface minerals which percolate to surface (for example, calcium carbonate, gypcrete, ferricrete, calcrete). Inverted wadis have been identified in a number of localities on Earth, including multiple localities in Sahara and Arabia, Australia, the Ebro Basin of Spain, Utah, and New Mexico and west Texas (e.g., Miller, 1937; Maizels, 1987; 1990; Zaki, 2014), inversion of relief also has been observed in a number of locations on Mars, for example, Eberswalde Crater, Arabia Terra, Juventae Chasma, Olympus Mons, and Antoniadi Crater,(e.g., Pain et al., 2007; Williams et al., 2007).

Examples: Image 1 shows an inverted dendritic pattern which covers an area of about 20,000 square kilometers in Nejd, eastern Saudi Arabia. Complex processes of erosion which led to development of inverted topography in this range, with a cementation of valley floor via several minerals. The exhumed ridges in this image extend to 8 km in length, stand approximately 21 m in height, and widths extend to 210 m. Cross section profiles range from trapezoidal to convex, have steep side slopes between 8° to 26°.

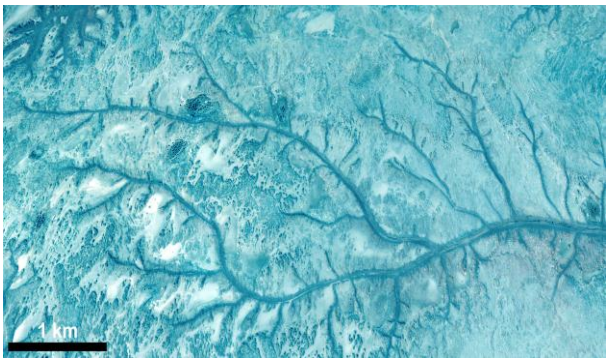

Image 1: Space image for dendritic pattern preserved as inverted wadis in eastern Saudi Arabia.

Inverted wadis in SE Egypt take the pattern of rectangular (Image 2), with an average length extending for about 10 km, maximum width not exceed 300 m, and height of as much as 20 m. Inverted wadis in study area developed via cementation of minerals and surface armouring which detected in a few spots. Giegengack (1968) indicated that the minerals, which led to the cementation of inverted wadis, are calcium carbonate, hematite, silicon dioxide, and iron oxide, he also pointed out, grain size ranges from boulder 1 meter in diameter to fine sand in some examples.

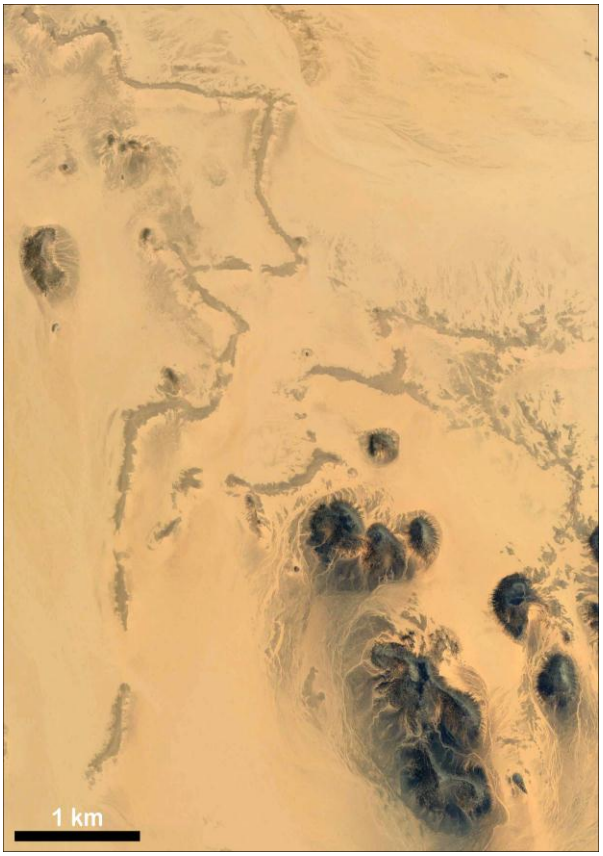

Image 2: Space image for rectangular pattern of inverted wadis in SE Egypt.

The Martian surface has distinctive alluvial fans, one of them has been observed via HIRISE imagery on the floor of a large, 60 km (38 mi) diameter equatorial crater (Image 3, 23.4° S 74.3° E). This one is very similar to textbook examples, as there are well-delineated ridges that appear so obvious on the crater floor. These ridges become inverted because they are more resistant to complex processes of erosion. These processes might be; the floor of a channel cemented via minerals during percolating or filled by lava.

Another example of inverted channels has been identified in Anotoniadi Crater (Image 4, 21.5° N 61.1° E). There are short dendritic tributaries that connect southward to a large trunk. This zone had a lake that dried. These dendritic features would be several kilometers in size.

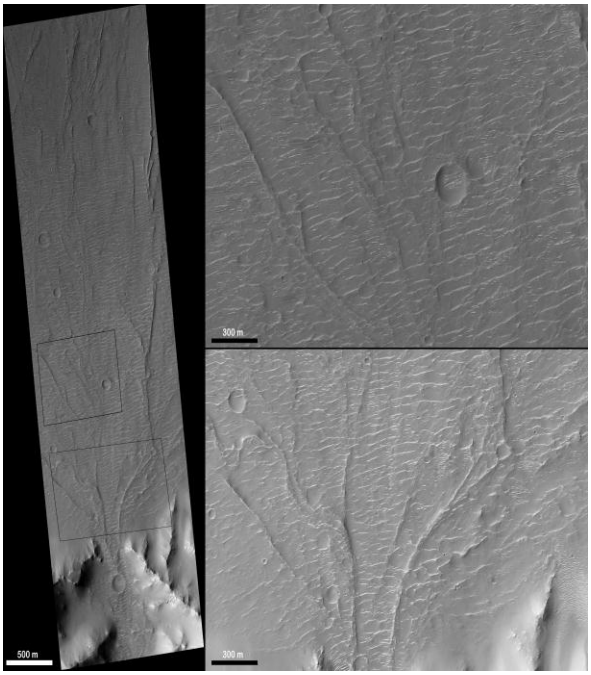

Image 3: An alluvial fan in a low-latitude crater preserved as inverted channels (23.4° S 74.3° E). HIRISE Image ESP_028799_1565.

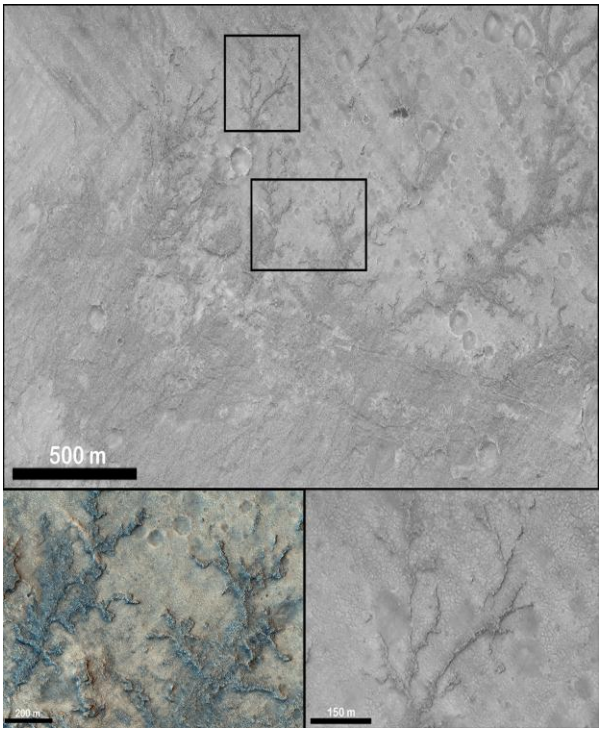

Image 4: Inverted dendritic channels in Antoniadi Crater (21.5° N 61.1° E). HIRISE Image PSP_007095_2020.

Summary: Overall, study of terrestrial analogs is very important to understand more about a range of fluvial environments which preserved as inverted topography on Martian surface, the nature of minerals which led to the development of inverted topography, geomorphic features for this landform, and inversion of relief sites as candidate landing sites for future missions.

References: [1] Miller, R. P. (1937) *Journal of Geology*, **45**, 432-438. [2] Maizels, J. (1987) *British Geological Society, Special Publication*, **35**, 31-50. [3] Maizels, J. (1990) *Palaeogeography, Palaeoclimatology, Palaeoecology*, **76**, 241-277. [4] Pain, C. F., J. D. A. Clarke, and M. Thomas. (2007) *Icarus*, **190**, 478-491. [5] Williams, R. M. E., Chidsey, T. C., and D. E. Eby. (2007) Central Utah-Diverse Geology of a Dynamic Landscape. Utah Geological Association, Salt Lake City, Publication, 36, 221-235. [6] Zaki, A. B. (2014) Eight International Conference on Mars, abstract # **1084**.