SWATH PROFILE ANALYSIS TO UNDERSTAND MARTIAN FLUVIAL VALLEYS' MORPHOLOGY.

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Introduction: Various methods were applied for ancient Martian fluvial systems to reconstruct their parameters and estimate the discharge and total liquid volume that has flown inside them. A poorly exploited method is the usage of swath profiles: a horizontally extended version of simple line profiles in order to avoid arbitrariness of sampling and local irregularities especially for old, eroded topography [1], despite swath profiles have been wideliy used on the Earth in tectonic geomorphology [2] glacial erosion ([3], etc.). It is an excellent tool not only for determinging a physical landform, but to deduce contributing processes (eg. changes in erosion rate, climate, etc.).

Methods: Swath profile plugins and add-ons are available for several softwares (ArcSwath for ArcGIS 10.2, Swath Profile plugin of QGIS, etc.). In this study, the method of Telbisz-Kovács-Székely [4] was used. The swath was deliminated in ArcGis 10.1 with the definition of a baseline (longer edge of the rectangle swath) and the x,y coordinates and z-levels were exported to a dbf file. Using the swath calculating macro of Telbisz-Kovács-Székely [4] the distance from baseline is calculated for each points. Then they were binned into strips according to their baseline distance and statistical parameters were calculated for categories, also plotting the result on diagrams [1].

Results: The target was a valley at 2°55'S 111°53'E we called Tinto-B based on the nearby Titno Vallis. Nine swaths were obtained on the 50 km long section of Tinto 'B' with a width of 1 km. The extracted points were binned into 10 strips (100 meters distance/class). The sites were chosen based on possibly interesting landforms of the ancient river morphology.

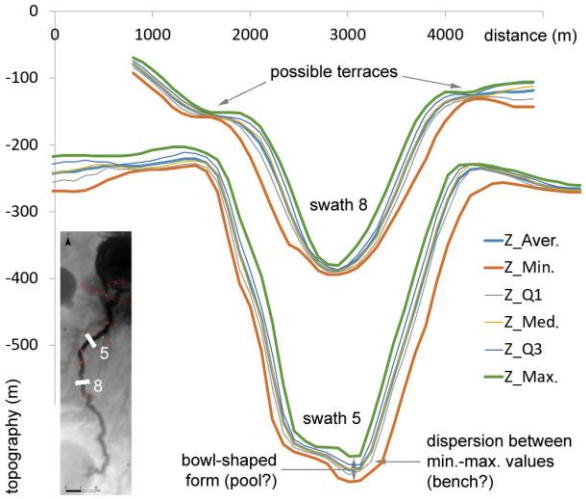

Figure 1. Two swatch profiles and their locations

On Fig. 1 two swaths are presented from the upper, erosive section of the ancient valley. The characteristic, V-shaped valleys were probably tectonically anticipated by faults based on the DTM as long, straight valley-sections are observable, with more trenchant changes in directions at the curves than in simple meanders.

On swath 8, flatter sections on each slopes (at -150 m W and -120 m) could be possible river terraces by change in the erosive capability but also could be produced by "canyon-like" lithological differences. On swath 5, the dispersion between statistical parameters point to the riverbed morphology. The min. values at 3 km shows a bowl-shaped part of the riverbed that is 20-40 meters deeper than the average or max. points. This difference may be related to a rupture at the riverbed that could lead to the formation of a waterfall. The pouring water might eroded a pool that could be obsereved as the bowl-shaped form on the swath profile.

Discussion: V-shaped valleys on the cross sections (swaths) of the presumed river valleys are good indicators of fluvial erosion, based on the similar patterns on Earth. Bowl or U-shaped patterns should allude to other landforms or origin as well (e.g. crater or simple denudation valleys). Therefore the phenomena of the swaths should be also examined in the broader framework of the valleys and surrounding areas, using the bird's eye view aspect of DTMs.

Conslusion: Swath profiles are useful tools to detect possible landforms of river morphology in Martian valleys, comparing with analogies on the Earth (comparative planetology). In case of less clearly traceable, supplementary valley-like landforms, the origins should be distinguished from other features visible on maps [5] (e.g. craters) using swaths and DTM together.

In our study the sites were picked deliberately at characteristic changes of z-levels and the morphology on the DTM. For further analysises, a whole valley should be evenly sampled as well, using a curvilinear swath profile [1]. Furthermore, circular swath profiles could be applicable for circular or semi-circular landforms on the Mars (e.g. craters, plateras) to gather statistical parameters about changes in morphology.

References:: [1] Telbisz et al (2013) *Zeitschrift für Geomorphologie* **57**, 485-487. [2] Fielding et al (1994) *Geology* **22,** 163–167. [3] Van der Beek, P. & Bourbon, P. (2008) *Geomorphology* **97:** 52–72. [4] Telbisz et al. (2012) *Földtani Közlöny* **142**/2, 193–200. [5] Hargitai H. 2006. *Cartographica* **41**, 149-167.