WHERE DO TERRESTRIAL POLYGONS OF ADVENTDALEN (SVALBARD) STAND IN RELATION TO QUANTITATIVELY CHARACTERIZED MARTIAN NETWORKS? L. Bandeira[1], J. Saraiva[1,2], P. Pina[1], [1]CERENA/IST, Lisboa, Portugal (lpcbandeira@ist.utl.pt), [2]UNIS, Svalbard, Norway.

Introduction: The comparison of Martian polygonal networks with terrestrial analogues has been, and still is, often performed on a qualitative analysis basis, normally based on the diameter of the polygons [1-3]. Extensive quantitative analysis of this kind of Martian patterned ground based on geometric and topological features [4-6] and comparison with terrestrial analogues through a spatial point pattern analysis [7-9] are much more promising as they permit to make objective comparisons between networks in order to better understand the origin and the processes involved in their evolution. We present some results to verify where a terrestrial analogue network of Adventdalen, Svalbard (Norway) [10,11] stands in relation to quantitively characterized polygonal networks on Mars [4-5].

Adventdalen network characterization: A field survey was conducted in June 2010 in a selected region of about 0.65 km^2 in the valley of Adventdalen to gather accurate data on the geometry and topology of the polygons, among other characteristics [12,13]. Two recent sets of aerial imagery with very high spatial resolution of the test site were also available: one with a spatial resolution of about 20 cm/pixel in true-colour and near-infrared modes acquired by the Norsk Polarinstitutt, and the other with 4-6 cm/pixel in spatial resolution in true-colour mode photos captured by Kolibri GeoServices.

From the processing of the remotely sensed images, validated with the ground-truth constructed during the field campaign [13], we were able to delineate the contours of the polygons in the study area (Figure 1). Some of the edges of the polygons on the border of the network (indicated in green in Figure 1) are incomplete or missing and could not be correctly detected (both on the images and on the ground), so an artificial border was added to close them. These virtual polygons are not used to compute the geometric features, but they are used for the topological countings, making available a higher number of polygons of the network with complete neighbourhoods. Thus, this network contains 264 polygons, whereas 105 of them are completely surrounded and used to compute their characteristics. Some geometric (area, diameter, shape, among others) and topological features (number of neighbours) were thus obtained for each and every individual polygon of the network. The average polygon diameter obtained for this network is 20.7 m. In addition, three classic laws (Lewis, Desch and Aboav-Weaire [4][5]) derived from the combination of those geometric and topologic features were verified for the global network. In particular, we have computed the following relations between:

(i) The average number of neighbours $<i>$ and the number of polygons in a network;
(ii) The polygon density d (number of polygons per unit area) and the average longer axis $<L>$;
(iii) The experimentally determined Desch and Lewis parameters, λ_L vs. λ_D;
(iv) The experimentally determined Aboav–Weaire parameter a and the second moment of the distribution of the number of neighbours μ_2.

Comparison of features of Adventdalen and Martian networks: The above relations for the terrestrial network were plotted together with the same relations obtained for 33 Martian networks [5] (Figure 2). The main issue is that, in these relations, the terrestrial network always lies within each of the clusters or trends of the Martian networks features; a more detailed analysis shows that the Adventdalen network is normally located in the external parts of the clusters.

Conclusions: These preliminary and generic results show that it is possible, through quantitative measurements, to perceive where the Adventdalen network of ice-wedge polygons stands in relation to others, in particular to the Martian networks. Other characteristics of this terrestrial network (soils, active layer depth, water content) may also help to infer those of the Martian networks.

Acknowledgements: This research is supported by FCT, the Portuguese Science Foundation, under the project ANAPOLIS (PTDC/CTE-SPA/99041/2008), which also supported JS (SFRH/BD/37735/2007) and LB (SFRH/BD/40395/2007).

References: [1] Mangold N. (2005) *Icarus*, 174: 336-359. [2] Mellon M.T. (2008) *JGR-Planets*, 113, E00A23, doi:10.1029/2007JE003039. [3] Levy J.S. et al. (2010) *Icarus,* 206: 229–252. [4] Pina P. et al. (2008) *Planet. Space Sci.*, 56:1919-1924. [5] Saraiva et al. (2009), *Phil. Mag. Lett.*, 89:185-193. [6] Bandeira L. et al. (2010) *Patt. Rec. Lett*, 31: 1175-1183. [7] Rossbacher L.A. (1986) *Geografiska Annaler A*, 68:101–105. [8] Dutilleul P. et al. (2009) *Environmetrics*, 20: 206–220. [9] Haltigin T. (2010) *Planet. Space Sci.*, 58: 1636-1649. [10] Sorbel L. and Tolgensbakk J. (2002) *Norwegian J. Geography*, 56: 62–66. [11] Christiansen H.H. (2005) *Permafrost Periglacial Processes*, 16: 87–98. [12] Pina P. et al. (2010) *LPS XLI*, Abs. #1372. [13] Pina P. et al. (2011) *LPS XLII*, Abs. #1387.

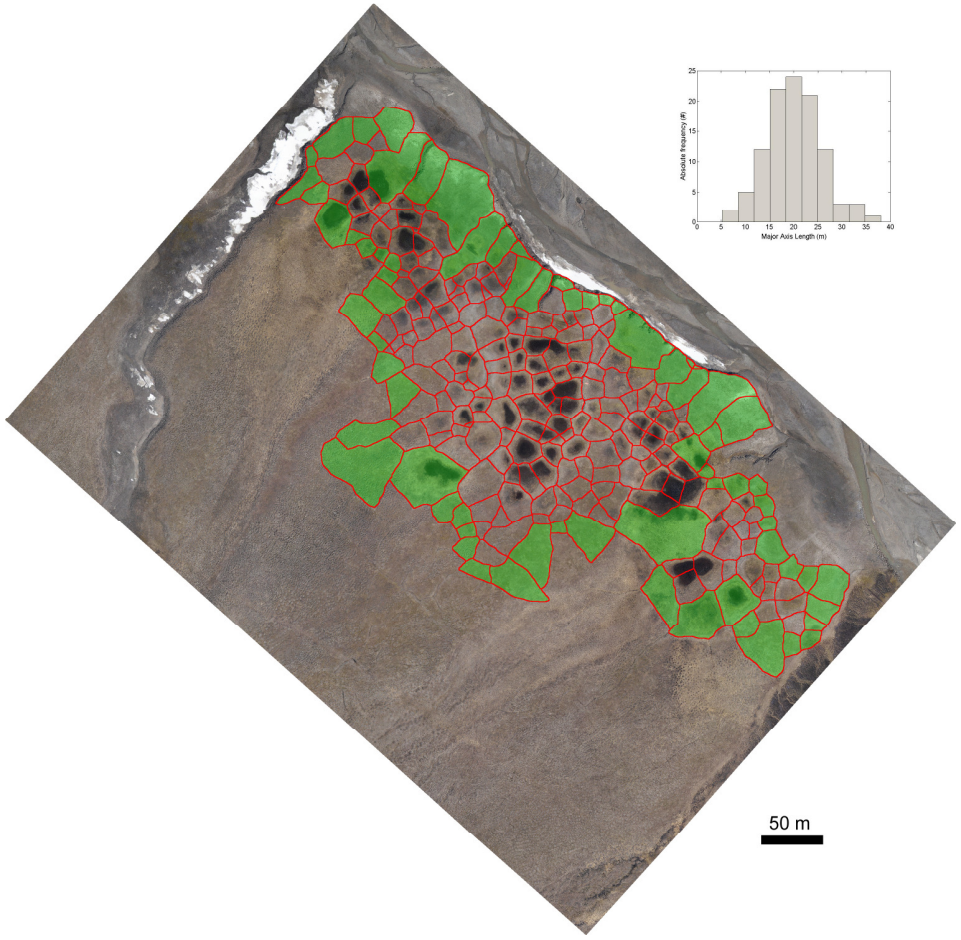

Figure 1 – Polygonal network delineated in Advendalen superimposed on an approx. 6cm/pixel aerial image: red colour indicates the edges of the polygons detected and green colour specifies the polygons on the border of the studied network. Top-right inset shows the histogram of polygon dimensions (major axis).

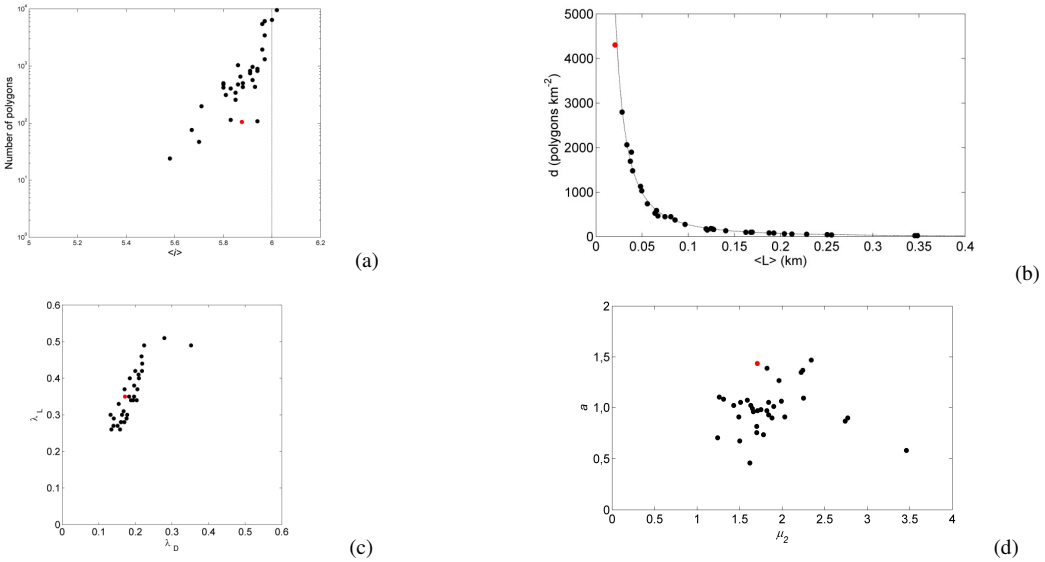

Figure 2 – Where terrestrial polygonal network (red dot) stands in relation to martian networks (black dots). Relations between: (a) The number of polygons in each network and the average number of neighbours <*i*>; (b) Polygon density *d* and the average longer axis <*L*>; (c) Lewis and Desch parameters, λ_L vs. λ_D; (d) Aboav–Weaire parameter *a* and the second moment of the distribution of the number of neighbours μ_2.