INVESTIGATION OF DISTINCT LATE AMAZONIAN ERUPTIVE EPISODES SOUTH-EAST OF ARSIA MONS. P.-A. Tesson[1], A. Lagain[2], D. Mège[1], J. Ciazela[1], M. Ciazela[1] and J. Gurgurewicz[1]. [1]Space Research Centre, Polish Academy of Sciences, ul. Bartycka 18A, 00-716 Warsaw, Poland (pt@cbk.pan.wroc.pl), [2]Space Science and Technology Centre, Curtin University, Kent Street, Bentley, Perth, Western Australia 6102, Australia.

Introduction: Understanding the chronology of eruptive events at the Tharsis Montes, and their evolution can give insights on the history of Tharsis region and the internal evolution of Mars. Late Amazonian volcanic activity has taken the form of a large number of long and narrow lava flows, the investigation of which is critical to characterize the recent dynamics of the Tharsis magmas and their influence on tectonic activity. Here we identify two small groups of lava flows located SE of Arsia Mons (10.9-14.1 S, 113.2-118.5 W). We map individual flows and determine their crater retention age.

Geological Setting: Arsia Mons is the southernmost shield volcano of the Tharsis Montes. The edifice is ~400 km wide and rises 10 km above the surrounding topography. Its eruptive history is complex, with alternating explosive and effusive episodes [1]. The youngest episodes are thought to have occurred within the caldera and in the southern rift zone, forming a large fan-shaped lava aprons at ~130 Ma [2,3]. Mapping of individual lava flows around vents [4] constrains the intra-caldera activity between 200-300 Ma and 90-100 Ma, with a peak at 150 Ma.

Dataset and methods: Individual lava flows are mapped based on CTX images (6 m/px), THEMIS Night and Day-IR imagery (~100 m/px), and MOLA topography data, and their succession is established using cross-cutting and stratigraphic relationships.

Absolute ages are estimated using automated crater detection and counting based on machine learning technique [5]. The algorithm was trained on THEMIS images where database for craters >1 km already exists [6]. The algorithm is applied to CTX mosaic from Murray Lab [7] to detect impact craters of diameter >200 m. A second algorithm based on cluster analysis is used to clean clusters of secondary impact craters. Crater ages and errors are derived from crater size frequency distribution plots using Craterstats II [8] using Hartmann's [2005] chronology system [9].

Results: We have mapped 15 individual lava flows, divided into two groups within which ages are in the same range (Fig. 2). The first group is composed of 4 individual flows located at SE foot of Arsia Mons (Fig.2), of average length of 90 km and width 1–5 km.

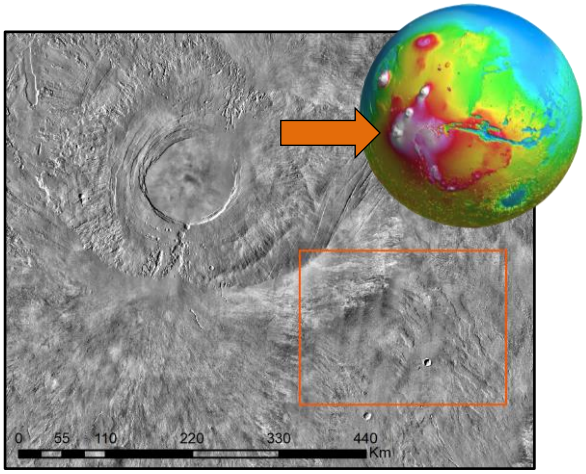

Figure 1 Location of Arsia Mons and the lava flows investigated in this study. Orange frame indicates the location of Fig. 2

They appear to originate from the edge of the Arsia Mons edifice. They flow eastward, following the current topography. They overprint SW-NE-trending grabens, but are themselves cut by other normal faults from the same graben system. Dating could be achieved for a single flow, yielding an age of 350±90 Ma.

The second group is composed of 11 lava flows located further south (Fig. 2), of length 83–243 km and width 2.7–19 km. The best age, 200±30 Ma, is obtained for the youngest flow. The flows from this group can be traced back to the area now covered by the large southern lava apron of the Arsia edifice, and flow towards SE following the regional Tharsis dome slope.

Discussion and perspectives: On the eastern side of Arsia Mons, in spite of similar Amazonian lava flow morphology, discrete periods of eruption have been found, separated by ~150 million years. These eruption periods do not overlap the age of the peak eruption age within the caldera, 150 Ma [4].

Moreover, crosscutting relationships indicate that extensional tectonics was coeval with some of the eruptions. Lava flow length compared to width suggests lavas of mafic compositions; morphometric study based on high-resolution digital terrain models shall help confirm this interpretation and determine viscosity [10], a first step towards understanding the dynamics of the most recent magma eruptions at Arsia Mons.

Acknowledgments: This work was supported by the TEAM program of the Foundation for Polish Science (TEAM/2016-3/20), co-financed by the European Union under the European Regional Development Fund.

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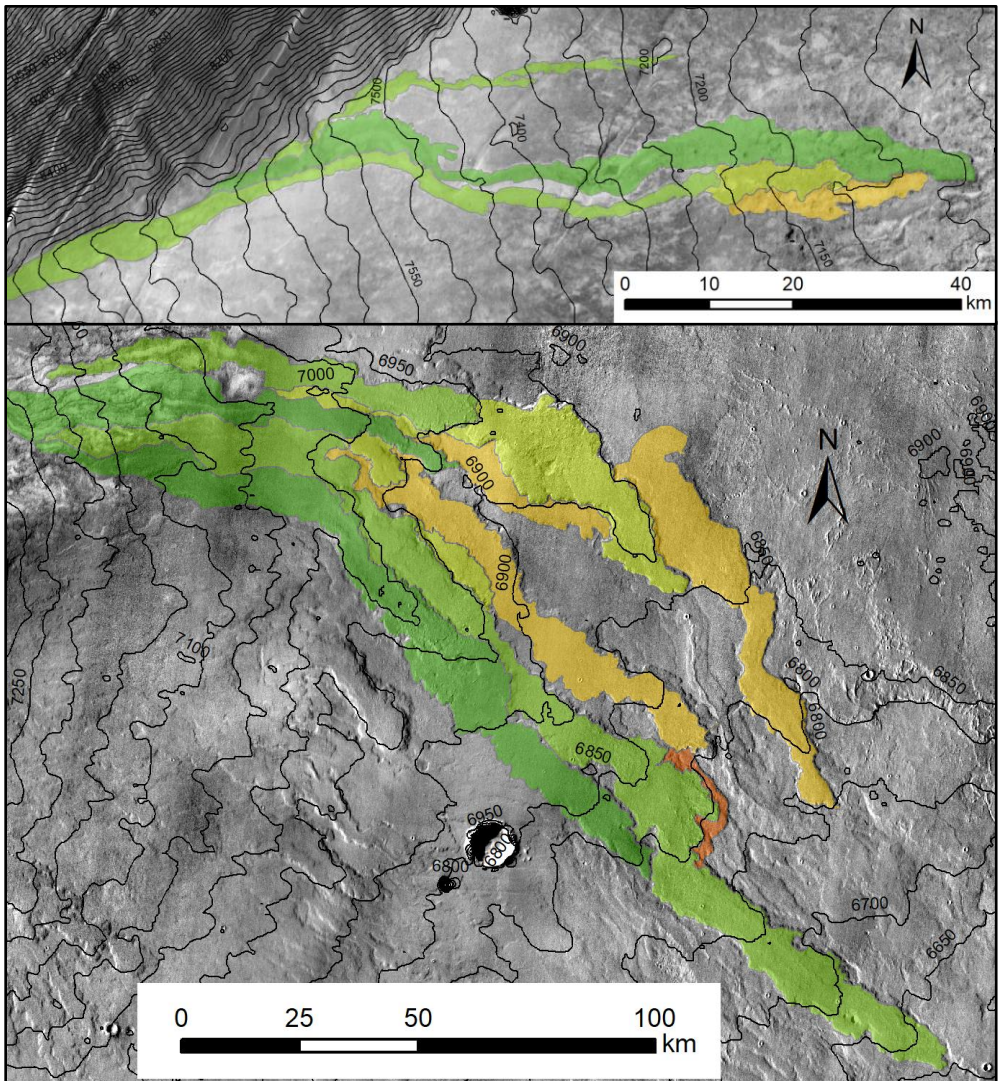

Figure 2 Mapping of two groups of individual lava flows SE of Arsia Mons, with THEMIS Day-IR background. Isocontours (50 m) are derived from the MOLA 256 ppd digital terrain model. Flow color indicates relative flow chronology, with dark green the youngest and orange the oldest.