STREAM-LINED FORMS ON MARS: 
LATE AMAZONIAN CHANNEL AND ISLAND SYSTEMS 
IN THE CYANE–GORDII–OLYMPICA REGION, THARSIS RISE

H. Hargitai1 and V. Gulick2

1 NASA Ames Research Center / NPP (MS 239-20 Moffett Field, CA 94035, hhargitai@gmail.com), 2 NASA Ames Research Center / SETI Institute (MS 239-20 Moffett Field, CA 94035, virginia.c.gulick@nasa.gov)

Channel systems East of Olympus Mons

We have mapped the Northwest Tharsis Region East of Olympus Mons that includes the Cyane, Gordii, Pavonis and Olympica subregions and described three distinct channel-and-island systems.

The channel systems are: 1) the E-W trending, subparallel Olympica systems with lava and fissure-fed fluvial systems; 2) the S-N trending, discontinuous Pavonis–Cyane lava flow systems co-aligned downslope from each other; and 3) the short, Gordii fissure-fed systems scattered around the base of Olympus Mons.

Different origin?

We distinguished between characteristically different channel-and-island system producing mechanisms by the morphologies of islands and channels. Islands include accretional lava islands, erosional islands in lava channels and fluvial systems and residual islands in collapse systems.

While the origin of the anastomosing channels and the channels with dominantly rounded streamlined forms can be traced back to straight troughs, the origin of perched lava channels and rille-and-pit systems is typically unresolved, which might be due to postdating, overlapping lava flows.

Interpretation

We interpret these channels to have formed by a combination of tectonic, mass wasting (collapse), volcanic and fluvial processes that formed fissures, pits, lava flows and channels with streamlined islands, respectively. This formation model is consistent with other Martian fossa-fed channel-and-island systems where both lava and water was transported along the same channels, in some cases alternating and repeatedly (Keske et al. 2015, Burr 2005). Collapse channels and pits along subsurface conduits exhibit irregular islands; lava channels typically display a pattern of pressure ridges and knobby (rocky) margins; and fluvial channels are generally smooth surfaced.

Individual channel-and-island systems East of Olympus Mons with informal nomenclature. Red areas are channels, yellow dots are islands, yellow flow symbols represent cross-channel island rows, black lines are tectonic troughs, purple lines are rilles (narrow channels). Dashed line shows boundary of CTX resolution survey. Dotted areas are regions where we conducted crater counting.

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<table>
<thead>
<tr>
<th>Channel</th>
<th>Description</th>
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<tbody>
<tr>
<td>Cyane</td>
<td>E-W trending, subparallel systems with lava and fissure-fed fluvial systems</td>
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<tr>
<td>Pavonis</td>
<td>S-N trending, discontinuous lava flow systems co-aligned downslope</td>
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<td>Eunostos</td>
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The most complex system in the Olympus–Alba Region is Olympus 1a. The major, most complex Olympica channel system was first described in detail by Mouginis-Mark (1990) who interpreted it to be fluvial in origin. Plescia (2013) interpreted this system as fluvial-volcanic-tectonic.

A braided anastomosing channels with rounded, layered islands commonly split to smaller forms by island-crossing channels. These are the oldest features on the top level, likely fluvial. These channel belts are cross-cut by B, a deep trough, central Olympica Fossa. This fossa is likely tectonic, but it contains an ogive (pressure ridge) pattern that is characteristic of lava flows and this pattern is cross-cut by a sinuous interior channel, which may be fluvial. The banks of central Olympica Fossa are lined, suggesting layered substrate and/or scouring, which in turn suggest that the tectonic graben was first eroded in a fluvial episode that also eroded the overbank areas already channels, and later the graben was flooded by lava. D is a straight channel, which suggests tectonic origin.