"Venera-D: landing site selection workshop"

Tessera as a high-wish site

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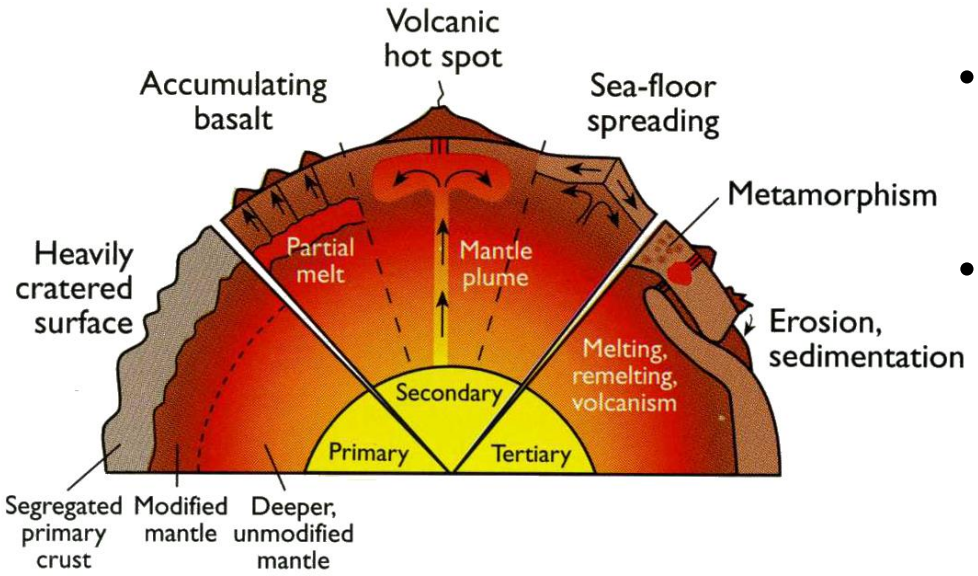
Introduction



- **The observed terrains represent the last 10-15% of the history of Venus.**
- **Earlier epochs may have included water (*high D/H*), crustal recycling (*episodic plate tectonics?*), and complex petrogenesis (*TTG?*).**

- **What is the oldest terrain type on Venus?**

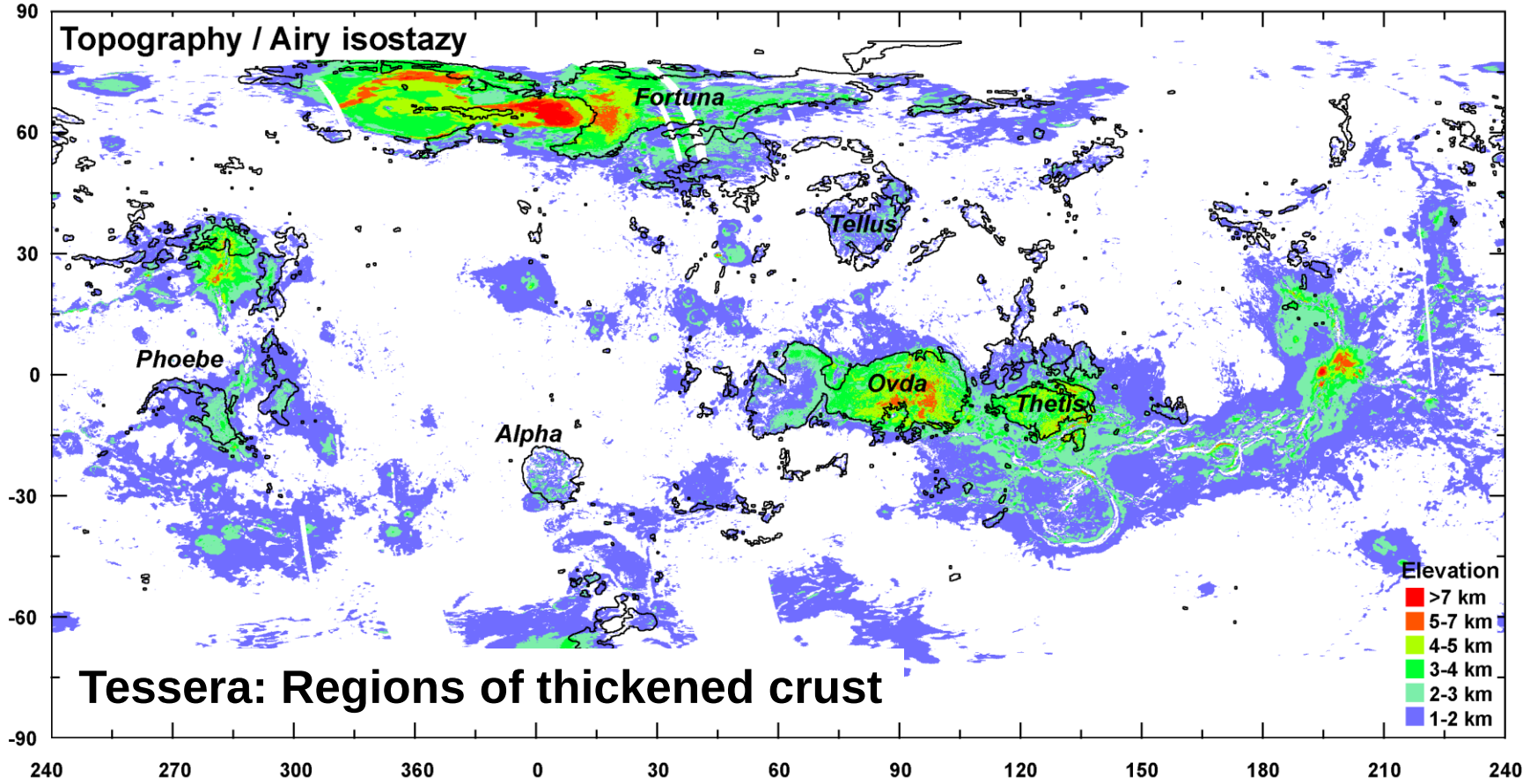
  - heavily tectonized tessera: <u>it is a window in the past</u>.
- **What is the nature of tessera? What clues could it provide for the crustal history and origin?**
- **Could tessera represent samples of the crust from the earlier 85-90% of the history of Venus?**
- **What type of crust dominates Venus?**

  - primary? (probably not)

  - secondary? (very likely)

  - tertiary? (need to know)

Introduction



Tessera: Regions of thickened crust

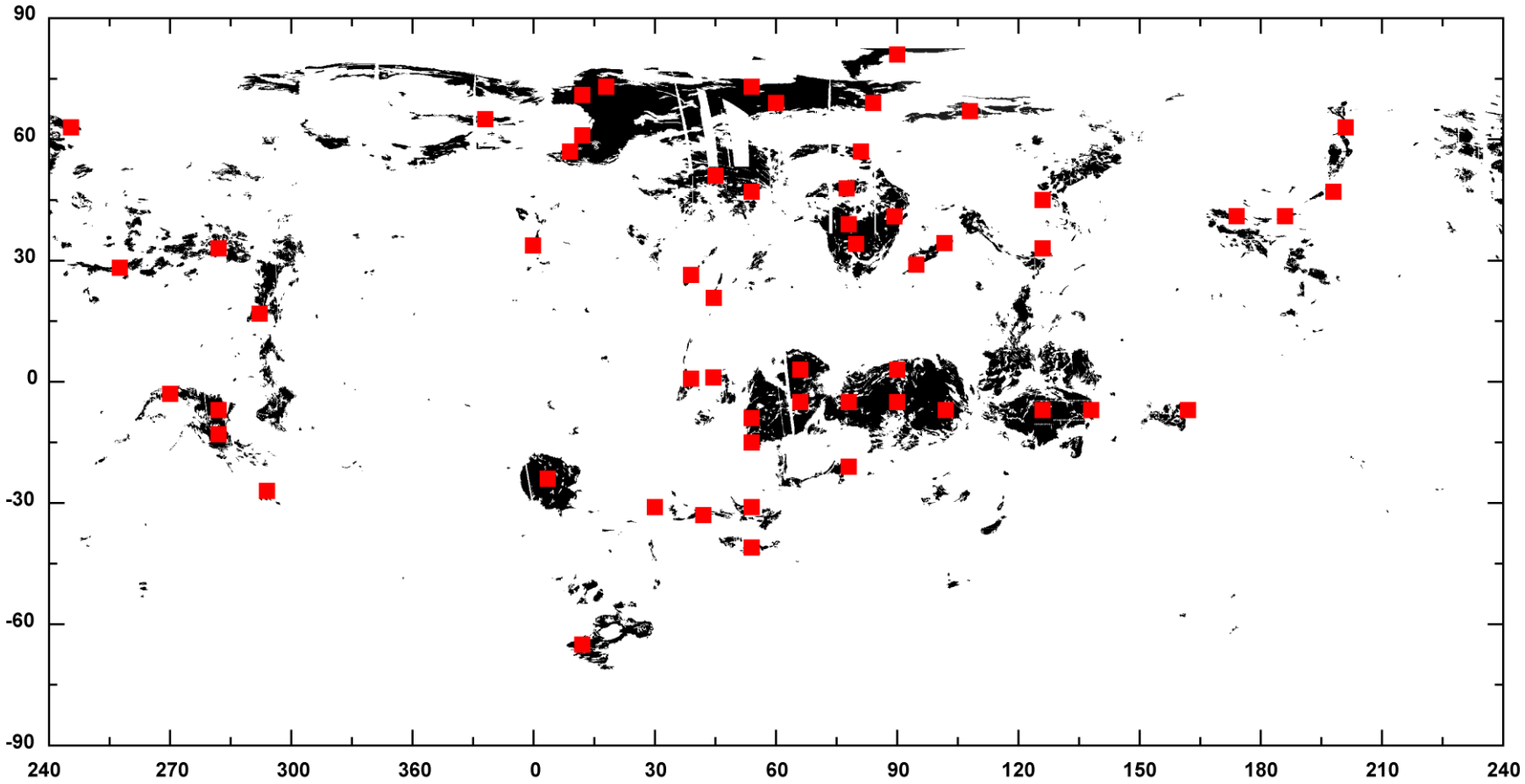
EARTH	VENUS
continents:	tessera:
- heavily deformed	- heavily deformed
- old	- old
- high-standing	- high-standing
- silicic	- ???

These similarities, although superficial, make tessera the best areally extensive terrain for the search of ancient and may be non-basaltic crustal material on Venus.

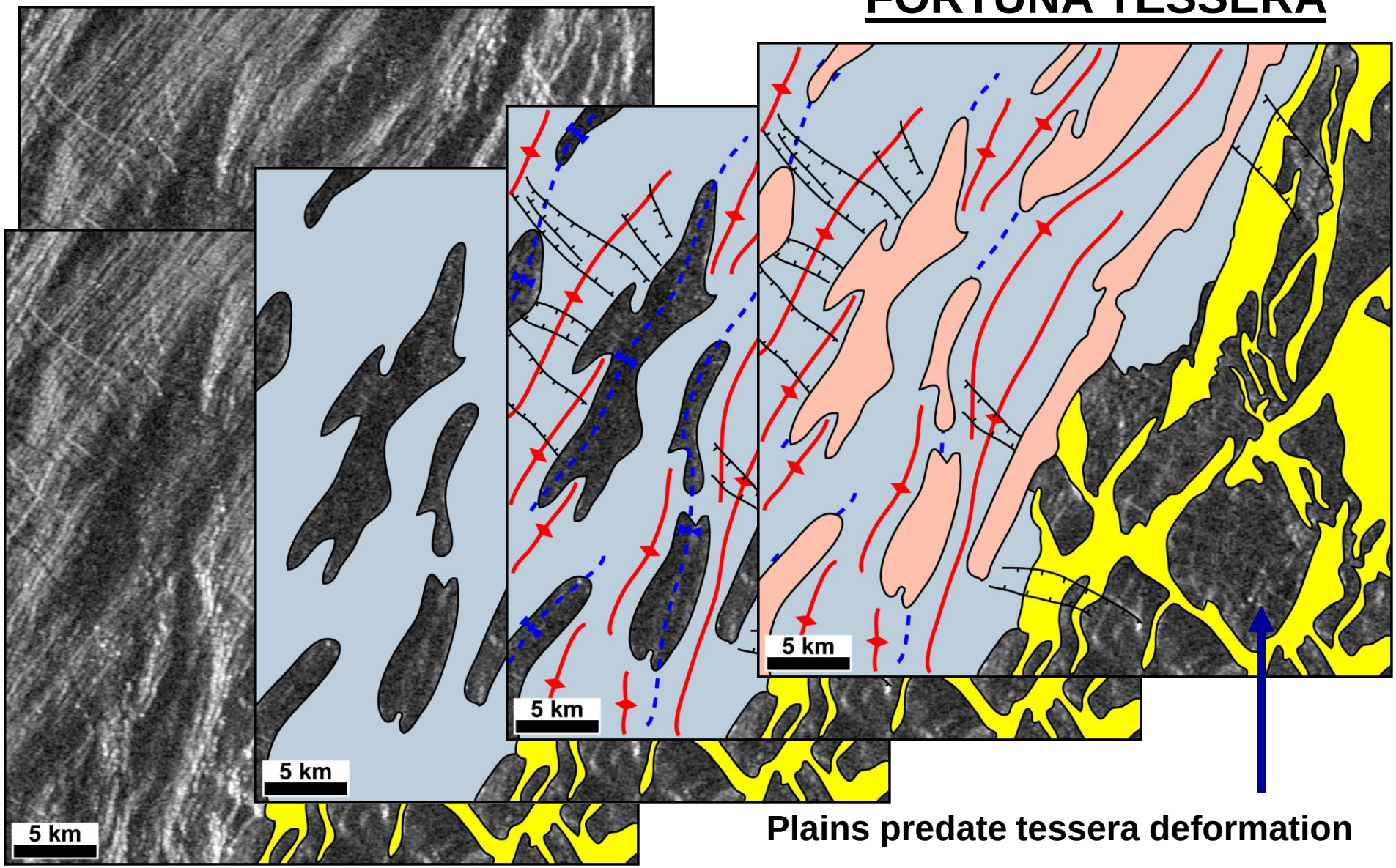
Morphology of tessera

A common opinion: morphologic characteristics of the tessera precursor have been erased by tectonic structures. Is this correct?

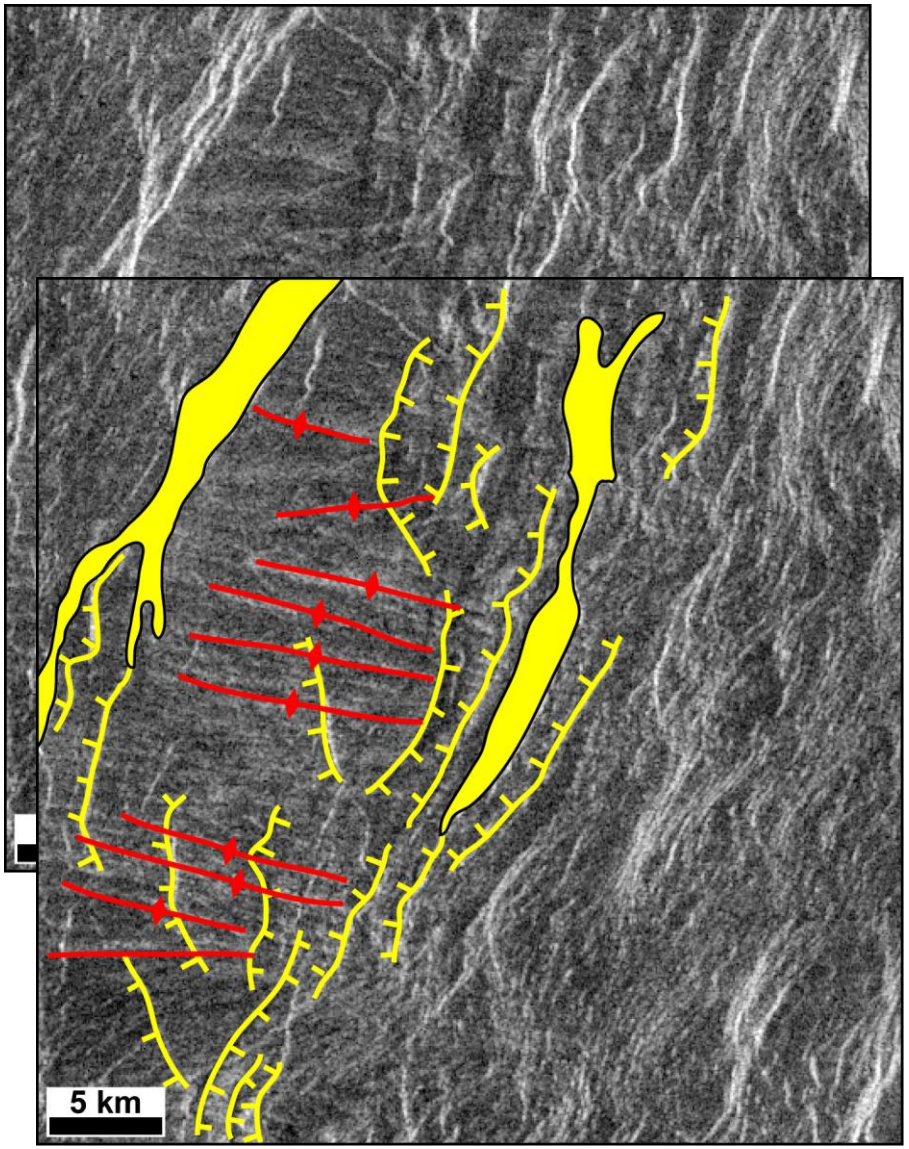
We have checked all large and medium-sized tesserae seeking for the presence of recognizable pieces of the tessera precursor.



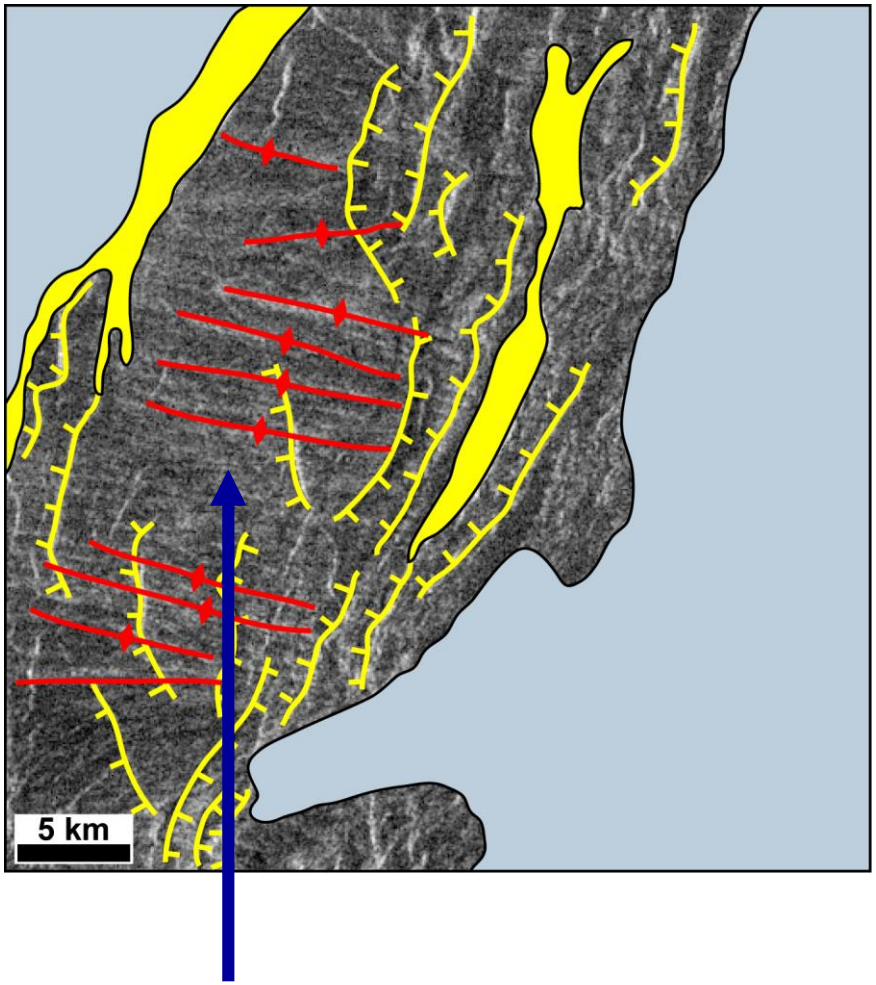
Morphology of tessera



Morphology of tessera

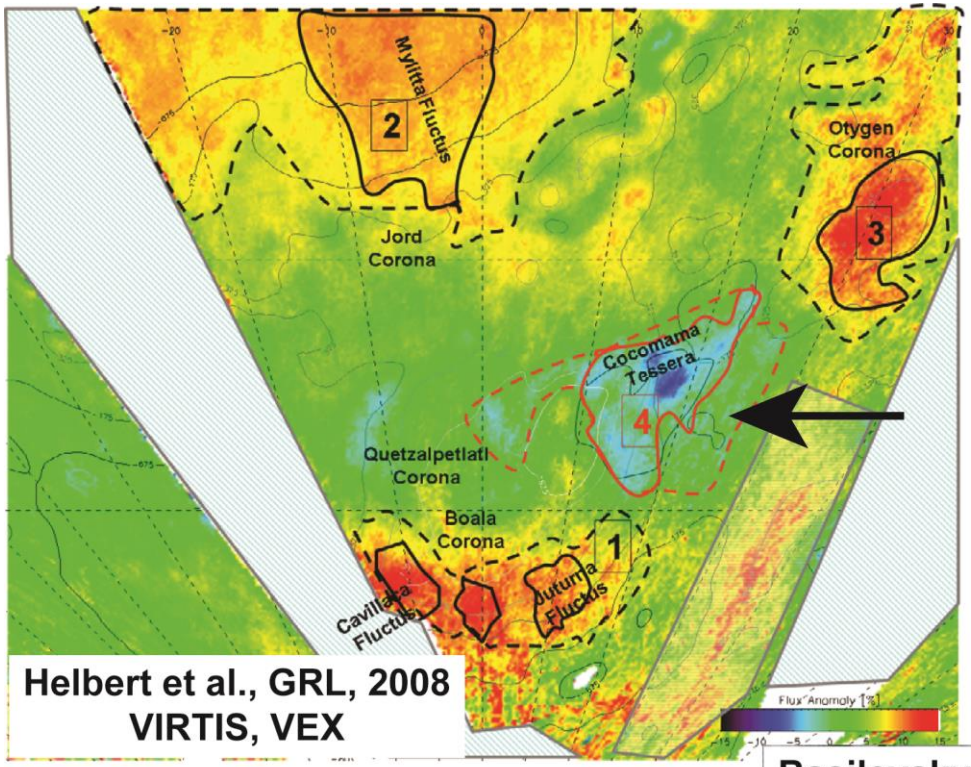


OVDA TESSERA



Plains predate tessera deformation

But... (No. 1)



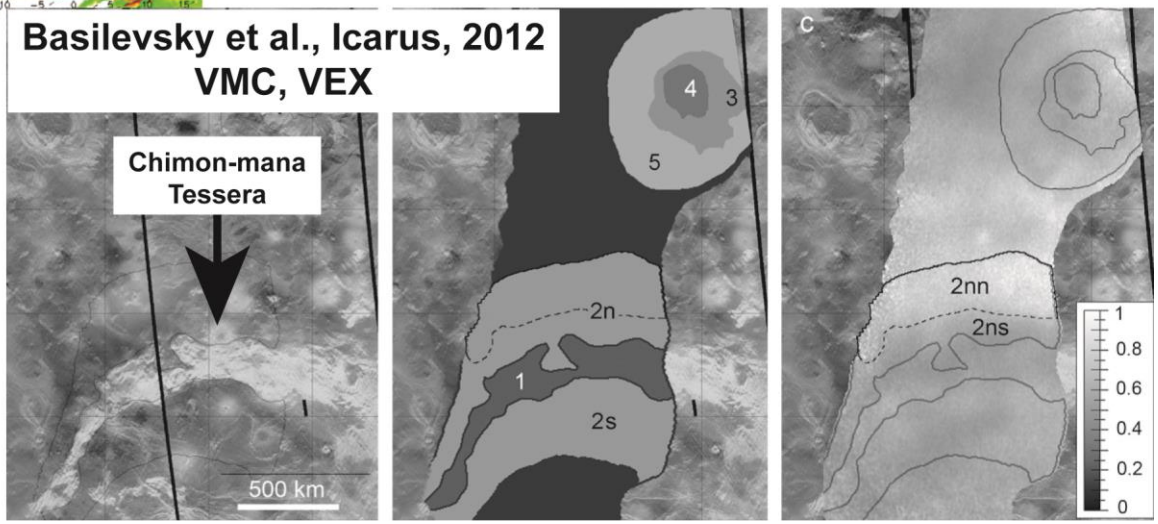
Helbert et al., GRL, 2008
VIRTIS, VEX

So, pre-tessera terrains have a plains-looking morphology. Common lava plains???

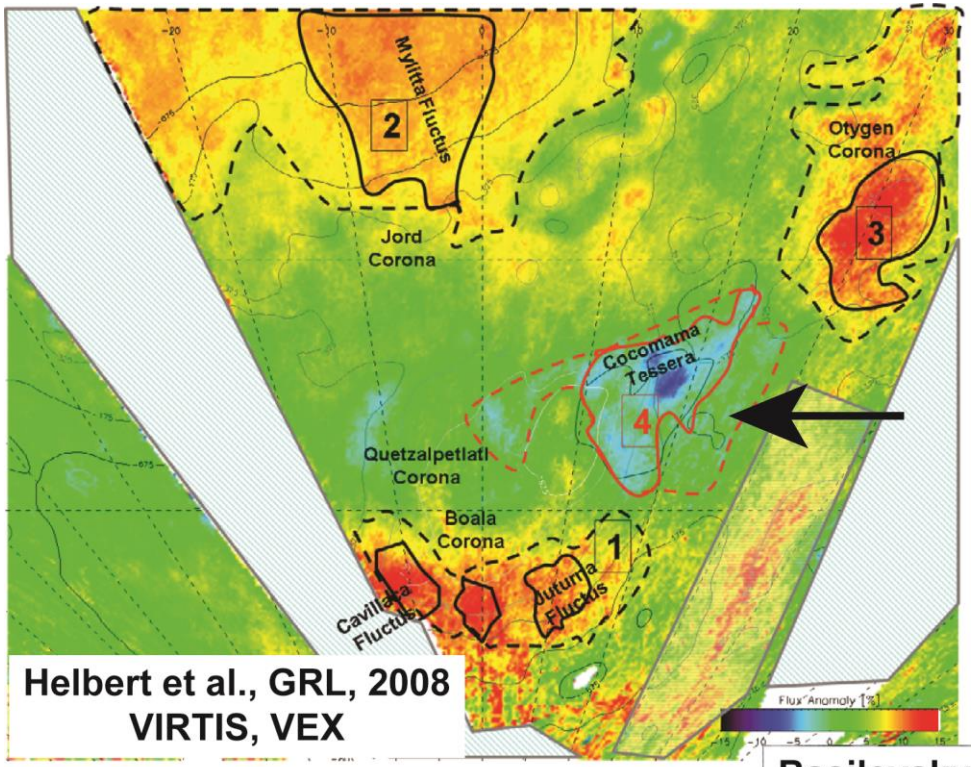
Some tesserae show a lower emissivity comparing with the surrounding lava plains.

Pre-tessera plains MAY represent some sort of a non-basaltic lithology. Sedimentary deposits???

Basilevsky et al., Icarus, 2012
VMC, VEX



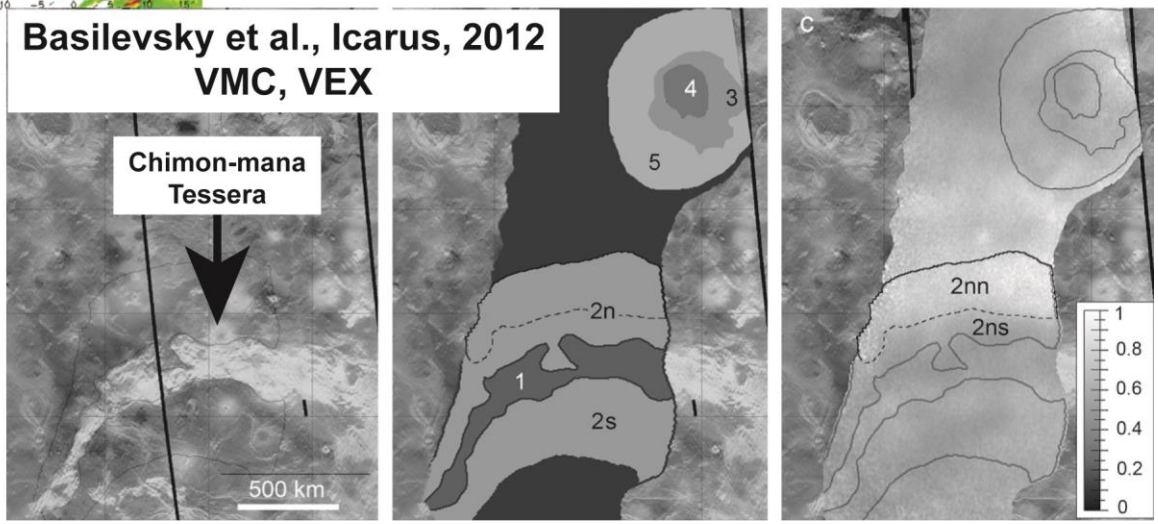
But... (No. 2)



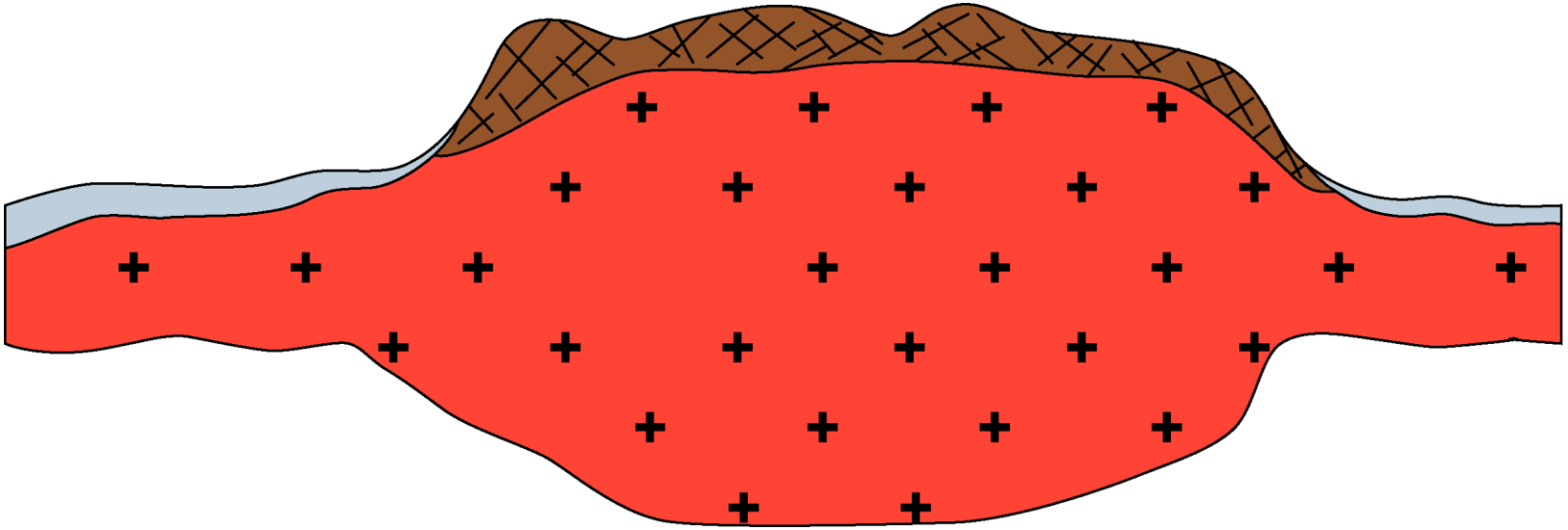
Helbert et al., GRL, 2008
VIRTIS, VEX

Venus-Express observations:
- very low spatial resolution,
- a few tesserae were investigated.

What intratessera volcanism may tell us about tessera composition?



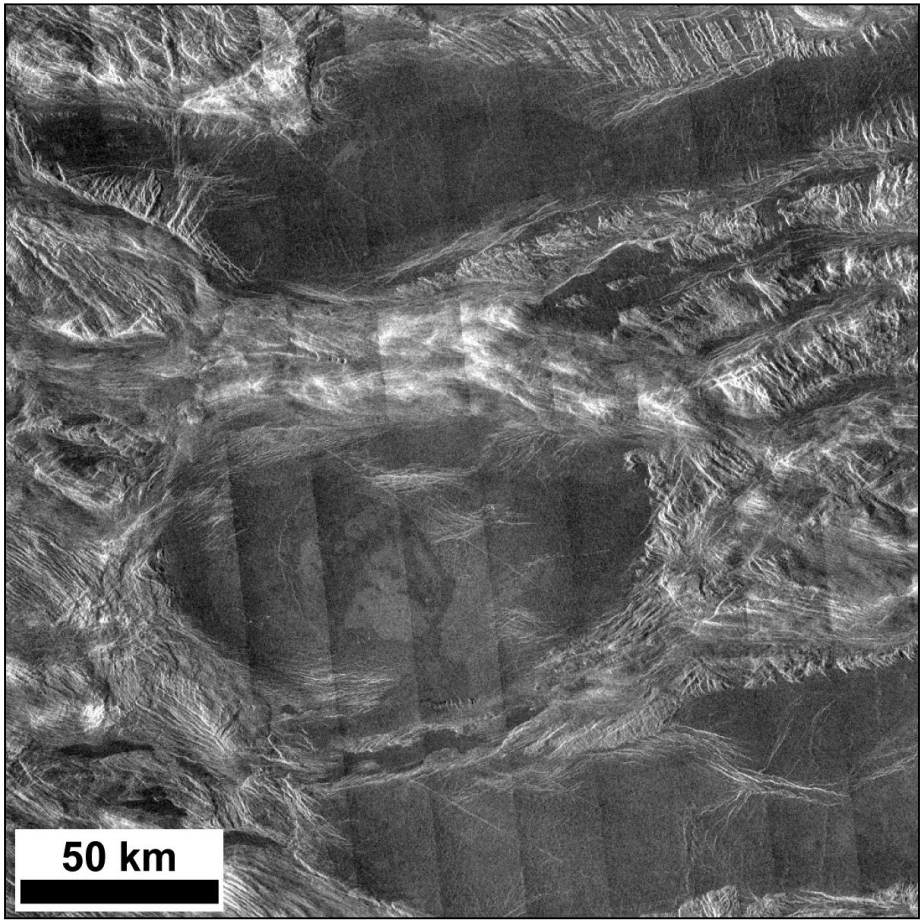
Tessera: Top of highlands



- **Tessera is made from deformed plains units.**
- **Largest tesserae are on top of regional highlands; regions of thicker crust.**

- **What if tessera is simply a "thin" skin of tectonized plains that overlay more silicic core of highlands?**
- **Post-tessera volcanism may help to assess this hypothesis.**

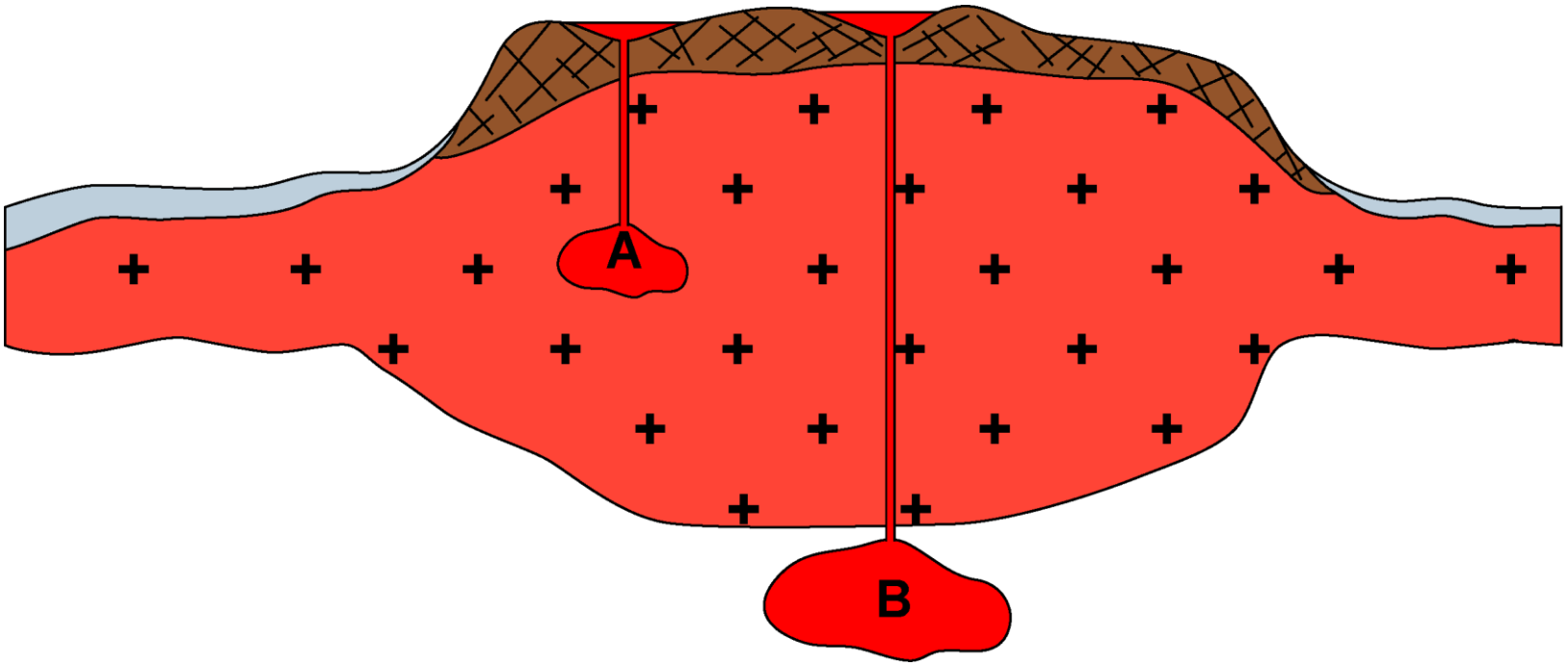
Post-tessera volcanism



Intratessera plains:

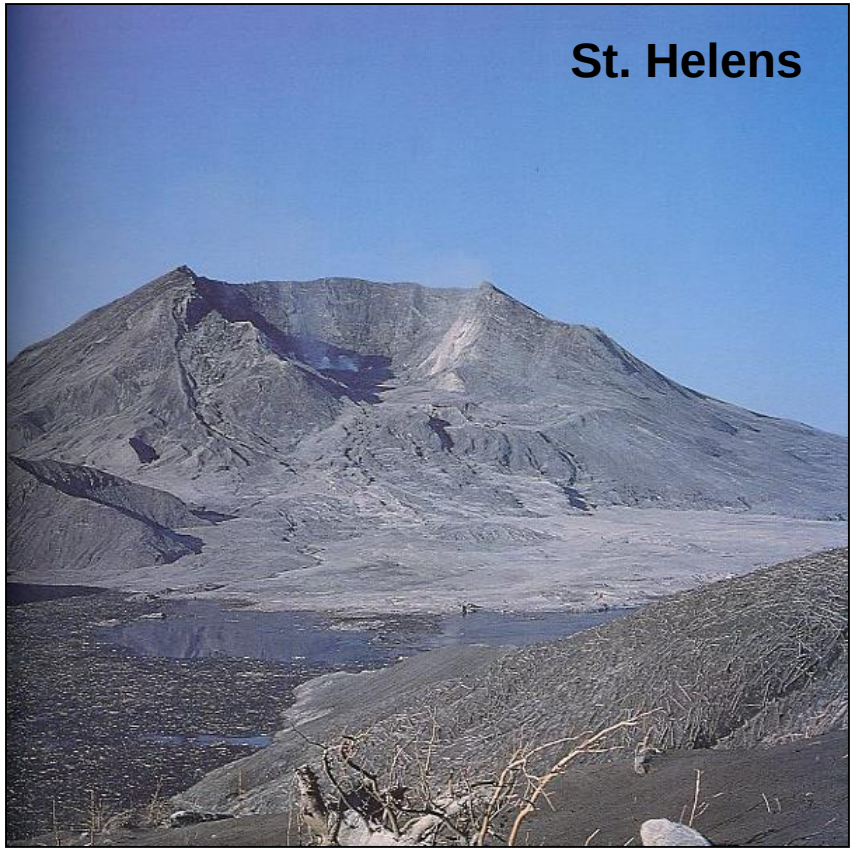
- **Common, smooth, undeformed.**
- **Patches 10s-100s km across.**
- **Related to dispersed sources.**
- **Late volcanism in tesserae.**
- **Morphologically identical to plains outside tessera massifs.**
- **Basaltic composition (highly likely).**

Post-tessera plains: Sources



- **A - sources within a tessera highland. Remelted highland material.**
- **B - sources are in mantle, beneath a tessera highland. Interaction of the melt and the highland body is expected. Specific morphology of volcanoes/flows may appear.**

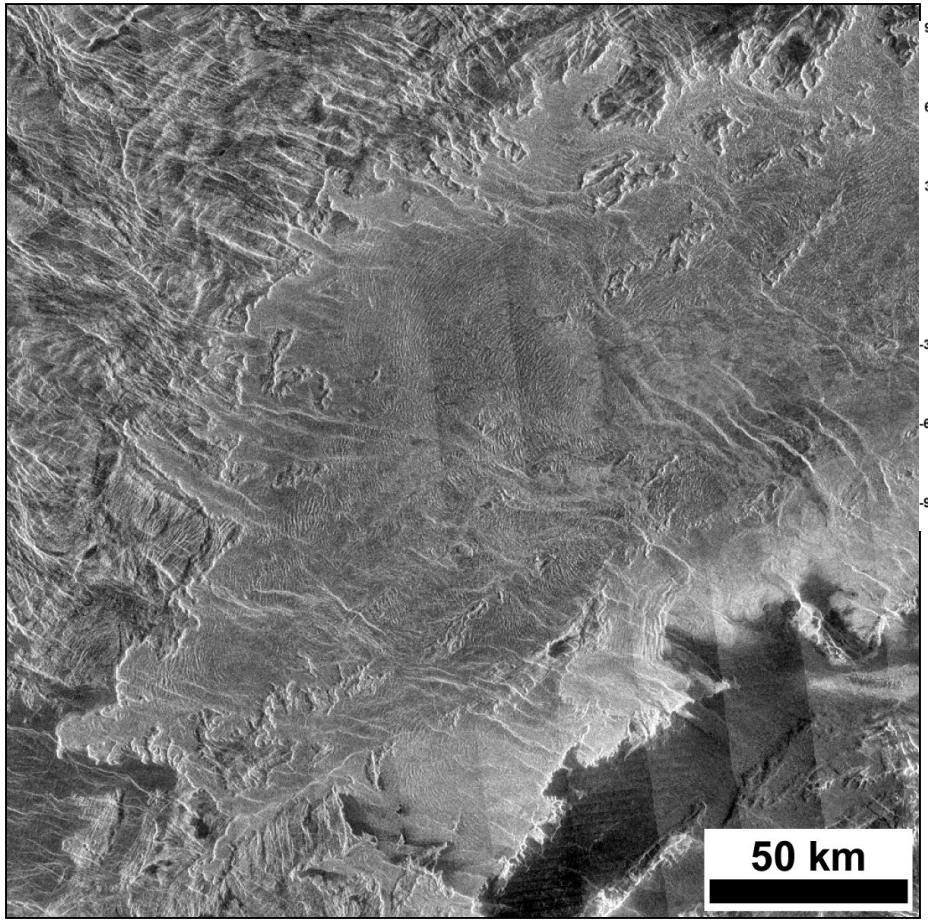
Earth

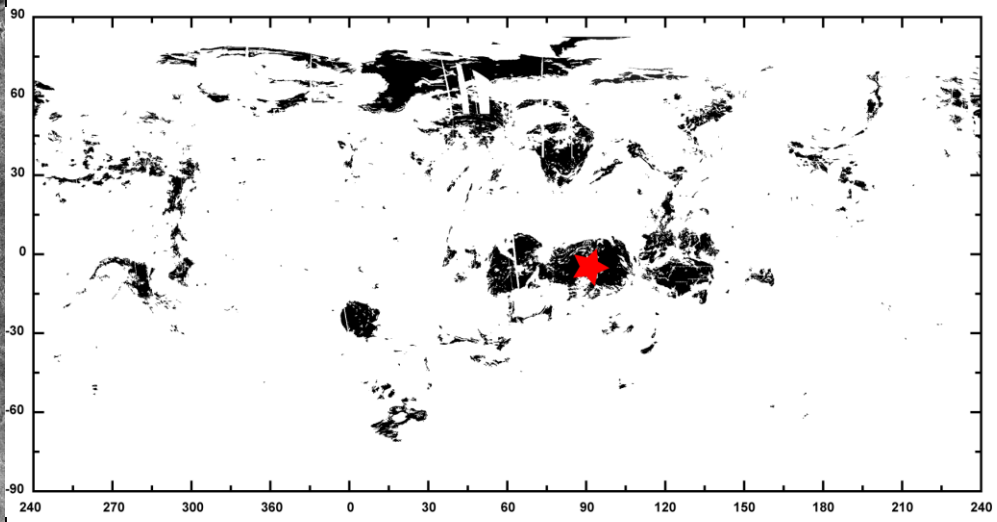


<u>Interaction of mantle melts with continental substratum:</u>

- **Bimodal volcanism:**
  - **Explosive calderas,**
  - **Steep-sided domes,**
  - **Cinder cones,**
  - **Basaltic flows, fields, plains.**

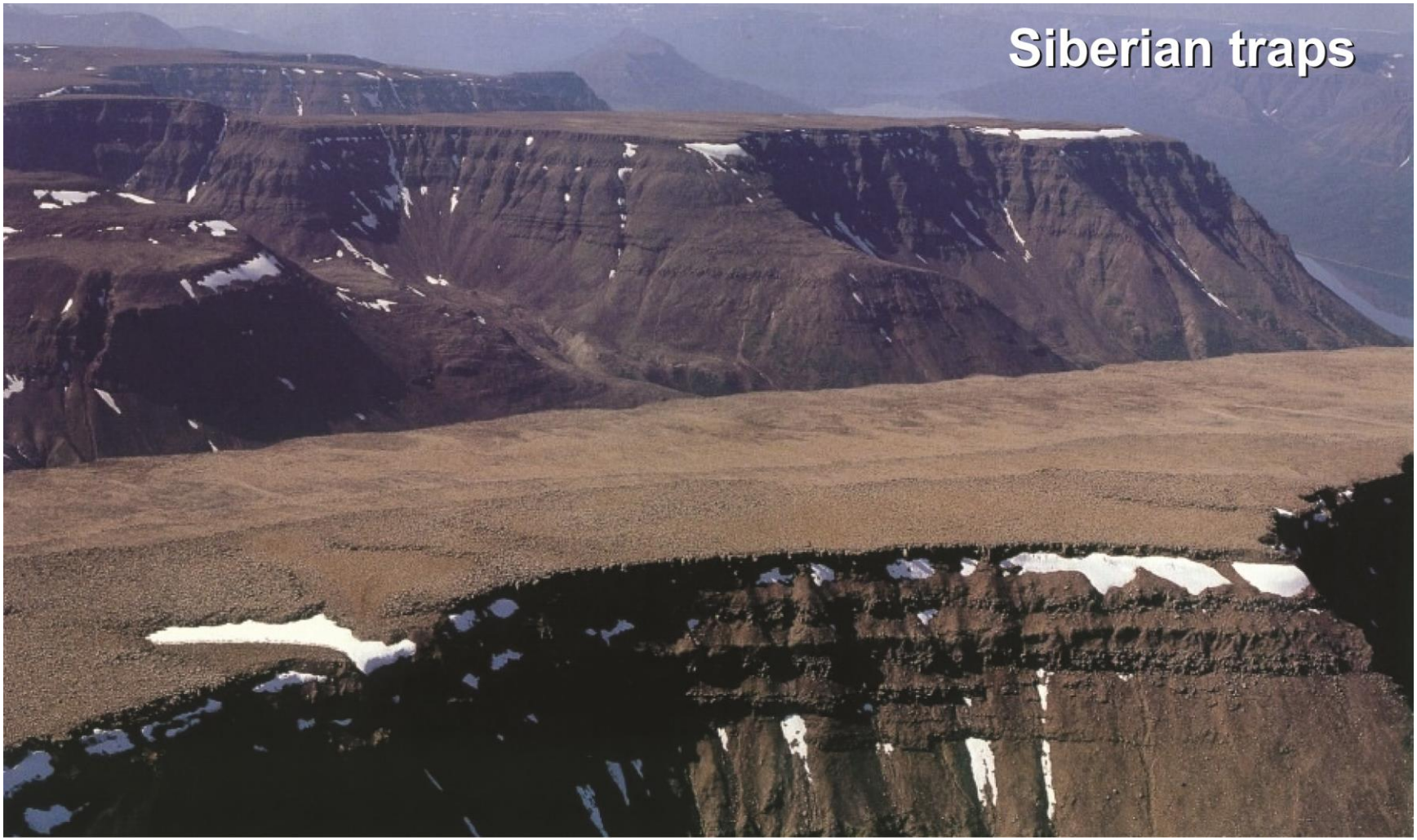
Venus





- **The only steep-sided, festoon-like flow is known in tessera (Ovda).**
- **The absolute majority of intratessera plains do not demonstrate characteristic features of interaction of hot mantle melts with possible non-basaltic material of tessera highlands.**

But... (No. 3)



Terrestrial continental platobasalts usually show NO evidence of interaction between the silicic wall rocks and intruding basaltic magmas.

Conclusions

- **Tesserae represent the oldest known terrain on Venus.**
- **The tessera-precursor materials have a plains-looking morphology.**
- **There is evidence *pro* and *contra* basaltic composition of the pre-tessera plains.**
- **A possibility remains that the pe-tessera plains have a non-volcanic nature and a non-basaltic composition.**
- **Tessera is a primary objective to address the fundamental problem of the structure of the crust on Venus.**
- **This target is an extremely dangerous site to land on.**
- **A technology of controlled landing on Venus must be developed in order to consider tessera terrain as a potential landing site.**