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# Ridge Dynamics in the expanding Artemis Coronae: axis sinuosity, transform faults, and microplates.

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Venus today presents no large-scale network of subduction and accretion ridges, which is the signature of plate tectonics on Earth. On the other hand, Venus relatively young surface points towards either a quite recent catastrophic renewal of the whole planet surface (« episodic subduction regime »), or the continuous renewal of small areas of the planet for exemple by volcanism.

Unique to Venus, coronae are circular features from 50 to 2600 km in diameter. The largest ones have been attributed to mantle plumes. Close inspection of Magellan's data revealed that subduction features are also encountered on part of their rim (McKenzie et al, 1992 ; Sandwell and Schubert, 1992, 1995).  Recent modeling has shown that plumes could indeed induce roll-back subduction around segments of an expanding coronae. Artemis coronae is the largest coronae on Venus and shows both plume and subduction features that are well explained by the plume-induced subduction mechanism (Davaille et al, 2017). Scaling laws then predict a slab roll-back (and therefore a coronae expansion) velocity between 1 and 10 cm/yr.  If the coronae has been expanding, then we should expect the existence of an accreting ridge system  inside the coronae, equivalent to the Earth's mid-ocean ridges developing in back-arc basins. Artemis interior indeed also presents a prominent ridge system (Sandwell and Schubert, 1992 ; Brown and Grimm, 1996 ; Spencer, 2001 ; Hansen, 2002), but its lateral tortuosity is much more prononced than on Earth (fig.1).

Using laboratory experiments, we recently showed that the shape of an accretion ridge is governed primarily by the axial failure parameter $\Pi_F$, which depends on the spreading velocity, the mechanical strength of the lithospheric material and the axial elastic lithosphere thickness (Sibrant et al, 2018). Experiments with the largest $\Pi_F$ presented quite unstable ridge axis with a large lateral sinuosity, long transform faults, and the formation of numerous microplates. These microplates rotate along the transforms before getting incorporated in the main plate on one side of the ridge axis or the other. There, they appear as blocks whose main fabric is either concentric or rotated compared to the main plate's.

On a planet, this regime occurs for high spreading velocity and/or low axial elastic thickness. For the Earth, it would require spreading velocities greater  than 30 cm/yr. But on Venus, where the surface temperature is about 500°C higher, and therefore the elastic thickness on the ridge axis is smaller than on Earth, spreading velocities between 1 and 10 cm/yr would suffice. The scaling laws derived from the laboratory experiments further predict a tortuosity of the ridge axis comparable to what is observed inside Artemis coronae (fig.1). Furthermore, guided by the experiments, we are tempted to identify two long transform faults on each side of Britomartis, as well as a number of rotated blocks or microplates. However, the resolution of Magellan data is not sufficient to be sure of our interpretation. There is an urgent need for better resolution and better coverage of Venus topography, that a mission such as VERITAS could provide.