DALI VINCULUM: RIFTING, CORONAE AND SUBDUCTION; R. C. Ghail, Environmental Science Division, Lancaster University, Lancaster, LA1 4YQ, United Kingdom.

Geological mapping of Dali Vinculum [1] has revealed a recent and still evolving region of rifting and corona formation. Careful stratigraphic mapping has revealed that the age relationships within Dali Vinculum are consistent with a rift system propagating eastwards from Latona Corona to Thetis Regio. Halle Crater and its parabolic halo has been cut by rifting and folding associated with the development of two coronae, indicating that the youngest sections of the vinculum are <20 Ma old [2]. Intense fracturing of Langtry Crater is consistent with a young age (<300 Ma [2]) for much of this region. I estimate that the youngest areas of rifting, through Thetis Tesserae, are active at the present day and that Latona Corona may be ≤150 Ma old, but still active and in the final stage of development. Dali Vinculum is therefore an ideal region in which to study the formation and evolution of coronae.

Fig. 1 Proposed Tectonic Structures In Dali Vinculum.

The major tectonic structures observed in Dali Vinculum are illustrated in fig 1. The interpretation of a spreading ridge in the southwest of Artemis follows that of McKenzie [3] but see Brown and Grimm [4] for an alternative interpretation. Although there is still some debate, many authors now accept that subduction is, or has been, occurring in at least some of the locations indicated in fig 1.

The observed evolutionary sequence deduced from the stratigraphic mapping and the geophysical interpretation of this sequence is illustrated in figs 2 to 4.

Fig 2 Initial Rift Formation.

Stretching of the lithosphere (fig 2) results in crustal rifting, thinning of the lithosphere and upwelling of warmer mantle material. Occasional flood basalt extrusion may occur immediately prior to rifting but there is no large scale volcanism at this stage. Initial venusian rifts are similar to terrestrial counterparts and propagate at a similar rate (estimated to be 1000 km every 5 to 20 Ma). Interestingly, propagation is not linear or ordered; the coronae that cut Halle appear to be part of a failed rift arm, similar perhaps to the Labrador sea and other failed arms of the early North Atlantic.
rifting. It is unclear what causes the initial rifting; it is perhaps related to the gravity anomalies associated with either Thetis Tesserae or with Atla Regio.

**Fig 3 A Juvenile Corona**

In marked contrast to terrestrial rifts, intensely folded elliptical structures form within ~20 Ma of the initial rifting (fig 3) and are regarded as juvenile coronae. It seems odd that such concentrated compressional structures should occur within a region of extension but it arises because the continued rifting thins the crust and lithosphere so that they become strongly coupled to the underlying mantle circulation. This circulation consists of concentrated downwelling plumes within diffuse upwelling sheets [6]. The lithosphere is compressed and thickened above the downwelling plumes, resulting in the circular to elliptical regions of folding within the rifted crust, forming the juvenile coronae.

**Fig 4 A Mature Corona**

As a juvenile corona develops and grows in size, the lithosphere at the centre of the corona is thickened to the point at which it decouples from the underlying mantle. Continued compression of the outer region of the corona, however, results in further thickening of the lithosphere at the centre, until it decouples from the crust and sinks into the mantle. This is observed to occur when the corona has grown to a radius of 50 to 75 km perpendicular to the rift axis. The undepleted, underlying mantle is drawn into the void created, suffers adiabatic decompression and melts, intruding the crust. Typically, this intrusion consists of a small (20 to 50 km diameter) batholith from which radiate dykes up to 200 km in length. Some of these dykes may reach the surface, causing flood basalt extrusion which resurfaces the interior of the corona.

Circulation now consists of an upwelling plume in the interior of the corona (fig 4), surrounded by a concentric downwelling sheet of delaminating lithosphere, all within diffuse upwelling sheets. The interior of the corona now consists of a complex mesh of flood basalt flows, a central domical rise and radiating grabens, surrounded by a zone of folding that forms an annulus 50 to 150 km wide. The corona grows from an initial diameter of 100 to 150 km until it reaches about 500 km in diameter. At this diameter, the annulus of the corona extends into previously undeformed lithosphere, outside the initial zone of rifting. In contrast to Parga Vinculum [1], the coronae in Dali do not cease to grow at this point, but start to subduct the outlying lithosphere at their annuli. Subduction rapidly increases the diameter of the corona, causing the interior to be further stretched, intruded and resurfaced, possibly to the extent of generating a spreading ridge system such as that proposed at Artemis. The reason for this occurring at Dali and not at Parga is unclear. It is possible that the subduction zones within Dali are the initial stages of a future global resurfacing event, such as that proposed [7] to have occurred ~300 Ma ago. However, other evidence in both Dali and Parga Vinculi indicate a more gradual style of global resurfacing.