Simulating Superimposed Topographic Signatures at Radially Fractured Centers (RFCs) on Venus Using Numerical Models of Dual Magma Reservoir Systems. R. V. Gale[1] and E. B. Grosfils[1], [1]Geology Department, Pomona College (185 E. 6th St., Claremont CA 91711).

Introduction: Radially Fractured Centers (RFCs) on Venus are features that have long been associated with a volcanic origin [1]. The details of that origin, however, are subject to debate. Some authors argue these features are purely the result of Venus' surface reacting brittly to the upwelling of diapirs [2-5]. Others however, noting that the radial lineaments commonly extend well beyond the bounds of the domical topography at their focus, argue that lateral dike emplacement from a shallow magma chamber must play a significant role [6-8]. In this study, building on these ideas, we continue to refine existing hypotheses about the volcanic origin of RFCs.

Many RFCs, to first order, display central domical topography. However, some RFCs–like Krumine South and Pavlova coronae–also have a second, smaller domical feature superimposed upon their crest, while still others–like Ninhursag corona–have a smaller concave depression superimposed instead. Here we test whether these morphologies could be the result of superimposed inflation and/or deflation events at two or more magma reservoirs at each such RFC.

Numerical Model and Optimization: A 2D axisymmetric elastic model, using methods described in [8], is expanded to assess a dual reservoir system. The current search method for the parameter space uses a Monte Carlo approach. To begin searching the parameter space, terms relating parameters and their maximum/minimum values are defined. Thereafter, the parameters are randomly set for a single run based on those conditions. After each model has run, the RMSE between the topographic data and the uplift is calculated and saved. This is done n times.

Application to Krumine South: To permit a fair exploration of the parameter space we chose $n = 2000$. The best fit model output is shown in **Fig. 1a**. Due to the way that the RMSE penalizes all points equally, the points closest to the center of the corona are underestimated. By refining the model to resolve this we obtain a solution that better fits the topography (**Fig. 1b**). However, in both instances the pressure needed to cause tensile failure of each reservoir is exceeded by an order of magnitude. To date, seeking a plausible solution in the elastic realm, we have explored solutions that reduce Young's modulus (less pressure needed to produce the topography) and/or assume that a fraction of the topography is a product of lava flow emplacement and edifice building so that only some of the observed topography needs to be explained by subsurface reservoir pressure changes.

Conclusions and Future Work: Elastic models of a dual-reservoir system, while mathematically capable of reproducing the topographic signature, violate the physical constraints under which the magma bodies involved can exist: the overpressures required are too high. As a result, we have now begun to explore the use of viscoelastic rheologies that yield more deformation at less intense overpressures [9].

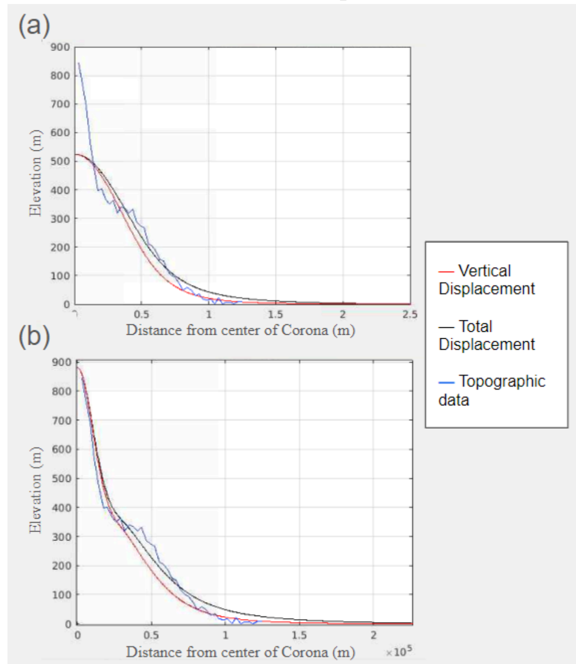

Figure 1. Model fit to topographic data from Krumine South. (a) Monte carlo search output (b) Model optimization without search algorithm.

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