Geophysical Research Abstracts, Vol. 7, 06472, 2005
SRef-ID: 1607-7962/gra/EGU05-A-06472

Martian crustal differentiation: what is the effect of the gabbro-eclogite transition?

S. Ferrachat (1) and D. Breuer (2)

(1) Instit. fuer Planetologie, Westfaelische Wilhelms-Uni. Muenster, and Instit. fuer Planetenforschung, DLR-Berlin ; (2) Instit. fuer Planetenforschung, DLR-Berlin ; (sylvaine.ferrachat@dlr.de, doris.breuer@dlr.de, fax: (49) 30 670 55 303)

Getting information about the martian crust thickness is of primary interest for better understanding Mars dynamics and secular evolution. On a more specific point of view, the crustal thickness is crucial to better constrain how the Mars silicate layer differentiated into crust and mantle. On the one hand, coupled gravity-topography models usually predict a mean crustal thickness of about 50 km (Zuber et al, Science 287 2000) to 100 km (Turcotte et al, JGR 107 2002), local values ranging from basically 0 to 150-200 km. On the other hand, thermal evolution models (Breuer & Spohn JGR 108 2003, Hauck & Phillips, JGR 107 2002) tend to predict a mean crustal thickness close to the highest estimates of the former models, or even larger, depending on the initial temperature and on the viscosity. A very thick crust (from 100 to 250 km) is also inferred from global interior structure models (Sohl & Spohn, JGR 102 1997). From SNC analysis and surface spectroscopy measurements, the martian crust is thought to be mainly basaltic, with possible andesitic material at the surface of the Northern hemisphere. In these conditions, the gabbro-eclogite type transition might be a relevant phenomenon to assess the dynamics of the martian crust. Depending on the temperature profile, this transition can indeed be initiated at a depth of about 50 to 100 km (Babeyko & Zharkov, PEPI 117 2000). Since it induces higher densities in the eclogitic part relative to the basaltic one, it may produce some Rayleigh-Taylor instabilities and consequently crustal delamination. In this study, we investigate the stability of the martian crust with respect to the gabbro-eclogite transition. We discuss the results in terms of critical crustal thickness above which crustal delamination will occur, yielding a possible feedback on the monotonically growing crust in the thermal evolution models. We use a 2D convection model to address this question. In this

problem, the local rheology is crucial: we implement variable viscosity, depending on both local temperature and specific material properties. Internal heat production distribution and temperature profiles are also discussed.