

Author's Accepted Manuscript

Plate tectonics on rocky exoplanets: Influence of initial conditions and mantle rheology

Lena Noack, Doris Breuer



www.elsevier.com/locate/pss

PII: S0032-0633(13)00161-X
DOI: <http://dx.doi.org/10.1016/j.pss.2013.06.020>
Reference: PSS3557

To appear in: *Planetary and Space Science*

Received date: 28 February 2013
Revised date: 5 June 2013
Accepted date: 21 June 2013

Cite this article as: Lena Noack, Doris Breuer, Plate tectonics on rocky exoplanets: Influence of initial conditions and mantle rheology, *Planetary and Space Science*, <http://dx.doi.org/10.1016/j.pss.2013.06.020>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Plate tectonics on rocky exoplanets: Influence of initial conditions and mantle rheology**Lena Noack^{1,2,*} and Doris Breuer¹⁾**

¹⁾ German Aerospace Center, Rutherfordstr. 2, 12489 Berlin, Germany.

²⁾ Royal Observatory of Belgium, Avenue Circulaire 3, 1180 Brussels, Belgium.

^{*}) Corresponding author: Lena Noack, lena.noack@oma.be, +32 23736 754

Abstract

Several numerical studies have been published in the past years speculating about the existence of plate tectonics on large exoplanets. They focus on aspects like the mass of a planet, the interior heating rate and the occurrence of water in the mantle. Different trends in the propensity for plate tectonics have been observed in particular when varying the planetary mass: with increasing mass the surface mobilization is found to be either more, equally or less likely than on Earth. These studies and their implications are, however, difficult to compare as they assume different initial conditions and parameter sets, and either neglect the pressure effect on the viscosity or assume a rather small influence of the pressure on the rheology. Furthermore, the thermal evolution of the planets (i.e. cooling of core and decrease in radioactive heat sources with time) is typically neglected.

In our study, we use a 2D finite volume code and apply a pseudo-plastic rheology. We investigate how a strong pressure-dependence of the viscosity influences not only the convective regime in the lower mantle, but also in the upper mantle and hence the likelihood to obtain plate tectonics. We investigate how our results change when either assuming a wet or a dry rheology or when employing different initial conditions, focussing on the initial

Download English Version:

<https://daneshyari.com/en/article/8143719>

Download Persian Version:

<https://daneshyari.com/article/8143719>

[Daneshyari.com](https://daneshyari.com)