Stability of hydrous ringwoodite in the Martian mantle

G. GANSKOW[1], F. LANGENHORST[1], K. POLLOK[1], D. FROST[2] AND H. KEPPLER[2]

[1]Institut für Geowissenschaften, Universität Jena, Burgweg 11, D-07749 Jena, Germany (geertje.ganskow@uni-jena.de)
[2]Bayerisches Geoinstitut, Universität Bayreuth, D-95440 Bayreuth, Germany

Introduction

Branching networks of valleys and huge outflow channels on Mars provide evidence for the previous existence of water on its planetary surface. The water was probably once stored in the Martian interior and was then liberated to the surface. To understand this process, knowledge of Martian mantle structure and stability of hydrous phases is required.

Experiments

In order to identify possible hydrous high-pressure minerals in the Martian mantle and to determine their stability fields, we have conducted a series of multi-anvil experiments at the Bayerisches Geoinstitut, University of Bayreuth. First experiments were performed at pressures of 15 to 18 GPa and at variable temperatures between 750°C and 1150°C using a mixture of 2 $Mg(OH)_2$ + Fe_2SiO_4 + SiO_2 as starting material. Experimental run products were examined by transmission electron microscopy, microprobe, IR and RAMAN spectroscopy.

Results and discussion

At 15 GPa and temperatures between 750° and 1150 °C cubic ringwoodite exists as single phase. Microprobe analyses yield the expected ringwoodite composition nominally equivalent to Fa48. At 18 GPa and 950 °C we observe a change to the three-phase assemblage ringwoodite + wüstite + stishovite, while the specimen compressed to the same pressure was melted at 1150°C. In comparison to the dry, Mg-rich system [1], the enhanced iron and water contents lower thus the transformation pressure by 3 GPa (from 21 GPa to 18 GPa) as well as the liquidus temperatures by at least 500°C. IR spectroscopy attests to an uptake of about 2800 ppm H_2O. To understand the incorporation mechanism of water we have also used Fe L_{32} electron energy loss spectroscopy, revealing that the iron is purely ferrous. Thus, the water is probably accommodated by the replacement of Mg^{2+} by $2H^+$.

Reference

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Application of the field seismic data in the security assessment of coal mining in Marbi Area

E.G. GAO* AND S.Y. SONG

CAS Key Laboratory of Crust-Mantle Materials and Environments, School of Earth and Space Sciences, University of Science and Technology of China, Hefei 230026, China (*grg@ustc.edu.cn)

Introduction

The Marbi area is located in Shanxi Province in north China, where plenty of coal resources are mined. In the past dacades, a large amount of seismic exploration work with the aim at coal recources has been done in the area successively. Based on the foundation of seismic exploration data, this study focuses on the structure of sedimentary basin and the security assessment of coal mining in the Marbi area.

Experiment and Results

Our data processing, combined with the existed local geological information, can be summarized concisely into the following steps (Claerbout, 1985; Ecker *et al*., 1996; Li *et al*., 2006): (1) carefully checked the positions of field shot-receiver pairs to obtain accurate localities; (2) calculated the static corrections in details; (3) eliminated bad shots, bad courses and abnormal amplitudes; (4) selected appropriate deconvolution parameters; (5) made accurate velocity analysis and got residual static corrections through stacking; (6) carried out the post stack processing and precise migration.

The result shows that there is a large syncline structure in the center of the region, suggesting long-term tectonic compression influenced Marbi area since Triassic. This crustal deformation was accompanied with dense rock cracking in both coal sills and their wall rocks, which could lead to the security difficulty and potential danger to the deep exploitation for coal mines.

Acknowledgment

The study is supported by the National Natural Science Foundation of China (40674071) and the Foundation of Hubei Provincal Theoretical-Technological Key Lab for Oil-Natural Gas Exploration and Development (YQ2006KF11).

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