Lithochemical characteristics of volcanic rocks during upper Jurassic –early Cretaceous, Songliao Basin, China

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There had frequent volcanic eruption during upper Jurassic –early Cretaceous in Songliao basin. Also, there had many kinds of volcanic rocks such as rhyolite, mixpah, dacite, basalt, andesite, tuff and volcanic breccia etc. Lithochemical characteristics of volcanic rocks are as follows.

Most of the volcanic rocks are subalkalic and haven't iron rich evolution trend. The results of major elements analysis show that the amount of Na_2O, TiO_2, $A1_2O_3$, Fe_2O_3, FeO, MnO, MgO, CaO, P_2O_5 have negative correlation with SiO_2 while that of K_2O has positive correlation with SiO_2 and indicate from above that soda metasomatism happened after volcanic rock formation.

Results of rare earth elements analysis show that most of the volcanic rocks are light rare earth elements (LREE)-rich (all data are standardized using original mantle data of Hofmann, A.W., [1]). rhyolites have apparent Eu negative anomaly while dacites have weak or haven't Eu negative anomaly and basalts, andesibasalts, andesites haven't Eu negative anomaly. They may have similar origin.

Results of trace elements analysis show that all of the volcanic rocks except basalt have apparent peak of Pb and valley of Nb, Ta. These indicate that volcanic rocks except basalt which may be formed by shell-mantle interacting while basalt may be formed by mantle magma.

[1] Hofmann, A.W. (1988) *Earth Planet. Sci.Lett.* **90**, 297-314.

Effects of spin crossover on Iron partitioning in deep Earth

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Introduction

The spin state of iron in the predominant lower mantle phases perovkite, its high-pressure polymorph post-perovskite, and its likely companion ferropericlase, is a fundamental parameter that may affect the physical properties and chemical equilibrium of the deep Earth. The effect of spin crossover on iron partiitioning among various phases in the lower mantle and core remains poorly understood, mainly due to limited understanding of the nature of spin crossover and the thermodyanmics and kinetics of iron partitioning under relevant pressure and temperature conditions [1,2]. Here we report new experimental data on the spin state of iron in perovskte and post-perovskite at pressures up to 145 GPa, and explore the implications for the deep Earth chemistry.

Synchrotron Mössbauer Spectroscopy (SMS)

In order to investigate pressure-induced spin crossover in the lower mantle, we conducted a SMS study at the undulabor beamline 3-ID-D of the Advanced Photon Source (APS), Argonne National Laboratory [2], on several perovskite and post-perovskite samples synthesized from ^{57}Fe-enriched starting materials. SMS spectra were collected at room temperature and up to 145 GPa. The CONUSS program [3] was used to extract hyperfine parameters.

Implications for Iron Partitioning

A spin crossover is accompanied by changes in internal energy, volume, and entropy and may therefore affect chemical euqilibrium between iron-bearing phases. Simplified analyses reveal that susequent to a spin crossover, iron may become gradually enriched in the low-spin phase whose crystal-field stabilization energy (CFSE) grows faster with increasing pressure. The distribution of iron in the lower mantle and core is further influenced by the strong affinity of ferric iron for perovskite and by the slow diffusion of iron in perovksite.

[1] Badro *et al.* (2003) *Science* **300**, 383-386. [2] Li (2007) *Post-Perovskite, the Last Mantle Phase Transition*, 47-69. [3] Sturhahn (2000) *Hyperfine Interact.* **125**, 149-172.