

## **The low-temperature shift of antigorite dehydration in the presence of sodium chloride: In situ diffraction study up to 3 GPa and 700 °C**

**ANNA YU LIKHACHEVA<sup>1,2,\*</sup>, SERGEY V. RASHCHENKO<sup>1,2</sup>, ANNA I. SEMERIKOVA<sup>1,2</sup>,  
ALEXANDR V. ROMANENKO<sup>1,2</sup>, KONSTANTIN GLAZYRIN<sup>3</sup>, AND OLEG G. SAFONOV<sup>4</sup>**

<sup>1</sup>Sobolev Institute of Geology and Mineralogy, Russian Academy of Science, Siberian Branch, 3 Koptyug Avenue, Novosibirsk, Novosibirsk region 630090, Russia

<sup>2</sup>Novosibirsk State University, Pirogova str. 1, Novosibirsk, Novosibirsk region 630090, Russia

<sup>3</sup>Deutsches Elektronen Synchrotron (DESY), PETRA III, Notkestrasse 85, Hamburg 22607, Germany

<sup>4</sup>Korzhinskii Institute of Experimental Mineralogy RAS, ul. ac. Ossipiana 4, Moscow region, Chernogolovka, 142432 Russia

### **ABSTRACT**

The dehydration of serpentine mineral antigorite,  $\text{Mg}_{2.8}\text{Si}_2\text{O}_5(\text{OH})_{3.6}$ , is regarded as the key step in metamorphic transformation of ultramafic hydrated rocks in subduction zones, which affects seismicity and feeds volcanic activity. The abundance of alkali-chloride brines derived from deep subduction/upper mantle sources implies the possibility of a large control of the  $\text{H}_2\text{O}$  activity by the dissolved salts. The present study examines the effect of alkali chlorides, lowering the  $\text{H}_2\text{O}$  activity in fluid, on antigorite stability at high pressure. The decomposition of natural antigorite (Ural) in the presence of a halite-saturated  $\text{NaCl-H}_2\text{O}$  fluid was studied up to 3 GPa and 700 °C by in situ X-ray diffraction combined with resistively heated diamond-anvil cell. Reference experiments were also performed on salt-free sample. At 1.5–3 GPa in the presence of halite-saturated fluid ( $X_{\text{NaCl}} \approx 0.15$ ), antigorite decomposes to an intermediate product assemblage of talc+forsterite at about 550 °C, which is  $\approx 150$  °C lower compared to salt-free  $\text{H}_2\text{O}$ -unsaturated system. Such a low-temperature shift supports the previous models of a broadened  $P$ - $T$  area of serpentinite dehydration in the subducting slab. In addition, the present experiments reveal active dissolution of the product Mg silicates, first of all forsterite, in the  $\text{NaCl-H}_2\text{O}$  fluid at 600–700 °C/1.5–3 GPa. This implies that dehydrated serpentinites are a potential source of fluids enriched in MgO and  $\text{SiO}_2$ , which play an important role in deep metasomatic processes.

**Keywords:** Antigorite, decomposition, subduction zone, NaCl aqueous fluid,  $\text{H}_2\text{O}$  activity, high pressure, high temperature, in situ X-ray diffraction