THE FIRST FINDING OF HIGH-PRESSURE HYDROUS SILICATE MG$_3$SI$_4$ (OH) *N*H$_2$O (10Å PHASE) IN A MANTLE ROCK

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10 Å Phase – a dense hydrous magnesium silicate (DHMS) - has been synthesized at 500 ^oC, 30 – 90 kbars [1-10] by the following reactions:

(1)	serpentine $\rightarrow$ forsterite + 10Å phase + H_2O	[8,]
(2)	MgO + SiO_2 (gels) $\rightarrow$ 10 Å phase	[3]
(3)	talc + H_2O $\rightarrow$ 10 Å фаза	[4,5,7,9]
(4)	brucite + SiO_2 (gel) $\rightarrow$ 10 Åфаза	[6]

The chemical composition of 10 Å phase corresponds to the chemical formula of talc with excess of water; where the n value varies as 0.65 [3]; 1.0 [1], 2.0 [7]. The *PT* stability field for 10 Å phase was determined by [3,4,9,10].

10 Å phase as well as the other DHMSs synthesized at high-pressures in MgO-SiO_2-H_2O system is considered as storage site for H_2O in the mantle. However natural DHMSs (with the exception of clinihumite) have not as yet been found.

10 Å phase is first discovered during our TEM investigation of olivine nodules and megacrysts from kimberlites [11]. 10 Å phase and the products of 10 Å phase alteration (serpentine and talc) were identified in transmission electron microscope on the base of the chemical analysis data (including detection of water content) and *d*-dimensions. FTIR data gave additional evidence for the 10 Å phase, talc and serpentine occurrence in olivine nodules [11]. 10 Å phase was observed as (i) nanometer-sized inclusions and (ii) thin veins developed along healed microcracks. 10 Å phase and the host olivine are always in strong orientation relationships to each other.

(i) Nano-inclusions are several hundred nanometers in size; they are hexagon-like in shape with elongation along ***c***-direction of the olivine host. 10 Å phase fills equatorial part of inclusions (equatorial plane is parallel to (100) of olivine), while two polar parts of inclusion at the boundaries with (100) planes of olivine look “empty” and possibly are filled by water fluid. (ii) The veins developed along healed microcracks are several hundred in thickness.

The results of observations show that both reactions of the 10 Å phase formation and alteration were different in inclusions and microcracks. The precursor phase of 10 Å phase could be non-stoichiometric olivine: hydrous olivine $Mg_{2-x}SiO_4H_{2x}$ in inclusions and $Mg_{2-x}SiO_{4-x}$ in cracks.

The following reactions of 10 Å phase formation are proposed:

(i) olivine $\rightarrow$ hydrous olivine $(Mg, Fe)_{2-x}SiO_4H_{2x}$ $\rightarrow$ 10Å phase + H_2O (nano-inclusions)
(ii) olivine $(Mg_{2-x}Fe_x)_2SiO_4$ + O_2 $\rightarrow$ nonstoichiometric olivine $Mg_{2-x}SiO_{4-x}$ + hematite;
nonstoichiometric olivine $Mg_{2-x}SiO_{4-x}$ $\rightarrow$ 10Å phase + forsterite (microcracks)

Microcracks represent “open system” and dehydration of 10 Å phase proceeds in opposite direction to reaction (3). Relicts of 10 Å phase are observed at the contacts with the olivine host whereas middle parts of veins are substituted for talc.

Inclusions represent “closed system” and 10 Å phase + water (inclusion) interacts with surrounded olivine to produce serpentine + talc (reaction of “auto-serpentinization”).

10Å phase (inclusion) + H_2O (inclusion) + olivine (matrix) = serpentine + talc

Water fluid filled caverns at polar parts of inclusion are used during reaction and the polar parts began empty. 10 Å phase is mainly substituted for talk while new-formed serpentine substitutes surrounding olivine and the inclusion grows by penetrating into olivine.

These investigations demonstrate the first finding of 10 Å phase in nature. The reactions of 10 Å phase formation proposed on the base of the present data are other than the reactions used in experiments (reactions 1-3). The results led to conclusion that point defects in olivine together with deformation process played the main role in the 10 Å phase formation. On the base of the available data on the *PT*-sability field of olivine in respect to talc + H_2O and enstatite + coesite+H_2O, on one side, and in respect to serpentine, on the other side, we conclude that 10 Å phase formed in nodules and megacrysts at pressures not lower than 30-40 kbar. Such pressures correspond to the upper mantle conditions. The direction of reactions of both formation and alteration of 10 Å phase indicate the conditions of decompression at T<700 ^oC.

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