# Tectonic evolution of the Qinling-Tongbai-Dabie orogenic belt

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The Qinling-Tongbai-Dabie-Sulu orogenic belt marks the suture between the North and South China Blocks in Central China, forming one of the most important orogens in the eastern Asia. Although it has been extensively studied for more than 20 years, there are hot controversies about the location and number of sutures and the timing of arc-continent and continent-continent collisions during the convergence between the North and South China Blocks. The Dabie-Sulu orogenic belt is characterized by the occurrence of Triassic UHP eclogite-facies metamorphic rocks. On the other hand, there are Paleozoic events of arc-continent collision in the Qinling-Tongbai orogenic belts that were subsequently followed by the Triassic process of continental collision. Rifting occurred at the northern part of the Yangtze Block, synchronous with the middle Paleozoic collision, and was followed by the opening of the Paleo-Tethyan ocean during the Late Paleozoic. These indicate that the Qinling-Dabie-Sulu orogen is a typical multiple evolution orogen, including the Early to Middle Paleozoic continental subduction and collision, the Silurian extension and rifting in relation to the opening of the Paleo-Tethyan ocean during the Late Paleozoic, and the Triassic continental material subduction, HP-UHP metamorphism and subsequent exhumation. Therefore, it is a complex orogenic belt on the time and location of arc-continent and continent-continent collisions between the North and South China blocks, and the amalgamation of the two continental blocks along the Qinling-Tongbai-Dabie-Sulu orogenic belt is a multistage process that spans about 300 Ma.

# Composition and structure of the 3.65 Å phase: A DHMS with exclusively six-fold coordinated Si

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Dense Hydrous Magnesium Silicates (DHMS) are suggested to be important hosts and carriers of water under hydrous conditions of the Earth´s mantle and in subduction zones. Therefore, their study is central to the understanding of the Earth´s deep water cycle. The so-called 3.65 Å phase, named after the *d*-value of its prominent X-ray reflection, is the least well-characterized phase of the DHMS family, as neither its chemical composition nor its structure are well constrained.

In our recent study [1], the 3.65 Å phase was synthesized in the system $MgO$-$SiO_2$-$H_2O$ at 10 GPa and 425 °C for 77 hours run duration in a multi-anvil press from a gel plus excess water. The composition of the 3.65 Å phase was determined to be $MgSi(OH)_6$ by combining results from SEM-, TEM-, EMP-, IR- and Raman-analysis. Powder XRD combined with Rietveld refinement revealed the 3.65 Å phase to be isostructural with δ-$Al(OH)_3$. Its structure can be described as an A-site vacant perovskite with probably long-range random distribution of Si and Mg at octahedral sites. The 3.65 Å phase represents beside phase D the second DHMS with exclusively six-fold coordinated Si.

The H-positions could not be determined by the powder XRD Rietveld refinement. Therefore, the apparent orthorhombic space group – either *Pnam* with protons in unordered configuration, or $P2_12_12_1$ with ordered H-positions – was ambiguous. Preliminary first-principles DFT-calculations predict the structure with $P2_12_12_1$ or monoclinic $P2_1$ symmetry with ordered Mg and Si as the most stable structure at ambient conditions.

The 3.65 Å phase is stable at pressures above about 9.0 GPa and decomposes above about 500 °C due to the reaction 3.65 Å phase = high-clinoenstatite + water. This limited P-T-stability together with its high water content of 35 wt.% makes it a rather unrealistic phase in the Earth´s mantle. If at all, the 3.65 Å phase might only exist under hydrous conditions in very limited areas, i.e., in the coldest parts of old and extremly fast subducted slabs, e.g., Tonga.

[1] Wunder *et al.* (2011) *Am. Mineral.*, in press, DOI: 10.2138/am.2011.3782.