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Archean hot subduction: Evidence from the complexes in the area of Northwest Hebei, China

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In the northern area of North China Craton, there exists a WE-striking Shangyi–Chongli–Chicheng–Labagoumen deep fault zone with a length of over 250 km and width of 3–6 km. To the south is an Archean granulite belt and to the north the Hongqiyingzi Group, which is metamorphosed to amphibolite facies. The complexes along the fault zone mainly occur in the Shangyi area of North Hebei and the Labagoumen area in Beijing. Studies on field geology, petrology and geochemistry indicate that the rock associations in both areas contain MORB-type or Nb-enriched basalts and cumulate gabbros, now metamorphosed to amphibolites, ultramafic rocks (plagioclase-bearing cumulate pyroxenite), a metatrolite enclave, red banded chert, serpentine marble with calcite, dolomite and aragonite micro-spherulites (interpreted as fossils of early life), low-Al₂O₃ and high HREE TTG (2512 ± 19 Ma), K-rich and high Cr (Closepet-like) granite and sanukitoids. These rocks have been preliminarily regarded as amphibolite-facies fragments of Neoproterozoic ancient oceanic crust [1]. Furthermore, a high-pressure granulite belt to its south is parallel to the fragment belt, with Gt–Cpx–Pl–Qtz mineral composition and conditions of formation of temperature of 800–1000 °C and pressure of 1.0–1.6 GPa. Magmatic rocks related to this Neoproterozoic hot subduction include a TTG rock suite, Closepet-like granite and sanukitoids. There are two types of TTGs in Northwest Hebei, based on content of Al₂O₃. Low Al₂O₃ TTGs distributed in the vicinity of the Shangyi ancient oceanic crust shows a distinct negative Eu anomaly, low Al₂O₃ and enriched HREE, which indicates low-pressure partial-melting behavior of ancient oceanic crust basalts. High Al₂O₃ TTGs lie to the south of the Shangyi ancient oceanic crust. Red K-rich and high Cr Closepet-like granites have been identified in the two areas of Northwest Hebei. Geological evidence indicates that they are the anatexitic melting products of high Al₂O₃ TTG; they are intruded by sanukitoids and closely related to hot subduction. Sanukitoids in the area of Northwest Hebei can be divided into two major groups. Intermediate–acid sanukitoids are found as monzodioritic veins in Closepet-like granite and quartz monzonite. Intermediate–basic sanukitoids are monzodioritic rock bodies and gabbroic dykes. Basic sanukitoids generally preserve gabbroic and diabasic textures. Sanukitoids represent an evolutionary series from acid via intermediate to basic rocks (quartz monzonite–monzodiorite–gabbro) [2]. Our studies suggest that there exist not only wide rock types related to hot subduction in the area of Northwest Hebei but also an obvious regional zonation related to a plate tectonic framework during the Neoproterozoic era. Furthermore, hot subduction without blueschist and eclogite, characteristic of Archean plate tectonics, shows some similarity to but also great difference from modern cold subduction.

References:

[1] Wang R M et al. (2009) *Acta Geologica Sinica* 83(3): 535-543

[2] Wang R M et al. (2014) *Exploring the Secrets of ancient ocean crust*. Seismological Press (in Chinese)

