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The Garnet Exsolution Texture and Petrological Investigations on a Typical Pelitic Granulite from Eastern Himalaya Syntaxis

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The ultrahigh pressure (UHP) metamorphism has been documented in the Western Synataxis (Mukherjee et al., 2003) and central part of the high Himalayan (Wang et al., 2015). However, high pressure granulite facies but not UHP metamorphism had been reported by several researchers (e.g. Zhang et al., 2015). The reason why there are differences of the metamorphic degrees between Eastern Synataxis and Western Synataxis in the high Himalayan orogeny confused researchers for several years. In order to testify whether the rock in the Eastern Himalayan Synataxis experienced UHP metamorphism, an atypical granulite near Nanche Barwa with mineral assemblage of garnet, biotite, othopyroxene, cordierite, plagioclase, quartz, rutile and ilmenite has been studied by petrological and phase equilibrium methods.

Two types of garnet have been identified in the thin section. Type 1 garnet with rutile and ilmenite exsolution lamella have obvious prograde composition zoning with pyrope increase and grossular decrease from core to rim. Type 2 garnet are characterized by relatively uniform composition, which can be compared with the rim composition of the type 1 garnet. This may indicate the formation sequence of these garnets. No exsolution texture has been found in type 2 garnet whereas plenty of rutile and ilmenite inclusions are preserved. Metamorphic phase equilibrium calculations have indicated that this granulite had experienced prograde metamorphism at least 2 GPa, 660℃ and followed by the 'peak' temperature at 1.2 GPa, 800℃ recorded by the garnet rim compositions. The 'peak' temperature is not the real T_{max}, which is considered to be the point where retrograde *P-T* path meet the solidus while part of melt have lost from the system. The peak pressure is also hard to predict only with phase equilibrium modeling.

The Ti-bearing mineral like rutile and ilmenite exsolusion texture from garnet was reported in eclogite and garnet peridotite as an indicator of UHP metamorphism (e.g. Zhang et al., 2003; van Roermund et al., 2000) and also gramulite as UHT metamorphism (e.g. Marschall et al., 2003). With mass balance method, we calculated the exsolution rutile back to garnet at 0.6 wt% content, which equal to the pressure at 3 GPa by the former experimental data. With the high pressure metamorphic conditions shown in the prograde *P-T* path,

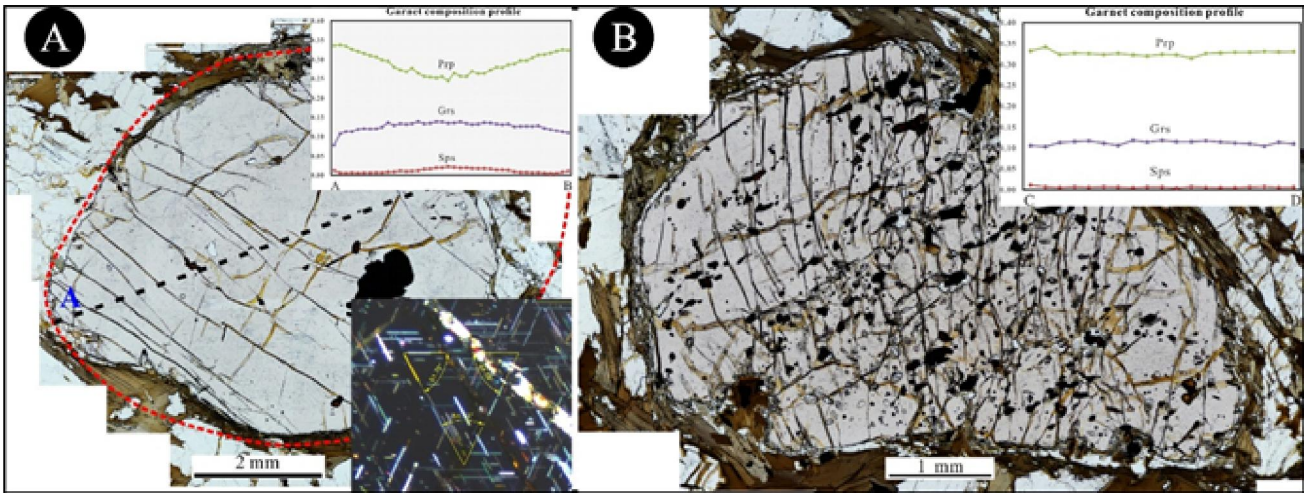

Fig.1 The photo and composition profile of two types of garent

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we deduct this studied granulite may have also experienced UHP metamorphism in the Eastern Synataxis of high Himalayan. This is also supported by the similar metamorphic *P-T* path between the studied granulite and the UHP rocks in the western Synataxis.

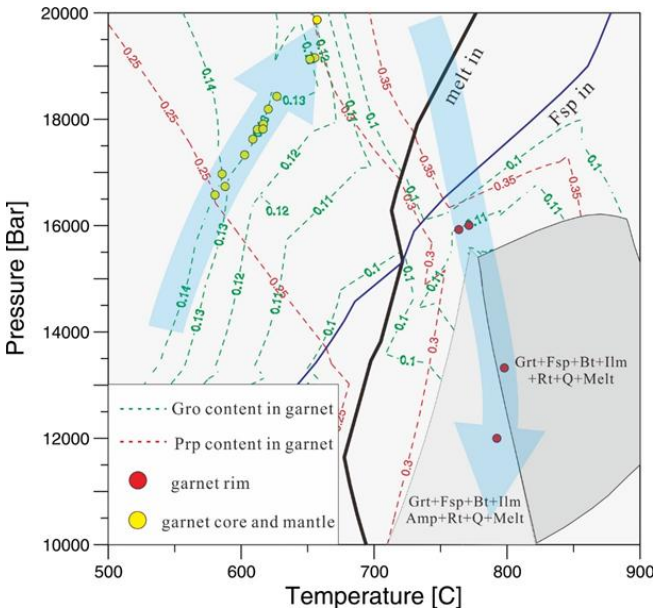

Fig.2 The pseudosection of the grumulite in the eastern Synataxis of high Himalayan

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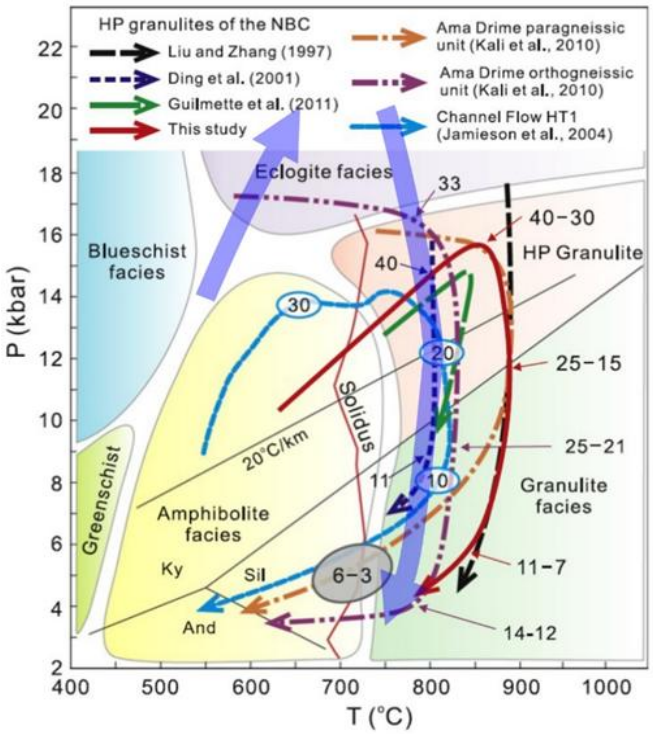

Fig.3 The comparison of the *P-T* path in the eastern and western synataxis