The Metamorphic Evolution of the Xilang Eclogite in the Sumdo Metamorphic Belt—Constrained by Phase Equilibrium Modeling and Raman Microspectroscopy

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Abstracts: Eclogitic oceanic crust material record abundant information in understanding the processes in the subduction zone. Due to the high density of the subducted oceanic crust in mantle depth, it is rarely exhumed to the earth surface, making it hard to acknowledge the evolution and dynamic behaviors of the oceanic eclogites. The Sumdo eclogite-bearing metamorphic belt, lies between north and south Lhasa terranes, provide us a nature laboratory to study the metamorphic evolution of the oceanic eclogites (Li et al., 2019; Yang et al., 2009; Zhang et al., 2019a; Zhang et al., 2019b). The phase equilibrium modelling, combined with detailed petrological investigations, has been performed on the newly discovered Xilang eclogite in the Sumdo metamorphic belt in Tibet and got the near peak metamorphic conditions of ca. 539 °C at 1.84 GPa and a fast exhumation P-T path with big slope (Fig. 1). Quartz inclusions in garnet from high pressure rocks has been proved to preserve residue pressure during fast exhumation process, which can be measured by laser Raman microspectroscopy. By comparison of the obtained residue pressure in different areas of the Sumdo belt, it shows that the quartz residue pressure has positive relationship with the peak metamorphic conditions in the same area with similar exhumation processes (Fig. 2a), which can be used to identify high pressure metamorphism on extensively retrograde rocks. It decreases with the exhumation duration of the host rocks in the Sumdo metamorphic belt (Fig. 2b), which is also confirmed by numerically modelling of the mechanical solutions for viscous relaxation of the host mineral (Zhong et al., 2018). This may provide us a new way to get geochronological information even without applying isotopic investigations.

Key words: metamorphic evolution, Sumdo metamorphic belt, Raman geobarometry, pseudosection, exhumation mechanism of oceanic crust

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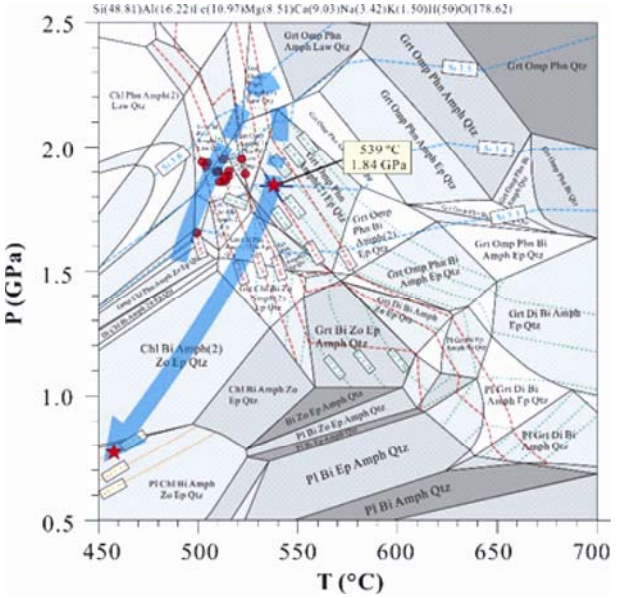

Fig. 1. P-T pseudosection calculated in the system of NCKFMASHO (+H_2O) for Xilang elcogite. The pseudosection was contoured with isopleths of grossular (e.g. Gr0.28) and pyrope (e.g. P0.08) contents in garnet and Si content in phengite (e.g. S3.4). The red points represent the garnet composition plotted according to grossular and pyrope content from microprobe. The blue arrow with both dash line and solid line shows the suggested P-T path based on garnet composition and mineral assemblages. The peak metamorphic conditions recorded by the rim of garnet is shown in the yellow box with red star.

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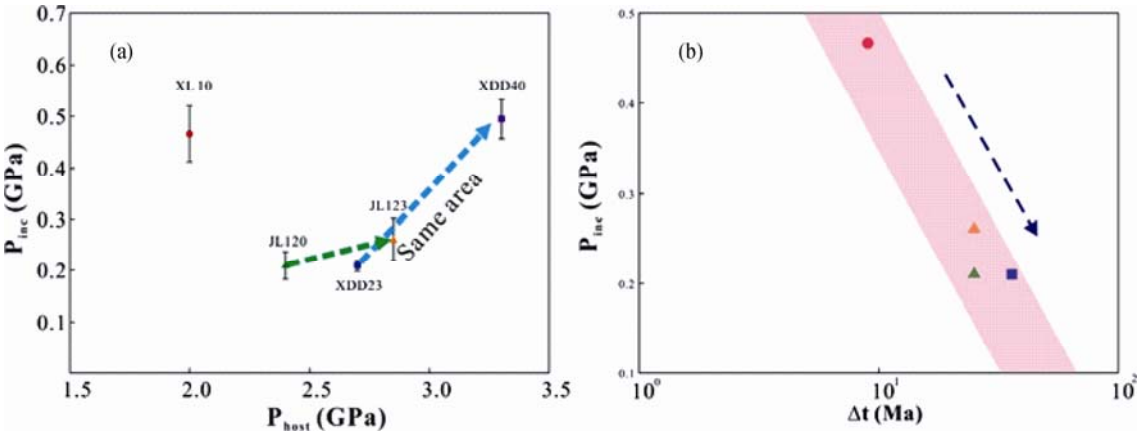

Fig. 2. The relationship between residue pressure in quartz Pinc and pressure of host minerals Phost and exhumation duration of eclogites Δt.

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