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Discovery of eclogite in the Bangong Co–Nujiang ophiolitic mélange, central Tibet, and tectonic implications

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ABSTRACT

An eclogite has been recently identified within ophiolitic mélange in the western segment of the Bangong Co–Nujiang suture zone, at Shemalagou in the Gaize area of central Tibet. The eclogite consists of garnet, omphacite, phengite, rutile, quartz, diopside, and amphibole. The omphacite, which has not been recognized in the suture zone until this study, occurs as rare relics within diopside grains in the eclogite. Phase equilibria modeling shows that the eclogite formed under *P–T* conditions of 22–28 kbar and 600–650 °C with a low geothermal gradient of ca. 8 °C/km, suggesting that it formed during the subduction of oceanic crust. The protoliths of the eclogite and coexisting garnet amphibolites have geochemical characteristics similar to those of normal mid-ocean ridge basalt (N-MORB), confirming that the eclogites formed from oceanic crust. The presence of high-pressure (HP) eclogite indicates that the ophiolitic mélange in the Bangong Co–Nujiang suture zone underwent oceanic subduction and was subsequently exhumed. We conclude that this ophiolitic belt represents a newly identified HP metamorphic belt in the Tibetan Plateau, adding to the previously recognized Songduo and Longmucuo–Shuanghu eclogite belts. This discovery will result in an improved understanding of the tectonic evolution of the Bangong Co–Nujiang suture zone and the Tibetan Plateau as a whole.

1. Introduction

In recent years, two eclogite belts have been identified on the Tibetan Plateau, namely the Songduo eclogite belt in the Lhasa Block (e.g., Li et al., 2009a, 2009b; Yang et al., 2009; Zeng et al., 2009; Zhang et al., 2014b), and the Longmucuo–Shuanghu eclogite belt in the Qiangtang Block (e.g., Li et al., 2006; Li et al., 2009a, 2009b; Zhang et al., 2006; Zhai et al., 2009; Zhai et al., 2011a, 2011b; Zhu et al., 2013). In addition, outcrops of mafic granulite and garnet amphibolite have been reported in the Bangong Co–Nujiang suture zone (Xia et al., 2013; Wang et al., 2015; Zhang et al., 2015), and at two sites the rocks have been identifiedas "eclogite" (Xia et al., 2013; Zhang et al., 2015), although omphacite was not observed. Therefore, it remains debated whether the Bangong Co–Nujiang suture zone contains high-pressure or ultrahigh-pressure (UHP) metamorphic rocks. To better understand the tectonic evolution of the Bangong Co–Nujiang suture zone, it is

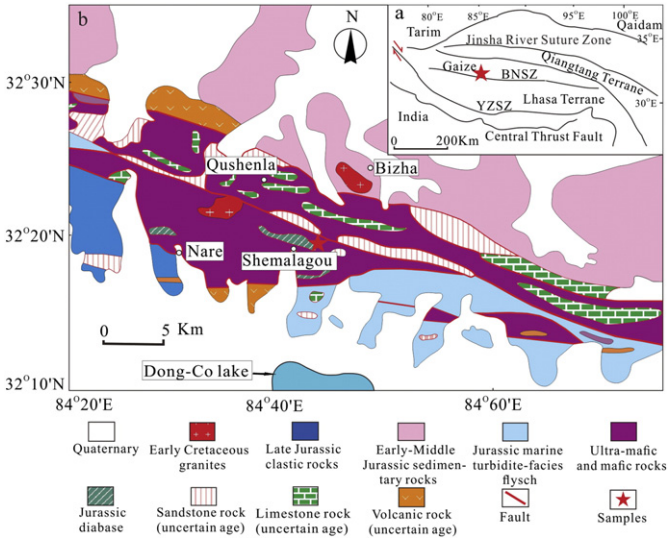

Fig. 1. (a) Simplified tectonic map in the Tibetan Plateau (modified from Wang et al., 2008). BNSN: Bangong Co–Nujiang Suture Zone. YZSZ: Yarlung Zangbo River Suture Zone. (b) Geological map of ophiolitic mélange in the Dong-Co area (modified from Wang et al., 2015).

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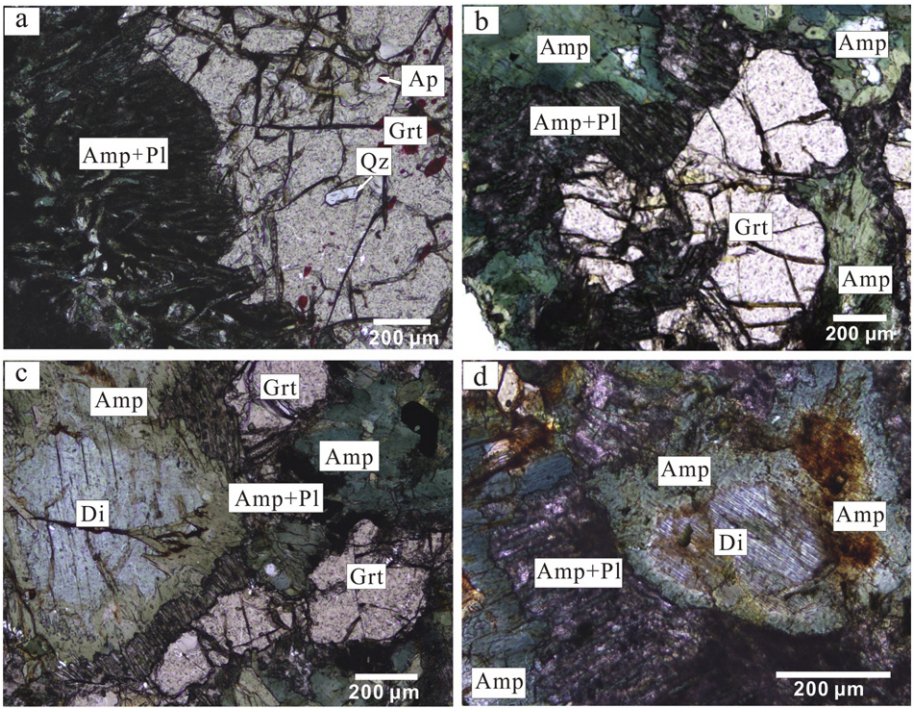

Fig. 2. Photomicrographs of the retrograde eclogite. (a and b) Garnet with amphibole + plagioclase symplectites. (c and d) Relics of omphacite within diopside, which has rims of secondary amphibole.

necessary to further investigate the metamorphic history of the mafic granulite and garnet amphibolite in this zone. This study is the first to identify eclogite from the mafic granulite reported by Wang et al. (2015) at Shemalagou (32°19′41″N, 84°44′15″E), north of Dong-Co lake, in the western segment of the Bangong Co–Nujiang belt, indicating that HP metamorphism occurred in the Bangong Co–Nujiang suture zone. We also discuss the tectonic significance of the eclogite in terms of the evolution of the Bangong Co–Nujiang Tethys. The mineral abbreviations used in this study are as follows: Ab = Albite, Ac = Acmite, Ae = Aegirine, Alm = Almandine, Amp = Amphibole, An = Anorthite, And = Andradite, Ap = Apatite, Bt = Biotite, Chl = Chlorite, Coe = Coesite, Cpx = Clinopyroxene, Di = Diopside, En = Enstatite, Ep =

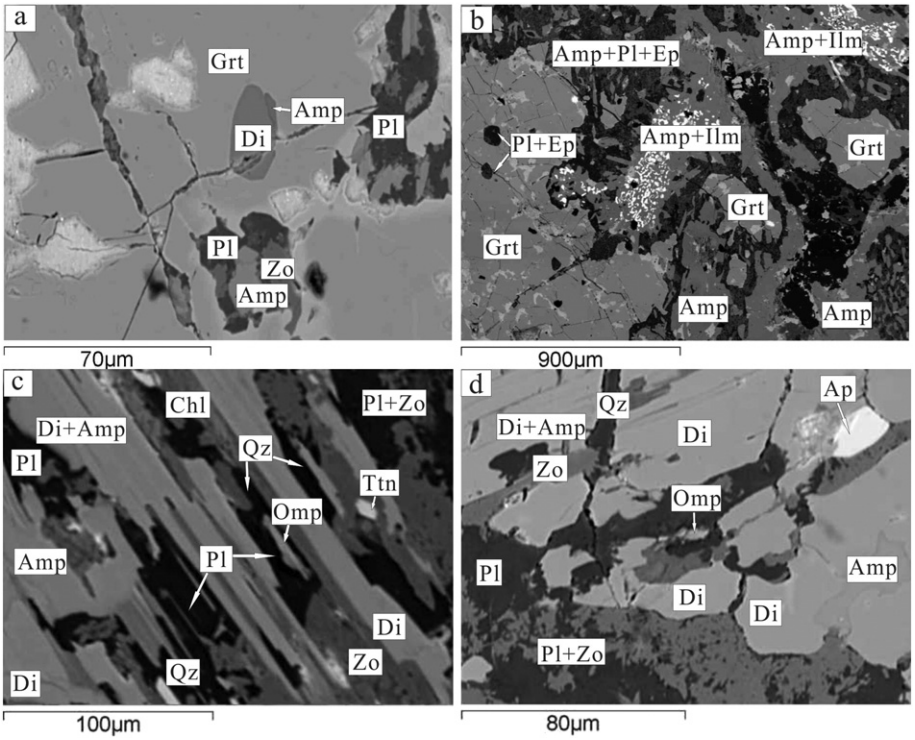

Fig. 3. Backscattered electron images of the retrograde eclogite. (a) Diopside occurs as inclusions within garnet. (b) Garnets partly replaced by worm-like symplectites. (c and d) Minor omphacite relics within diopside.