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FINDING A NEW ULTRAHIGH-PRESSURE METAMORPHIC TERRANE IN JAPAN

The Japanese islands present an excellent field area for studying subduction zone tectonics. The islands are a volcanic arc that formed at the continental margin of the China craton as a result of two subducting oceanic plates (the Pacific plate and Philippine Sea plate) under the craton. Paired metamorphic belts, the Sanbagawa Belt and the Ryoke Belt, developed in this tectonic setting during the Cretaceous (e.g., Wallis and Okudaira 2016). The Sanbagawa Belt consists of typical high-grade subduction zone metamorphic rocks (blueschists and eclogites) which reached pressures up to 2.5 GPa. Although ultrahigh-pressure (UHP) conditions (>3.0 GPa) have been recorded in garnet-bearing ultramafic rocks (Enami et al. 2004), no Sanbagawa Belt crustal material has, to date, shown a UHP signature. The Sanbagawa Belt possibly extends to the Nagasaki Metamorphic Complex in western Kyushu. New findings of microdiamonds from the Nishisonogi Unit of the Nagasaki Metamorphic Complex (Nishiyama et al. 2020) (Fig. 1) shed new light on the possible existence of a UHP ocean-subduction metamorphic terrane that might be different from that of the Sanbagawa Belt.

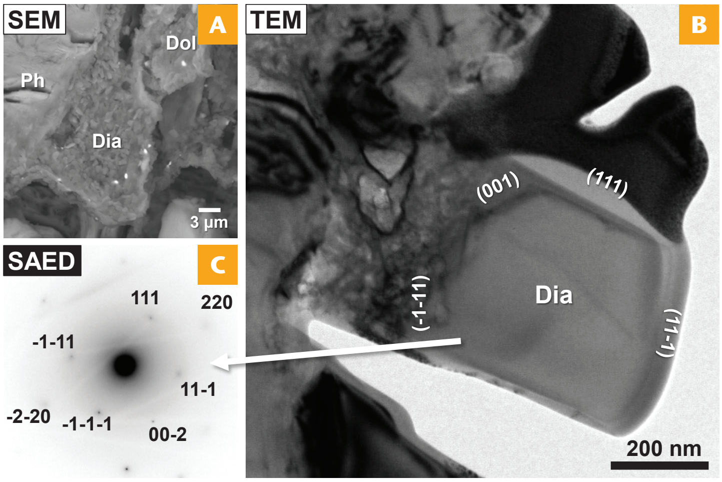

Figure 1 Scanning transmission electron microscope (STEM) study of a microdiamond aggregate. (**A**) A scanning electron microscope (SEM) image of an aggregate of microdiamonds from the Nishisonogi Unit of the Nagasaki Metamorphic Complex. Abbreviations: Dia = diamond aggregate; Dol = dolomite; Ph = phengite. (**B**) A higher magnification view of Figure 1A using the transmission electron microscope (TEM). The visible diamond crystal faces are indexed. (**C**) Selected area electron diffraction (SAED) pattern obtained from a grain within the microdiamond aggregate. The pattern is the reciprocal lattice along the [110] zone axis of a diamond, where the *d*-spacing for the larger inner spot is 2.06 Å, which is the diamond (111).

The Nishisonogi Unit is a subduction complex consisting mainly of pelitic and psammitic schists and minor amounts of metabasites and serpentinites (massive serpentinites and serpentinite mélanges). The unit reached epidote-blueschist facies conditions but with no obvious sign of UHP metamorphism. However, Nishiyama et al. (2020) reported four occurrences of microdiamonds from within a serpentinite mélange at Yukinoura, located at the western end of the Nishisonogi Peninsula (western Kyushu). The four microdiamond occurrences are as follows: (1) as pseudo-secondary inclusions in chromite from a chromitite layer within serpentinite; (2) as inclusions in a pseudotachylyte in a magnesite–quartz rock (i.e., a carbonated serpentinite); (3) as inclusions in strongly deformed pyrite in a metapelite; (4) as aggregates in the matrix of a metapelite. Microdiamonds have been confirmed by Raman microspectroscopy, transmission electron microscopy (TEM), and by electron probe microanalysis coupled with soft X-ray emission spectroscopy (EPMA-SXES). The microdiamond aggregates in the metapelite are irregularly shaped and 10–50 μm in size, consisting of numerous diamond grains embedded in very fine-grained phengite. The aggregate is always associated with carbonates (either magnesite or dolomite) in the matrix of the metapelite, suggesting coprecipitation with the carbonates from a C–O–H fluid.

The metapelites and associated metabasites in the Yukinoura mélange have been extensively retrograded and show no evidence of their previous UHP condition. However, a possible pseudomorph after coesite (i.e., a quartz inclusion with radial cracks filled with quartz extending from the inclusion) in garnet was found and illustrated as Figure 2d in Nishiyama et al. (2020). Some garnetite lenses in the metabasite blocks contain possible pseudomorphs after lawsonite, suggesting that they were originally a lawsonite eclogite (see Fig. 3 in Nishiyama et al. 2020). The temperature condition of the Yukinoura mélange was estimated by Raman thermometry of graphite to be about 450 °C. If this temperature can be regarded as the temperature of microdiamond formation, then the pressure condition, as judged from the stability fields of diamond, would have to have been >2.8 GPa. Our project to clarify the nature of the UHP metamorphism in the Yukinoura mélange is still in progress and we anticipate that new findings will be published in the near future.

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