

# Microdiamond in pelitic gneisses from the Kokchetav Massif, Kazakhstan

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Abundant microdiamond occurs in dolomite marble and pelitic gneiss in the Kokchetav UHPM terrane, northern Kazakhstan. In the dolomite marble, microdiamond has been classified into three types (S-, R-, and T-types) by its morphology with other characters, and dominant type S (Star-shaped grain consisting of the core and the rim) occupies over two thirds of microdiamond grains in dolomite marble. On the basis of cathodoluminescence, C-isotope, laser Raman spectroscopy and micro-Laue diffraction, those microdiamond grew at two different stages: the 1st stage growth of R-type and the core of S-type, and the 2nd stage growth of T-type and the rim of S-type. Extremely high concentration of microdiamond has been reported in dolomite marble (2700 carat/ton: Yoshioka et al., 2001).

Another representative diamond-bearing rock type in the Kokchetav Massif is pelitic gneiss. The occurrence of microdiamond and its characteristic features in pelitic gneiss show the strong contrast with the microdiamond in dolomite marble. Here, we describe the microdiamond in pelitic gneiss in detail and compare those with in dolomite marble.

Diamond-bearing metapelitic rocks have various mineral assemblages. For UHP conditions, some of other evidence is observed (e.g. coesite in zircon and exsolution lamellae in clinopyroxene). Microdiamond is included mainly in garnet, zircon, kyanite, clinopyroxene, and tourmaline.

In pelitic gneisses, the morphologies of microdiamond are variable and differ from those of dolomite marble. The dominant morphology (more than 80%) is rounded to cuboidal form with rugged surface; this form corresponds to R-type. Rounded grain with smooth surface, cubo-octahedron, and trigonal plate (spinel twin) are also observed. S-type that has been defined in dolomite marble, polycrystalline grain with core part and rim crystals, is rare in pelitic gneiss. Most of microdiamonds are translucent and yellowish with exception of spinel twin which is extremely transparent and colorless. Different forms of diamonds are observed even in the same garnet grain. Microdiamond grain ranges from 1 to 30 micrometers in diameter. Microdiamond often forms composite inclusions with biotite, phengite, calcite, and graphite.

On the laser Raman spectroscopy, FWHM (Full Width at Half Maximum) of Raman band of microdiamond varies with the type of rocks, however, no correlation with peak position, intensity, morphology, and grain size was detected. The difference in FWHM of Raman band represents the crystallization environment of diamond to some extent.

Morphology of microdiamond is controlled by growth and/or dissolution. R-type and spinel twin are considered to show growth form at the same stage, because they are included in the same garnet grain; their size and FWHMs are similar each other; spinel twin has no resorption evidence. In contrast, rounded grain with smooth surface may show the resorption after diamond growth.

The absence of S-type diamond is a great difference from the microdiamond in dolomite marble, and indicates that fluid play different roles in both two diamond-bearing rocks; 1) carbon dissolved into aqueous fluid in pelitic gneiss, and 2) carbon precipitated from fluid to form microdiamond at the 2nd stage in dolomite marble. Composite inclusions of diamonds with hydrous minerals and carbonates suggest that diamond crystallized from C-O-H fluid or diamond was dissolved by fluid.