

Andradite from Dashkesan iron skarn deposit as a potential standard reference material for U-Pb geochronological studies

Андрадит от желязно-скарново находище Дашкезан като потенциален стандартен материал за U-Pb геохронологички изследвания

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The Dashkesan skarn deposit is located in the NE part of Lesser Caucasus (Republic of Azerbaijan). Skarns formed in the contact zone between Middle and Upper Jurassic volcano-sedimentary rocks and multiphase Upper Jurassic–Lower Cretaceous intrusive complex. The ore formations include three types of skarns: garnet skarn, pyroxene-garnet skarn and Dashkesan skarn (Kashkay, 1965).

Garnet is one of the most common minerals of the Dashkesan complex. The grains size of garnet varies from 0.05 mm in fine-grain druse to 5–7 cm in some single crystals. The chemical composition of garnet

varies from grossular to andradite in different rock types (Kashkay, 1965).

Studied garnet samples are collected from the NE part of Dashkesan deposit. Garnet forms euhedral dodecahedral crystals ~1–3 cm across. The color of garnet is macroscopically dark-brown and light-brown in plane-polarized light in tiny fragments. Secondary electron (SE) images of large crystals show oscillatory zoning. The thickness of each zone ranges from 100 μm to 1 mm. On the ternary diagram showing chemical compositions of garnets both, the bright and dark parts of the garnet (Fig. 1) fall in the field of andradite-

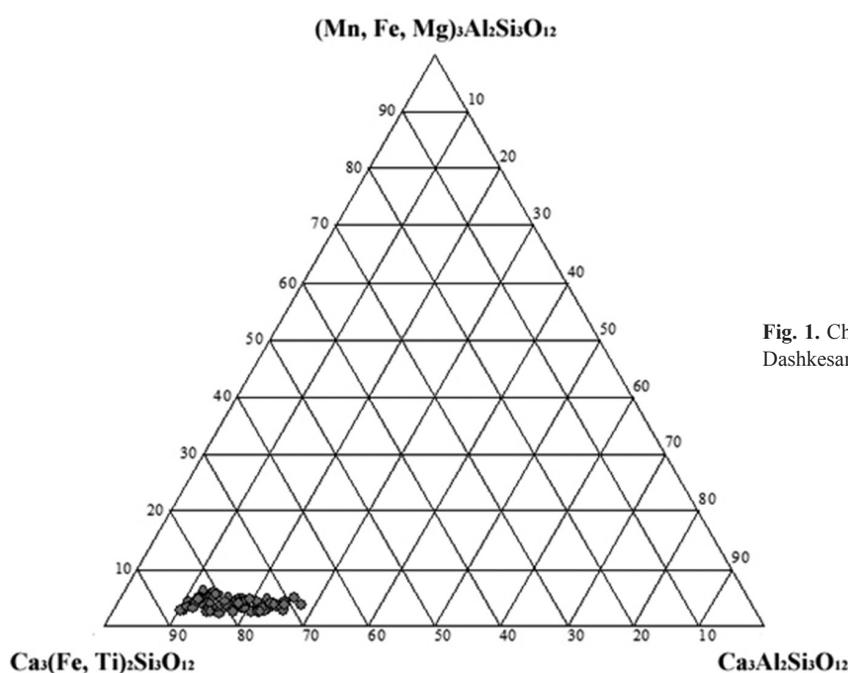


Fig. 1. Chemical compositions of Dashkesan garnets

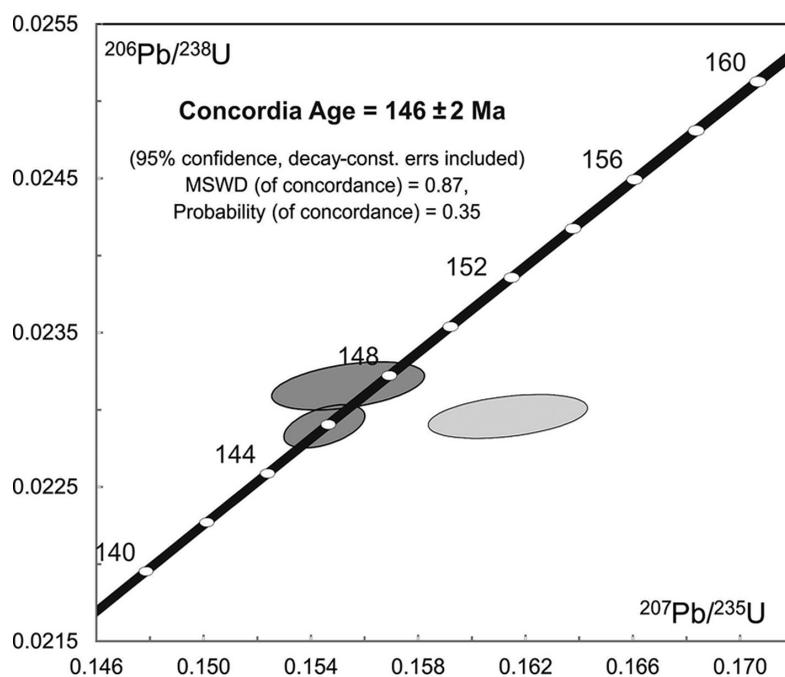


Fig. 2. Concordia diagram with the results of ID-TIMS U-Pb dating of Dashkesan garnet

shorlomite-morimotoite. The central part of the grain is more andraditic than the peripheral part and does not contain Ti. Minor fluctuation in Mn and Mg contents is observed between different zones.

The concentrations of lanthanides in the garnet range from 550 to 1248 ppm, and chondrite-normalized patterns display LREE enrichment and HREE depletion, with positive Eu anomalies. The REE pattern does not change perceptibly across the crystal. Uranium shows some fluctuation between different zones (from 6.5 to 9.3 ppm). The LREE contents decrease from the core outward and have positive correlation with U and Th. Uranium contents correlate negatively with HREE concentrations.

For the ID-TIMS U-Pb study, we hand-picked the most clean and visibly homogeneous garnet fragments 100–200 μm in size (3–20 fragments were used per analysis) and analysed them following the method described in Salnikova et al. (2018). The uranium content ranges from 8 to 8.5 ppm. Garnet is characterised by low common Pb ($\text{Pb}_c/\text{Pb}_t = 0.01\text{--}0.17$). The concordia age defined by two analyses is 146 ± 2 Ma (MSWD = 0.87; Fig. 2).

Dashkesan garnet demonstrates uniformly high U content despite the variation in the chemical composition. The low content of common Pb and precise U-Pb ID-TIMS ages demonstrate the advantages of this mineral to geochronological research and fur-

ther using as a LA-ICPMS standard reference material (SRM). The high uranium content in garnet is especially crucial for quadrupole ICP-MS because of its lower sensitivity compared with high resolution mass-spectrometers.

Some hand-picked fragments of the Dashkesan andradite were analyzed using the UP193FX New Wave LA system and Elan DRCE quadrupole ICP-MS at the Geological Institute of the Bulgarian Academy of Sciences. They defined a concordia age 146.9 ± 4.2 Ma (2σ , decay-const. errors included, MSWD of concordance 0.59) that is in agreement with the ID-TIMS age. The results favor the use of the Dashkesan andradite as SRM in further LA-ICP-MS studies of skarn garnets.

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