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NEW FINDING OF ANDRADITE (DEMANTOID VARIETY) FROM THE MINE OF SA SPINARBEDDA, DOMUS DE MARIA (CAGLIARI): MINERALOGICAL CHARACTERIZATION AND SPECTROSCOPY ANALYSIS

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This work reports a new occurrence of demantoid, the green variety of andradite $[\text{Ca}_3\text{Fe}_2(\text{SiO}_4)_3]$, belonging to the garnet group, recently discovered in an abandoned mine of Sa Spinarbedda, Domus de Maria (Cagliari), Italy.

The well-known deposits of this appreciated gem are located in Russia, northern Madagascar, southeast Iran, Canada northern Pakistan and central Namibia (1-6). Recently, gem-quality demantoids have occasionally reported in the Muslim Bagh area of Balochistan, a large province in south-west Pakistan (7). In Italy isolated andradite crystals (demantoid variety) have been found in Val Malenco (Sondrio) and in Montjovet (Aosta) (8-9).

By gemmological point of view, the brilliance is considered one of the most important qualities of this gem and its name is referred to the similarities with the diamond gem. The general formula is $\text{X}_3\text{Y}_2(\text{SiO}_4)_3$ in which X site can be occupied by divalent cations (Ca^{2+} , Mg^{2+} , Fe^{2+} , Mn^{2+}) while the Y site usually hosts six-fold coordinated trivalent cations, as Al^{3+} , Fe^{3+} , Cr^{3+} , Ti^{4+} .

In this work gemmological, geochemical and mineralogical properties of two Sa Spinarbedda potential gem quality andradites are investigated to verify their belonging to the demantoid class. The samples examined by standard gemmological methods were transparent, with evidence of graphite inclusions as macroscopic features. They have refraction index (RI) values > 1.81 , UV fluorescence in the region of 366-254 nm, and hydrostatic Specific Gravity (SG) in the range of 3.7-4.1. Laser Ablation-Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) microanalyses and X-ray powder diffraction (XRPD) techniques were carried out to determine the chemical composition as well as the structural features of garnets. Electron probe microanalyzer (EPMA) results showed that the analysed samples are chemically a nearly pure andradite (TiO_2 0.035 %wt, Na_2O 0.018 %wt, Al_2O_3 0.433 %wt), but with very low Cr contents (~ 8 ppm). This is consistent with the chemical features of the demantoid gem variety. Strong similarities with the chemical composition of Namibian and Madagascar demantoids are highlighted, especially concerning the skarn matrix (9). The match of the results obtained through the different techniques suggested that a new occurrence of demantoids in Italy, and Sardinia can be added to the list of demantoid deposits providing high quality gems.

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