

Insights on the “Great Dunite Shortage” from New Dunite Breccias NWA 12217 and 12562

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“The Great Dunite Shortage” is a long-standing problem in planetary science consisting of the paucity of olivine-rich differentiated material evident in both the meteorite record and remote sensing of asteroids. This material should comprise the mantles, and thus most of the mass, of differentiated planetary bodies of chondritic bulk composition. Two recently discovered dunitic breccias, Northwest Africa (NWA) 12217 and 12562, potentially represent samples of this mantle material. NWA 12217 is approximately 93 vol% olivine, 4 vol% low and high-Ca pyroxene, with minor chromite, Fe-sulfide, FeNi metal, andesine plagioclase, and trace alkali feldspar, merrillite, and silica. NWA 12562 is approximately 87 vol% olivine, 9 vol% pyroxene, and it contains similar minor and trace phases. Both meteorites contain Mg-rich olivine, $Fa_{9.1 \pm 2.3}$ and $Fa_{14.7 \pm 5.0}$, respectively. Their oxygen isotopic composition is almost indistinguishable and plots in the vicinity of the brachinites, HED meteorites, and angrites in triple-oxygen space. Olivine composition and presence of andesine plagioclase and alkali feldspar preclude classification of either rock as a brachinite or HED meteorite. Fe/Mn and Fe/Mg contents suggest that they are cumulates formed by large degrees of igneous differentiation and fractional crystallization, possibly within a planetesimal mantle.