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Origin and structural character of haüyne$_{ss}$ in spinel dunite xenoliths from La Palma, Canary Islands

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ABSTRACT

Two spinel dunite xenoliths ($Fo_{89.8–91.2}$ in olivine) from La Palma contain minor amounts (<1%) of a pale-blue sodalite-group mineral with haüyne/lazurite chemistry. Selected-area electron diffraction (SAED) patterns of this phase indicate a cubic unit cell with dimensions 9.12 ± 0.02 Å, and space group $P\bar{4}3n$. Superstructure spots along three <110> directions are common, implying commensurate or incommensurate modulations along <110> directions. Raman spectra show peaks typical of both lazurite and haüyne. It is concluded that the mineral has a structure intermediate between those of pure lazurite and pure haüyne, and it is here referred to as haüyne$_{ss}$. The haüyne$_{ss}$ occurs together with strongly nepheline-normative glass in thin veinlets (<0.1 mm), in interstitial glass pockets, and as inclusions in olivine porphyroclasts. To our knowledge lazurite or haüyne has not previously been described in mantle rocks. The haüyne$_{ss}$ is strongly depleted in REE and most other highly lithophile elements relative to the coexisting glass, whereas $D_{mineral/glass}$ for Sr is ≈1.0, and D_{Eu} higher than the other REE. The haüyne$_{ss}$ crystallized from a melt now present as phonolitic glass, probably in response to rapidly decreasing pressure during transport of the xenoliths to the surface. The coexistence of haüyne$_{ss}$ and FeS-rich sulfide globules in some samples suggests slightly more oxidizing conditions than for samples in which the glass contains sulfide globules alone.