

Lamprophyres spatially associated with gold mineralization at the Monique deposit, Val-d'Or, Quebec

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Abstract

The Monique lode-gold deposit is found along the Larder Lake-Cadillac Break, within the Abitibi greenstone belt. The Monique deposit, which produced 51,488 oz Au from 660,655 t of ore (2.47 g/t Au) between 2013 and 2016, has the current resource of over 4 M oz Au in the Val d'Or East project. The deposit is hosted by tholeiitic basalt lavas and pyroclastic, and ultramafic rocks of the Jacola and Dubuisson Formations, which are metamorphosed to greenschist facies conditions. A series of syn-tectonic dyke swarms are found in the deposit, including lamprophyres as well as gabbro, diorite and feldspar porphyry dykes; the lamprophyre dykes are spatially related to zones of gold mineralization (> 1 g/t). Lamprophyre are hypabyssal rocks containing phenocrysts of phlogopite mica and amphibole \pm clinopyroxene. Representative samples were collected from diamond drill cores. The mineralogy and bulk rock compositions confirm that they are calc-alkaline lamprophyres. Minette lamprophyre is the predominant type; characterized by coarse-grained phlogopite mica ($Mg\# = [Mg]/([Mg]+[Fe])$: > 0.6) and no feldspar or quartz phenocrysts. Vogesite lamprophyre are minor, containing hornblende and phlogopite phenocrysts in K-feldspar-bearing groundmass. Phlogopite commonly contains small phosphate minerals (apatite, monazite, xenotime) and oxides (rutile, titanite), zircons and bastnäsite. Hornblende phenocrysts are pseudomorphically altered to actinolite as well as calcite. Lamprophyre rocks are Mg-rich ($Mg\# = 0.6 - 0.8$) relative to tholeiitic basalt ($Mg\# = 0.3 - 0.6$), and contain high concentrations of light rare earth elements (LREE, $> 100x$ chondrite values), which is reflected by the occurrence of minerals with high LREE, such as allanite, xenotime, monazite. Furthermore, chondrite-normalized REE show a negative slope pattern with elevated LREE, in contrast to the flat normalized REE pattern for the tholeiitic basalt ($\sim 10x$ chondrite values). Minor and trace elements further support a calc-alkaline clan of lamprophyres, with elevated large ion lithophile element values ($> 100x$ of primitive mantle) coinciding with low values of high field strength elements, such as Nb, Ta, and Ti ($< 10x$ chondrite values).