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New trace precious metal data on carrier minerals from the Kevitsa mine, Finland

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The Kevitsa mine located in northern Finland contains disseminated Ni-Cu-Fe sulfides and platinum-group minerals (PGM). Earlier studies originating at the University of Granada [1] and at the Geological Survey of Finland [2] had reported trace concentrations of platinum-group elements (PGE) in several minerals (specifically up to 454 ppm Rh, 868 ppm Pd and 277 ppm Pt in gersdorffite; up to 150 ppm Pd in pentlandite; up to 54 ppm Pt and 17 ppm Pd in chalcopyrite; up to 36 ppm Pt and 342 ppm Pd in nickeline; up to 241 ppm Pd in maucherite, and up to 30 ppm Pd in pyrite) by electron microprobe using special analytical conditions (accelerating voltage of 35 kV and a probe current of 100 nA) and metallic standards for Pd, Pt, and Rh [3].

Based on these reports, the present study targeted potential carrier minerals (sulphide, sulpharsenide, and arsenide) for trace precious-metal analyses by laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). The protocol used for these analyses has been developed, refined, and tested over the last 14 years to currently be able to analyse from 84 to 98 individual mineral grains per day, in addition to standards. Well-characterised fused synthetic pyrrhotite standard po-726 T1 [4, 5] and an in-house secondary Ni-rich fused sulphide standard PGE-B, similar to PGE-A [6], were used for calibration and quality control. The data were processed off-line using LAMTRACE (v.2.25-PGEv.7, 14 January, 2013) [7, 8], which incorporates interference correction algorithms for Rh and Pd from Sylvester (2001) [9]. This analytical work was part of a process mineralogy study of the ore, with the data used to determine the deportment of the precious metals. Trace precious metals data were obtained on pentlandite, pyrite, gersdorffite, maucherite and nickeline for Rh, Pd, Os, Ir, Pt, and Au. A unique feature of the data was the new discovery that nickeline is a significant carrier of Au (up to 76.9 ppm) in addition to Rh, Pd, Os, Ir and Pt. The unexpected concentration of gold in nickeline demonstrates the versatility of LA-ICP-MS analyses when using an appropriate calibration standard.

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