

Analysis of Geological Materials for Gold, Platinum and Palladium at sub-ppb levels by F-AAS, GF-AAS, and ICP-MS for Exploration Studies

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Reliable data of Pt, Pd, and Au in geochemical exploration samples for a given area are needed to assist in discovering precious metal deposits, and to understand the processes leading to their formation. Accurate and precise estimation of these metals in rocks, ores and other geological materials needs special requirements for sampling, sample preparation and chemical analysis. Currently GF-AAS and ICP-MS are the most sensitive instrumental analytical techniques suitable for precise estimation of very low concentrations of Pt, Pd and Au in geological samples. If proper separation and pre-concentration techniques are adopted, F-AAS methods can also be used for estimating these elements at very low concentrations.

Various digestion methods, such as alkaline cyanide, aqua regia, aqua regia-Br₂-HF, MnO₂-HCl, and HBr-Br₂ were investigated in combination with separation and pre-concentration techniques, such as solvent extraction and precipitation, for the extraction and separation of Pt, Pd and Au in several exploration samples from different parts of India. The solvent extraction efficiencies of DIBK and MIBK procedures were compared using Au data obtained by F-AAS and GF-AAS. MIBK procedure, especially, when coupled with GF-AAS gave reasonably accurate data for gold in several samples. ICP-MS offered relatively interference-free analysis though Pt, Pd and Au signals were suppressed due to the presence of excess of manganese when samples were dissolved using MnO₂-HCl. In general, these methods helped in generating highly precise data for Pt, Pd and Au even when they are present at sub-ppb levels in a variety of geochemical exploration samples.