THE ROLE OF COMPLEXATION BY NATURAL ORGANIC LIGANDS IN THE ENVIRONMENTAL GEOCHEMISTRY OF PD

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Recently, the platinum-group elements (PGE) have become an environmental concern. Their use in automobile exhaust systems to reduce air pollution has resulted in their becoming contaminants in roadside dust and river sediments, sewage sludges, soils and the marine environment. The PGE may be both bioavailable and toxic under certain circumstances. Some isotopes of some of the PGE are fission products of nuclear fuel. It has been suggested that the PGE can be transported in aqueous environments in the form of complexes with natural organic ligands, but our understanding of such processes is very limited. Solubility and spectroscopic methods were employed to study the interaction of Pd with the organic ligands acetate, oxalate, salicylate, phthalate and fulvic acid. The results show that all the organic ligands studied increase the solubility of Pd in aqueous solutions, and that this effect is indeed due to the formation of stable Pd(II)-organic ligand complexes. A preliminary estimate of the cumulative stability constant for the second Pd(II)-acetate complex of log K = 9.2 was determined. Acetate, oxalate, salicylate, and phthalate all bind to Pd(II) via oxygen-donor groups (carboxylate). Theoretical considerations suggest that N- and S-donor groups should form even stronger complexes with Pd(II), and experimental evidence suggests that amino acids do form very stable complexes with the PGE. It is likely that O-, N- and S-groups on natural fulvic acids are capable of solubilizing and transporting significant amounts of Pd in natural waters, particularly soil solutions and sediment porewaters.