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THE BEHAVIOUR OF THE RARE EARTH ELEMENTS DURING THE PRECIPITATION OF FERRIHYDRITE FROM SULPHATE MEDIA

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ABSTRACT

The deportment of all the rare earth elements (REE) during the precipitation of ferrihydrite was investigated by pumping ferric sulphate solutions into a REE-containing solution at 75°C. At a pH of 3.5, controlled by NaOH additions, increasing concentrations of the light rare earths in the 0 to 4-5 g/L range resulted in 2 to 3% REE adsorption on ferrihydrite. Light rare earth concentrations >4 or 5 g/L generated Na-REE double sulphate salts and gave up to 15% REE contents in the precipitates. Heavy REE concentrations as high as 10 g/L resulted in a near-linear increase in the adsorbed REE contents, up to 5-8% REE, and Na-REE double sulphate salts were not detected at the concentrations studied. Up to 70% REE precipitation occurs from <1 g/L REE solutions but the extent of precipitation decreases sharply to ~15% in more concentrated REE media. Formation of Na-REE double sulphate salts significantly increased the overall precipitation of the light rare earths. Increasing solution pH greatly increased the extent of REE adsorption on ferrihydrite, and controlled ferrihydrite precipitation at pH <3.5 offers a potential means of reducing REE losses during iron precipitation. X-ray diffraction analysis and mineralogical examination of the products consistently identified dominant ferrihydrite, although the "crystallinity" of the ferrihydrite decreased as the REE concentration increased. The conclusion is that the rare earth elements adsorb on the surface of the fine grain ferrihydrite precipitates and the adsorption somehow impedes the "crystallization" of the ferrihydrite.