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# Heavy minerals: ANALYSIS, RESULTS AND ECONOMIC IMPORTANCE

Traditionally, heavy minerals are not the first thing on the mind of explorer geologists worldwide, especially in South America. However, they are of crucial economic importance as non-metallic and metallic raw concentrations. Economic heavy mineral deposits are known as “placer and paleoplacer deposits” and they are mainly located in tropical and sub-tropical countries with high rate of sedimentary denudation and active tectonics since Ordovician time like in Peru.

Heavy minerals are traded globally as bulk and bagged minerals. The economic relevance of the various heavy minerals founded in Phanerozoic rocks in Peru is the subject of this abstract. The group of heavy minerals under study includes rutile, zircon, monazite, titanite, sillimanite, garnet, magnetite, as well as tourmaline. The study begins with a detailed study on the sedimentary processes to explain how heavy minerals are concentrated. Those are supported by data on mineralogy, petrography, and geochemistry of each of the heavy minerals, plus

extensive information on their application, their uses in various products, and their potential substitutions by other materials. Background information, reserves and production data, as well as a selection of basic references, are presented as maps of facies and isopachs (stratigraphic thickness). As preliminary results, detrital Phanerozoic rocks in southern Peru are matter of study in terms of sediment provenance. Concentrations of heavy minerals on Paleozoic and Mesozoic rocks (Figure 1) are formed by early settling of heavy

particles from a transport medium when the flow energy abates; for instance, deposits like point bars and bottom of minor-scale channels. After a detailed facies analysis, sandstones of the Paleozoic Mitu Group and the Jurassic Hualhuani Formation (Figure 2) are presented as large systems of braided and meandering deposits, which heavy mineral contained in sandstones (for instance, silica, ~88%, rutile 8%, zircon, 4%) are of economic importance (i.e. Mitu Group along southern Peru). ■

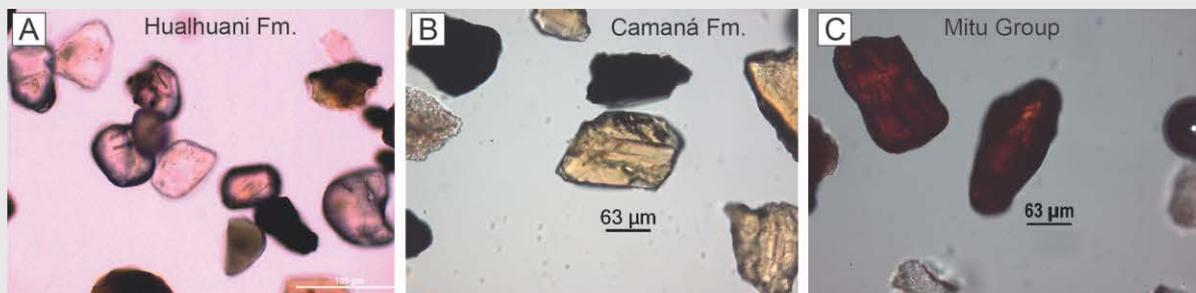


Figure 1. Heavy minerals extracted from sedimentary rocks in southern Peru. In A: concentrations of zircon ( $ZrSiO_4$ ) and tourmaline ( $Ca,K,Na[Si,Al,B]_6O_{18}$ ). In B: concentrations of titanite ( $CaTiSiO_5$ ) and amphibole ( $Ca,Mg,Fe,Na[Si_8O_{22}(OH)_2]$ ). In C: concentrations of rutile ( $TiO_2$ ).



Mesozoic stratigraphy of Tacna Province, southern Peru. Hualhuani Formation in quebrada Chachacumane is around 200 m thick.