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Evaluation of contribution sources for the sediments of the La Paz Lagoon, based on statistical treatment of the mineralogy of their heavy fraction and surrounding rock and drainage basin characteristics

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To identify the main sources of terrigenous sediments of the La Paz Lagoon, a description of the hydrology of the drainage basins and the mineralogy of the heavy fraction of the lagoon sediments is needed. In this work, 14 terrigenous sediment samples from the arroyos (dry streams) and 55 superficial marine sediment samples were collected from the study area. The drainage basins of the principal arroyos discharging into the lagoon were defined using geomorphologic analyses on Geographic Information Systems (GIS). The sediment samples' grain size fraction of 3.25 – 3.00 phi was obtained by sieving. The heavy minerals were separated using bromoform and the mineralogical composition was determined using a petrographic polarization microscope. Three main sedimentary provinces in the lagoon were distinguished based on principal component analysis of the heavy mineral data and the study of the surrounding regional streams. The eastern sedimentary province is characterized by the predominance of orthopyroxene, especially hypersthene, as well as a high hornblende presence. This is due to the erosion of volcanoclastic sequences of the Comondú Formation and intrusive granitic complexes of Sierra de Las Cruces. The southeastern province displays a high abundance of hornblendes (up to 81% in some stations), micas, apatite, sphene, anatase, tourmaline, chlorite, clinopyroxene and orthopyroxene. Lower contents of amphibole (up to 27.2% in some stations) and resistant garnet and zircon minerals were found, as were some soft-pink piedmontite and pale-green hypersthene. These minerals were supplied by the El Cajoncito, Los Bledales, La Palma, Cardonal and El Novillo arroyos eroding the intrusive rocks of "Granito Sierra de Las Cruces", "Tonalita La Buena Mujer" and in a smaller extent the extrusive and non-marine rocks (tuffs, riodacites, conglomerates and sandstones) of the Comondú Formation. The predominant minerals of the northwestern province are clinopyroxene, orthopyroxene and phosphatic ooids. Relatively high abundance of olivine, hornblende, zircon, epidote and garnet were also found. These minerals are presumably supplied by the arroyos La Ardilla and other streams to the north of the El Centenario and El Comitán villages, as well as by eolian and littoral transport of the El Mogote sandbar dunes, which accumulates eroded sediments from the marine sedimentary rocks of El Cien Formation.

Palabras clave: Monitoring, heavy minerals, drainage basins, La Paz Lagoon, Principal component analysis, contribution sources