

Depositional Placer Accumulations in Coarse-Grained Alluvial Braided River Systems

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Abstract

Depositional paleoplacer accumulations in coarse alluvial braided river systems form by the concentration of heavy minerals during sedimentation of the detritus and, where present, are usually associated with one or more subenvironments of gravel-dominated longitudinal bar complexes. Conditions necessary for the formation of this deposit type were investigated using three separate approaches. Huronian, uraniferous paleoplacers were studied in working faces of mines to gain insight into areas of heavy mineral accumulation. Primary data on processes responsible for the concentration of heavy minerals in the various subenvironments of longitudinal bars were obtained from examination and sampling of matrix and surficial sands of modern gravel bar systems in the North Saskatchewan River, Alberta, and in the Jackpine, Agawa, and Mississagi Rivers, Ontario. Concentration processes were further investigated through a series of experiments using a sediment-water recirculating flume. Sand composed of a mixture of quartz, pyroxene, magnetite, and lead was moved over a gravel bed; flow velocity, depth of flow, grain size of the quartz sand, and clast size systematically changed during 27 experiments. Data from these studies indicate that a number of conditions are necessary, or at least desirable, for heavy minerals to accumulate in coarse-grained alluvium. These are (1) a low proportion of granule to very small pebble-sized lithic fragments; (2) a very heavy mineral population whose hydraulic behavior more closely resembles that of the pebble population than that of the quartz sand; (3) flow velocities capable of creating a suspension cloud from the coarse-grained quartz sand population; (4) a change in the regional slope (inflection point) creating a gradient-parallel zone of energy loss; (5) infrequent major flood events; and possibly (6) preconcentration, i.e., an enriched, erosional lag upslope from the ultimate area of depositional placer accumulation. These conditions, plus the presence of economically significant minerals in the sediment load, control the formation of exploitable placer deposits in longitudinal bars of braided rivers.

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