Models for the genesis of industrial mineral deposits and their relevance to exploration

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Establishing commercially successful industrial mineral extractive operations involves determining the technical properties of a rock or mineral product and matching these to market requirements. The properties can be mineralogical, physical and/or chemical. They do not relate solely to the presence of sufficient quantity of the mineral or rock for it to constitute a resource. There needs to be an understanding of the relationship between geological processes and the development of the relevant technical properties in the rock or mineral. Current genetic models mostly do not take this into account, and thus they are of limited use in exploration. Industrial minerals found in ultramafic rocks (magnesite and talc), kaolin, feldspars, and silica sands can be used to illustrate this problem. With magnesite a desirable high Ca/Si ratio for a refractory product is dependent on the presence of other minerals. This is controlled by the metasomatic regime. With talc, the presence of abundant shear zones appears to be important. The formation of kaolin with a high aspect ratio suitable for the paper industry may require a hydrothermal component as well as a meteoric weathering process to create a suitable deposit from a granite source. Low-Fe feldspar deposits of sedimentary origin can form near a leucogranite source in a restricted drainage basis. Silica sands are often shallow water marine sediments. Their diagenetic history is as important as the sedimentary regime in creating a low-Fe product suitable for the glass industry.