Module B. Colour from the Cosmos

Lesson 15: Beryl Geology and Geography

*Secondary*

Although not particularly dense, beryl's resistance to weathering and its high hardness means that it can also be found in secondary deposits concentrated through weathering processes. There are three main types of secondary deposits, eluvial, colluvial, and alluvial. Below we discuss these and why gem beryl can be found in some of these deposition environments but not in others. Useful tools for inspecting secondary deposits are sieves and gold pans. A conical gold pan (also known as a "batea") is used extensively in South America and is also very good for separating minerals by density.

Rock can effectively be dissolved and removed over long periods of time without significant erosion from running water. (Recall the difference between weathering and erosion, page 29 of textbook.) Minerals that are most susceptible to weathering will be dissolved and carried away first, and those that are resistant will be left over in the dirt. These "leftovers" are often called residual or resistant minerals and are concentrated where the original rock source was located. Thus, these so-called eluvial deposits are best formed in tropical environments where weathering rates are high. Because these deposits have been transported the least distance from its original source, excavation is usually uncomplicated. However, targeting these locations requires knowledge of the underlying geology.

Colluvial deposits normally exist as a fan of crystals or rocks migrating down a hillside, away from the primary source hosted in the bedrock. These types of deposits do not tend to concentrate residual and resistant minerals in great amounts, however, they do allow geologists to track gems back to their original source.

Alluvial deposits are the classic secondary deposits. They are formed from flowing water, normally in rivers but also in creeks and streams. In these environments, the flowing water will preferentially move lower density material (like quartz and feldspars) rather than higher density material. The end result is that the densest material gets "left behind" and is concentrated in bends or hollow depressions in the beds of rivers. These are also called placer deposits and are historically famous for their effective concentration of gold nuggets and diamonds! Secondary deposits of alluvial nature contain material that has been transported the longest distance from its original source.

Beryl's moderate specific gravity (SG) of ~2.75 doesn't allow it to concentrate in alluvial deposits as effectively as gold (SG=19), diamond (3.5), or sapphire (4) do. Furthermore, emerald does not usually concentrate in alluvial or colluvial deposits as well as aquamarine because emerald's abundant internal inclusions cause it to fracture more easily during transport. Eventually, only small fragments too small to be of economic interest will eventually remain. The gem placers (alluvial deposits) of Sri Lanka and the eluvial gem deposits of Brazil are two notable localities of significant secondary deposits of beryl where durability plays a more significant role than specific gravity (density).

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General model for secondary gem deposits with a hypothetical intrusive body and associated pegmatite and quartz veins. Filled hexagons are *in situ* **primary occurrences**and open hexagons are **secondary occurrences**.