Where Gems are Found and How they are Mined

An important distinction must be made between the place where a gem forms, and where it is mined or collected (these two, most often, are not the same). The places where we mine or collect gems are known as *gem deposits,* and these are classified as either primary or secondary.

Primary Deposits:

A primary deposit is one in which the sought-after material is still held within the original site of its formation. These "lode" deposits are often located deep underground, and encased in solid rock (pegmatites, veins, pipes, etc.) They are, in general, likely to require substantial monetary outlay in personnel and equipment for recovery.

Although metal ores (does the famous Comstock *Lode* come to mind?), are frequently mined from primary deposits, it is rarer with gemstones. In certain locations, though, diamonds, and colored gemstones can be profitably mined from such sites. Techniques involve either tunneling deep into the Earth, or using open pit technology necessitating removal of massive amounts of "overburden" to get to the deeper gem bearing layer.

A consideration which is important in this type of gem mining is that the typical blasting and crushing done with metal ore materials can harm fragile gem crystals, so that much of the work must be done by slower and more labor intensive hand work. Sapphires in the US, have been "hard-rock" mined, off and on (depending on economic factors) in Montana, primarily at Yogo Gulch. The deposit there consists of sapphire crystals in a lamproite pegmatite dike. Although they are some of the highest quality blue sapphires in the world, lacking color zoning, and possessing an "out of the ground" cornflower blue color that requires no heating, the extreme prices necessary to repay their mining costs limit their marketability.

[Yogo sapphires: before and after faceting. Yogos are among the most beautiful and expensive in the world: Images courtesy of www.foxfinejewelers.com]

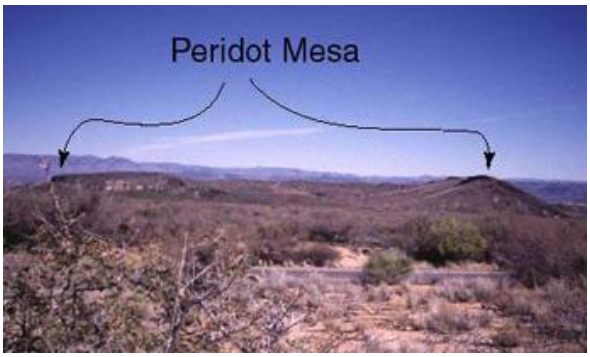
Secondary Deposits:

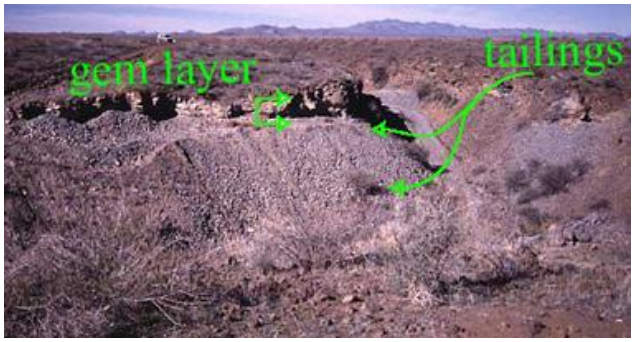
Although a primary deposit may have been *formed* deep in the Earth, uplift, crust folding, or other geologic events can bring it to, or very near, the surface. All exposed surface features are subject to erosion and weathering, and this is true of gem deposits, as well. The agents of erosion will then act to release the gems from their primary sites, and they collect in new secondary deposits. Secondary deposits are classed as either *eluvial* or *alluvial* depending on their relationship to the original source.

Eluvial: When the softer, more easily weathering primary structures simply release the harder and tougher gem materials, and the gems can be found at the site of decomposition, the deposit is eluvial. The gems can then be located within the debris, and generally it will be a relatively inexpensive process to gather and remove them. Additionally, the host rocks, which may contain valuable primary deposits can usually be easily located for other types of mining.

Eluvial gem rough, although often large in size, tends to be internally fractured, and quite angular and irregular in shape, which can limit its potential as faceting material.

The world's largest peridot mine, located on the San Carlos Apache Reservation in Arizona, is an eluvial deposit where the peridot is weathering out of the volcanic basalt primary source.





[Images courtesy of Robert Drummond, www.mtlilygems.com]

[Arizona peridot eluvial rough, note fractured area and angularity of pieces]

Alluvial: More common, and in most cases, more desirable, are alluvial (also known as "placer") deposits. The gems in these have been transported from the original site of their release, usually by water, but also possibly by wind or ice. As most gems are both denser and harder than most rocks, they accumulate on the bottom along with gravel, sand and mud, in eddies and pools in streams, rivers and along coastlines. (They can also be found in sites that had flowing water in the past, but have long since dried up).

The abrasive and frictional forces that occur as the gems are moved downstream cause the weakest parts to break off, and the edges to become more smooth and rounded. Alluvial rough, though usually relatively small, is often of high clarity, and superior faceting quality. The longer the distance the rough has traveled, the smaller and more rounded it becomes. Alluvial diamonds are an exception to this rule, in that they are harder than the surrounding rocks, and unless fractured or cleaved retain their original structure and size.

[Australian spinel rough from an alluvial deposit]

By far, the greatest amount of economically profitable gem mining is done by exploiting secondary deposits. Techniques range from simple one person panning and screening operations, to large scale dredging and hydraulic washing/sorting by big companies.

[Alluvial diamond miners in Sierra Leone, a collection of diamond rough from Arkansas, (the largest piece is under one carat) hand dug and screened from an eluvial deposit: Image courtesy of Kevin Jones]

[Tan Huong, Vietnam, ruby and spinel mine. Back hoes remove about six feet of soil then high pressure water is used to loosen the old buried stream bed so the miners can use screens and sluices: Image courtesy of www.gemsfromearth.com]

Within alluvial "gem gravels" several different types of gems may be found together, reflecting the various eroding primary sites within the local drainage area. Tracking back to the primary source of a particular gem (*"Mother Lode"*) is usually very difficult, if not impossible.

Source: Reprinted with permission from Dr. Barbara Smigel
http://www.bwsmigel.info/Lesson10/DE.Gem.Formation.html