The sedimentary rock history for the rest of the Presidential Range begins with deposition of the Rangeley Formation (Sr on the map). This rock was deposited in the Early Silurian period, 430 million years ago, in the deep marine Kronos Ocean basin immediately east of the Bronson Hill volcanic arc. The Rangeley Formation is largely gneiss and had been extensively metamorphosed up to the point where it actually started to melt in places. Photo 2 shows an outcrop where the lighter quartz and feldspar rich layers are the now solidified, once melted, parts.

Rangeley Formation

The Rangeley gneisses also have blocks of different rock types embedded in them, ranging in size from centimeters (Photo 3) to meters (Photo 4). These formed by a combination of processes. First, earthquakes caused sub-marine landslides...
along normal faults; the Mahoosuc, Graham Trail, and Pinkham Notch normal faults shown on the map. These seismic events broke the Rangeley Formation into a disaggregated mix of blocks surrounded by a muddy matrix. Second, as the Rangeley Formation metamorphosed and experienced partial melting, fluids and magma moved through the rock, further breaking it up into what we see in the Presidential Range today. Some of the blocks are big enough to show on the map. For example, the calc-silicate granofels of Srg and Sreg, rusty schists of Sscr, and amphibolites of Srea have been found on the flanks of Mt. Monroe, Mt. Eisenhower, and Mt. Clay, as well as down in the Route 16 Pinkham Notch valley at Emerald Pool.

**Perry Mountain, Smalls Falls, & Madrid Formations**

After deposition of the Rangeley Formation and throughout the remainder of the Silurian time period (to 410 million years ago), the Perry Mountain, Smalls Falls, and Madrid Formations were laid down in the ancient Kronos ocean basin. Each of these formations is quite thin, often discontinuous and composed of unique white quartzites (Spm), rusty schists (Ssf), and gray-green calcium-silicate granofels (Sm) (Photo 5).

The depositional setting for these formations is envisioned as a shrinking marine basin in which the geochemical environment became progressively more reducing as it was cut off from an oxygen supply. Subsequently the Kronos Ocean became a more open, oxygenated basin with good circulation. The Smalls Falls Formation is now weathering to a rusty-brown color, suggesting that it was oxygen-starved as a marine sediment. These characteristics result from the weathering of iron-bearing sulfide minerals like pyrite or pyrrhotite, where the iron is in the reduced chemical form. Atmospheric oxygen attacks these minerals resulting in iron-oxide minerals like hematite. The Madrid Formation is purple and green in color with a good deal of carbonate. At the time of deposition these rocks were in warm equatorial waters so a carbonate reef composed of limestone probably served as a sedimentary source for the Madrid Formation. This change from an oxygen-starved ocean basin to a more open
A portion of the map showing the lower elevations of Great Gulf and the West Branch of the Peabody River where excellent exposures of all the Silurian formations outcrop. Photo 5 shows an exposure of the Madrid Formation just above Long Island Rapids. This is a thinly laminated biotite and calcium silicate-rich rock type, a granofels, that is quite distinctive, but rare in the Presidential Range.
basin was caused by global plate interactions where some barrier to circulation opened up relatively quickly. These formations are quite distinctive in appearance, but generally difficult to find. The best places to see them are near Lakes of the Clouds, on Boott Spur, the base of the Lower Headwall at Tuckerman Ravine and, especially, along the West Branch of the Peabody River in Great Gulf just above Long Island Rapids.

The contact, or boundary, between the Madrid Formation and Littleton Formation is nicely exposed in the steep faces of the “Lower Headwall” of Tuckerman Ravine. The boundary is shown by the white line. This locality is below the main bowl of Tuckerman Ravine but above Hermit Lake. Here the Madrid Formation shows alternating layers of lighter calcium-silicate and plagioclase feldspar rich granofels and darker biotite-rich granofels. The Littleton Formation above is a massive schist without layering. Aaron is preparing to measure the contact.