GEOLOGIC MAPPING IN THE GRAND CANYON SUPPORTS WATER AND HABITAT STUDIES

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Introduction: Geologic maps of the Grand Canyon have many obvious values, particularly to park geology interpretation (figs. 1 to 3). However, revised digital versions of the geologic maps are helping park resource managers evaluate groundwater issues and habitats of canyon-dwelling plants and animals

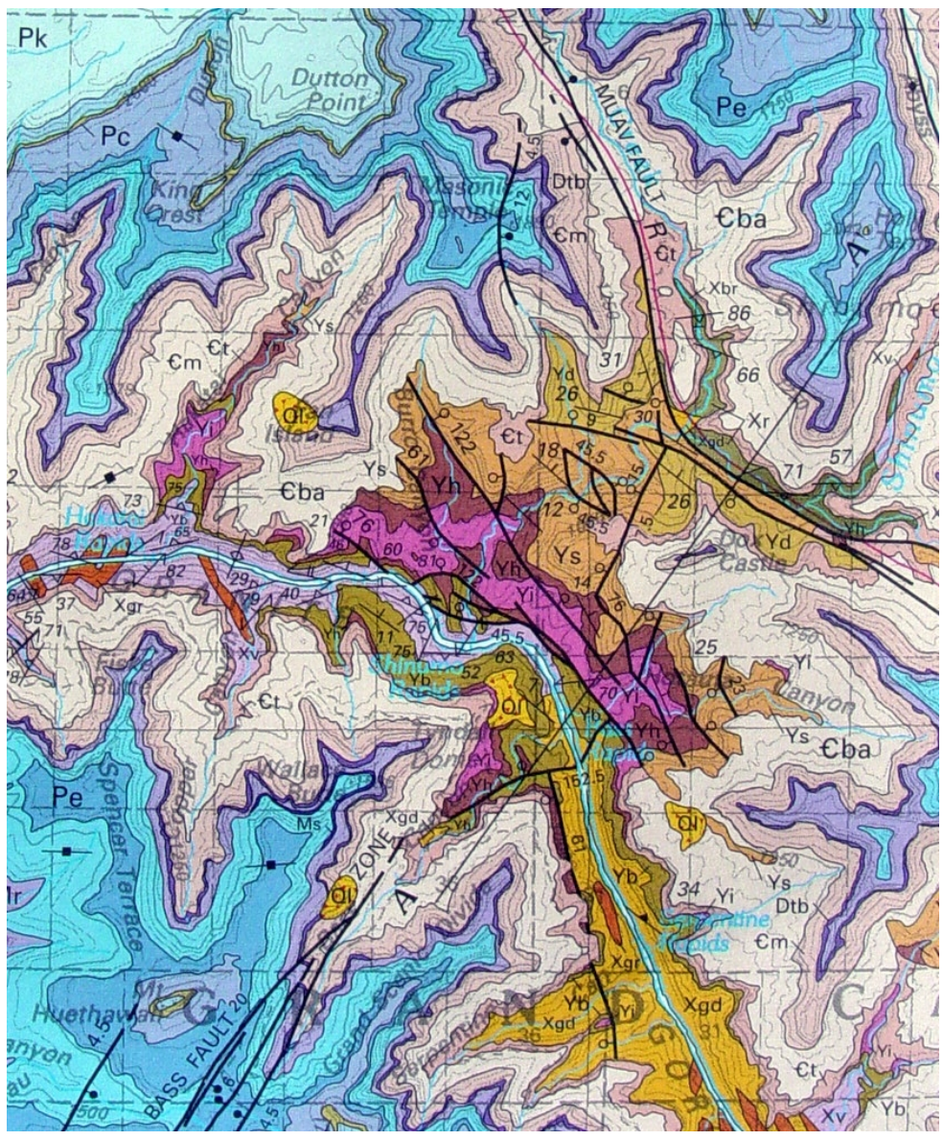

Figure 1. Map of the Inner Gorge of the Grand Canyon in the vicinity of the Muav Fault zone (from, George H. Billingsley, 2000, *Geologic Map of the Grand Canyon 30' x 60' Quadrangle, Coconino and Mojave Counties, Northwestern Arizona, USGS I-Map 2688; also on the web at http://pubs.usgs.gov/imap/2000/i-2688)*

The Geologic Map: As regional development proceeds, more municipalities (including the national park communities) are relying on groundwater supplies to meet demands. This raises an important question, how will increased groundwater extraction affect surface water discharge at seeps and springs throughout the park (fig. 4)? New high-resolution digital geologic maps will be used in combination with subsurface data to evaluate the regional hydrology and ground water flow on the Coconino Plateau south of the rim. Geologic maps help define the subtle structure of the mostly flat-lying sedimentary rocks in the park region. Information about the location of faults, fracture zones, folds, and other geologic structures may help determine the direction and volume of groundwater flow and surface discharge. It is possible that some areas in the region will have little surface impact from groundwater extraction, whereas in other areas excessive groundwater extraction could have detrimental impacts on both habitats and scenery within the canyon.

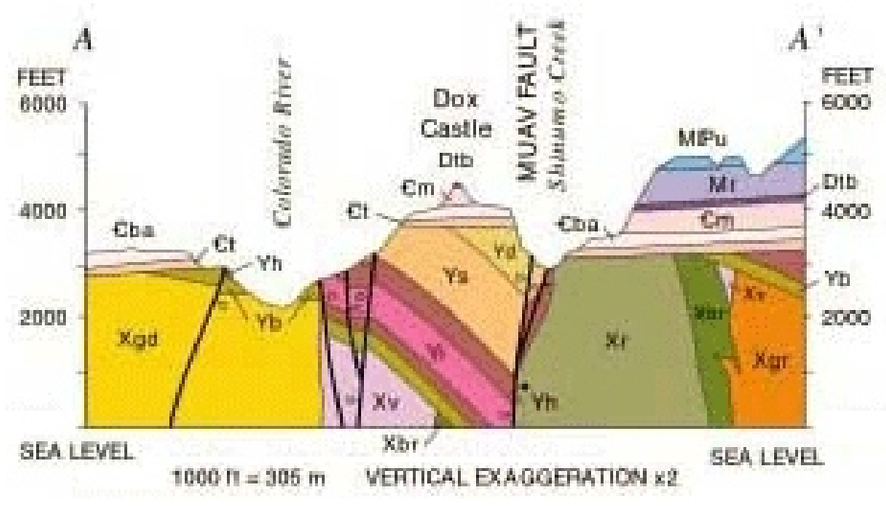

Figure 2. Cross-section (A-A") shown on fig. 1.

A similar study is underway for the region encompassing Pipe Spring National Monument and Kaibab Reservation area north of Grand Canyon by the Resource management of Pipe Spring National Monument, Arizona. Geologic maps, in conjunction with other data, will be used to develop a better management plan for the available water resources for local use by the National Park Service, the Kaibab Indian Reservation, the town of Moccasin, Arizona, and the local ranching interests, all of which depend on the springs and local ground water of this area.

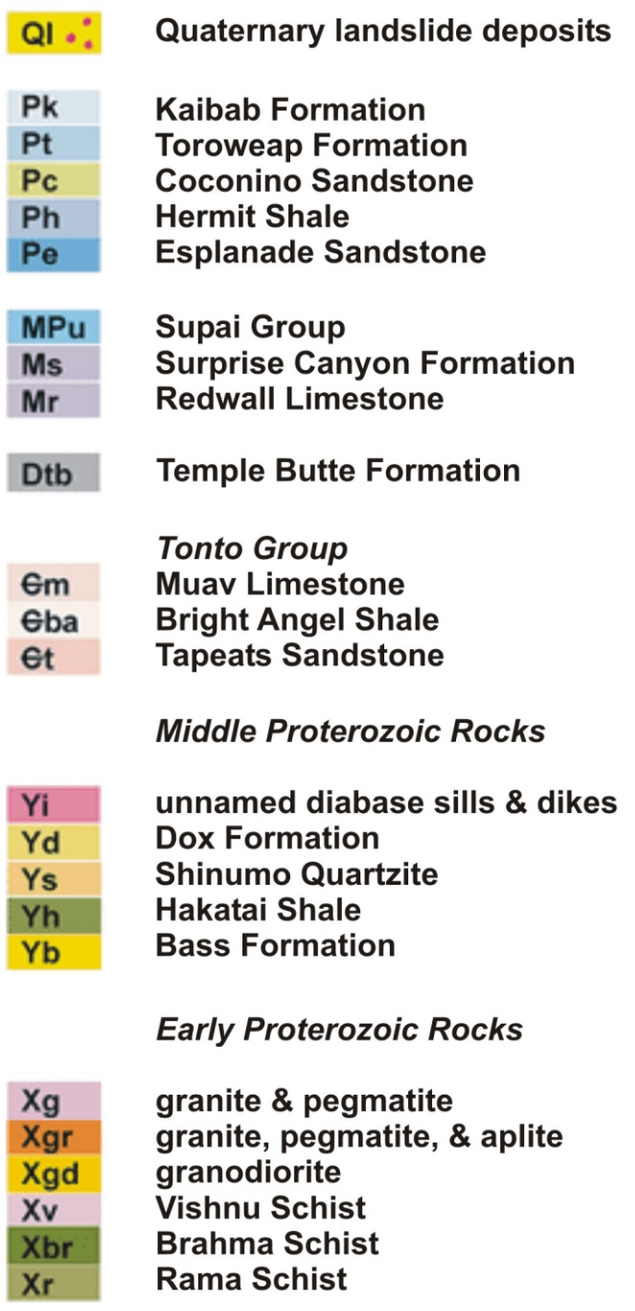

Figure 3. Legend for the geologic map showing select units.

Evaluating wildlife habitats are a critical concern of the management of National Park resources and land use. Preliminary investigations of both plant and animal habitats suggest that geologic maps of the Grand Canyon, in combination with other data, will help resolve questions regarding the potential distribution of habitats. For instance, field studies of the endangered spotted owl (*Strix occidentalis lucida*) *show that this avian species prefers the ledge/slope topography and vegetation characteristics of the Hermit Shale within the Grand Canyon (fig. 5). With the refinement possibilities of digital data sets (including the geologic map), park resource managers will be able to pinpoint prime spotted owl habitat areas within the park region.*

Figure 4. Vasey's Spring in Marble Canyon of the Grand Canyon.

Figure 5. A spotted owl (Strix occidentalis lucida).

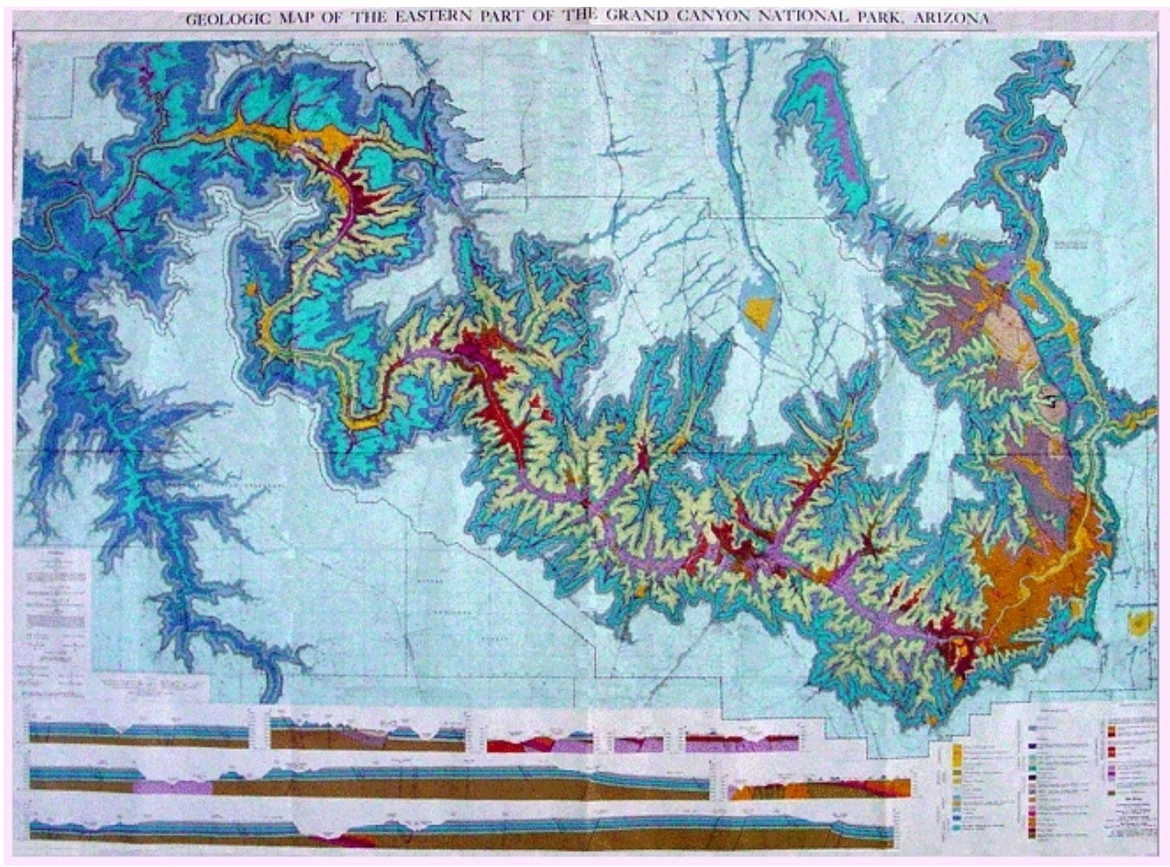

Figure 7. A small version of the large map.

Digital geologic maps are also being used for parts of the north Kaibab Ranger District to determine if there is a geologic connection of the Paradine Plains Cactus (*Pediocactus paradinei* B.W. Benson) plots to the local geology. Initial GIS comparisons of geologic data to plant locations show that the cactus appears to occupy sites primarily mapped only as young alluvial fan deposits and or shallow valley fill deposits. By using the geologic maps, the biological resource assessment teams have been able to identify several other communities of this rare cactus plants by looking where these specific map units are mapped.