Using Soil Survey Information for Geomorphic Analysis

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Instructor Notes:

Detailed county-level soil surveys have been produced by the Natural Resources Conservation Service and are available for much of the United States (http://websoilsurvey.nrcs.usda.gov/DataAvailability/SoilDataAvailabilityMap.pdf). County-level soil maps are produced at an impressive scale of 1:24,000. Paper copies of soil surveys can generally be obtained from a local Natural Resources Conservation Service office or library that houses government documents. In addition, all soil map data is now available online via Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm). However, in my experience, I have found that the web version is a little more difficult for students to use because of the limited view.

Although traditionally viewed as product for agricultural and land use development, researchers have begun using soil maps for geological investigations (Brevik and Fenton, 1999; Miller et al., 2008; Oehlke and Dolliver, 2011). The C and/or R horizons of the soil are the "parent material"- the geological material that the soil developed from, which can either be sediment (C horizon), bedrock (R horizon), or a combination. Since soils are "genetically" related to their parent material, the properties and characteristics (especially texture and color) of these horizons are most useful to a geomorphologist. For example, a soil developing on sandstone would have a sandy-textured parent material, whereas a soil developed on limestone would have more clay. A soil developing from loess would be silty well-sorted, whereas a soil developed from glacial till would have a larger range in particle size and contain large coarse fragments. In addition, color could yield important information on the mineralogy of the parent/rock material.

Example #1

I have included two examples of activities that I have developed that use soil surveys as a geomorphic tool within the state of Wisconsin. In the first one (Oneida County, Wisconsin Glacial History), students explore glacial sediments and landforms from an area glaciated by the lobes originating from the Labradoran Ice Dome. Students read the description of soil map units and record information on the glacial sediments and landforms each map unit is associated with.

Once students have become familiar with the basic map units, the most significant component of the activity involves determination of glacial landforms and history of an area within the county by using both the soil survey and a topographic map. The soil survey provides students with characteristics and properties of the soils, while the topographic map aides in landform determination. The activity ends with several questions to get students interpreting the information on their map.

Example #2

The second example (St. Croix County, Wisconsin), is more complicated since the region within the county has both glacial and bedrock soils. The activity starts with an exploration of the glacial sediments. Students read the map unit descriptions for two of the most extensive soil types and document the texture and color and determine that the glacial deposits are from two different ice source regions (Keewatin and Labradoran Ice Domes).

Next, students are given a diagram of the bedrock stratigraphy of the county to get familiar with the major bedrock units. From there, the students determine the characteristics of the major bedrock soils and discover that soils developed on each bedrock have distinctive properties (especially texture).

The most significant component of this activity has students use soil survey information to construct a concept map of a representative cross section within the county. Students use the soil survey to determine which glacial sediments/source and bedrock units each map unit is comprised of. A Quaternary Geologic Map is provided to give students information on the age of glacial sediments and particular formations. In addition, a topographic map is provided to help establish the topography of the area. The activity finishes with students assembling a history/timeline to explain the development of region based on their concept map.

Ideas

Since soil maps are available for much of the United States, it would be very easy to develop something for any given area/region. I have especially found it beneficial to incorporate activities where students do mapping, cross-sections, and timelines/reconstructions. To get started, I would recommend using a paper copy of the soil survey and consult the "General Soil Map", which is usually located in the middle of the book. This map is constructed at a scale of 1:250,000 and can be used to acquaint yourself with the basic soil geomorphology of the county.

Sources

Brevik, E.C. and Fenton, T.E., 1999, Improved mapping of the Lake Agassiz Herman strandline by integrating geological and soil maps, J. Paleolimonology, v. 22, 253-257.

Miller, B.A., Burras, C.L., and Cumpton, W.G., 2008, Using soil surveys to map Quaternary parent materials and landforms across the Des Moines Lobe of Iowa and Minnesota. Soil Survey Horizons, v. 49, 91-95.

Oehlke, B.M., and Dolliver, H.A.S., 2011, Quaternary glacial mapping in western Wisconsin using soil survey information, J. Natural Resources and Life Sciences Education, v. 40, 73-77.