Role of GIS in Geological Data Interpretation, Map Making and Data Storage: A Case Study from the Nepal Himalaya

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The use of GIS in petroleum, mining, and geo-environmental industries has long been recognized, but examples of GIS-based geospatial database development for small-scale structural analysis, geological mapping, and map compilation are relatively few. The power of GIS for spatial data analysis makes it a very important tool to compile and enhance geological maps. Using this technique we have compiled a new geological map of the far west Nepal Himalaya. This region contains exemplary geological features related to the ongoing collision between India and Asia. Although geological mapping has been underway in the Nepal Himalaya since the mid 18th century, systematic geological mapping did not start until the 1970s. Geological mapping conducted by Nepalese geologists in far western Nepal is based on regional geological correlation without the advantage of geochronology and systematic structural analysis. Geological investigations in far west Nepal since 1994 by a team of students and researchers from the University of Arizona involved geological mapping followed by detailed geochronological, geochemical, petrologic, and structural analytical work. Our new map combines results of this recent work with the earlier work by Nepal Government geologists. Himalayan tectonostratigraphy is complicated and involves numerous, thrust-bounded units ranging in age from Mio-Pliocene foreland basin deposits to Paleoproterozoic metasedimentary and meta-plutonic rocks. Major structures include active frontal and possibly out-of-sequence thrusts, a regional-scale duplex, major thrust faults with >100 km of displacement, and imbricate thrusts and related folds.

This project is focused on building a geospatial data model by integrating geochronological, geological, seismological, petrographic, and geochemical datasets from far west Nepal. The large data set integrated in this model may lead to better understanding of Himalayan geological history. The stepwise process includes the collection of all available geological, topographical, seismic, geochronological and geochemical information in the form of vector and raster spatial data, tables, and reports. With the available information a new geological map of far west Nepal was compiled in GIS using ESRI ArcMap 9.3. Several data layers were developed and hyperlinked with the newly revised geological map; this will allow users to access supporting data from the map directly. In general this study describes the process of geological data compilation, query, visualization, and analysis for map compilation and data storage in the GIS platform for the better understanding of regional structural and kinematic history of far western Nepal Himalaya. Ongoing work involves updating and overlaying geological mapping from all of Nepal onto our seamless topographic base for the entire country.

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