The Challenge(s) of Surface-Geologic Mapping in Louisiana

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ABSTRACT

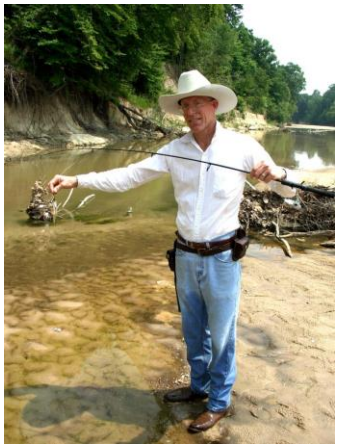
Most American geologists traditionally have been taught field techniques in settings with reasonably old and nakedly exposed strata, in geological terranes characterized by ancient, hard rock that are situated in semiarid or arid climates (e.g., Colorado, west Texas, Wyoming). The reason seems obvious: a relative lack of obstacles to observing, and thus to teaching, facilitates learning anything new. Quaternary strata in such terranes tend to be of minor if not negligible volume and geologic significance.

The value of learning in such an environment for the sake of introduction and attempted mastery of basic concepts and skills is indisputable. At the other end of the geologic and climatic spectrum, however, one finds that few of the specific skills learned and practiced at most geology field camps in the U.S. can be transferred directly to mapping exercises in Plio–Pleistocene terranes in tropical and subtropical climates. The surface of Louisiana, with dominantly Quaternary strata and a humid subtropical climate, represents one such terrane. Exposures are scarce and those that occur are largely ephemeral, as is the case in many coastal-plain settings, necessitating a completely different approach to the geologic-mapping enterprise than that likely experienced at field camp.

These natural difficulties of surface mapping in our state have been exacerbated by a particular cultural overlay during the past century: the advent of oil and gas exploration here led to a disproportionate focus on the deep subsurface, which eclipsed interest in surface geology. Additionally, the geological profession underwent its own culture change over the past half century, during which diversification of research techniques led to a relative deemphasis of field mapping, once the essential and main technique for conducting geological research.

Given these special circumstances and the research climate of recent decades, Louisiana Geological Survey (LGS) mappers have keyed primarily on geomorphic signatures of Quaternary and Pliocene units in the conduct of surface-geologic mapping projects. These stratigraphic units successively incise each other in the area updip of the hinge zone of northern Gulf basin subsidence, an area covering most of the onshore region. In this area they are terraced, and their depositional surfaces show a spectrum of age-related characteristics, including elevation range, relief, slope, and degree of dissection. As a result, Pliocene and younger stratigraphic units show distinctive geomorphic attributes relative to older strata and to each other. The most efficient strategy, therefore, is to (1) create new source mapping of Plio–Pleistocene and Holocene units based on geomorphic aspects using the best topographic data available; (2) integrate the newer mapping of Plio–Pleistocene units with legacy mapping of Tertiary "bedrock" units (where present); (3) modify the resulting contacts based on observations made during strategic field checking; and (4) recompile at the selected target scale (larger than the intended scale of presentation if developing the data in a GIS). Application of the above methodology, supported by selective checking of interpreted surface contacts against relevant subsurface information where possible in problem areas, has been LGS practice over the past two-plus decades. This time frame essentially corresponds to the duration thus far (24 years) of the STATEMAP component of the congressionally authorized National Cooperative Geological Mapping Program, which has been the principal sponsor supporting statewide completion of 30 x 60 minute geologic quadrangle coverage at 1:100,000 scale.

BIOGRAPHY



Richard P. McCulloh holds a B.S. degree in geology from Oklahoma State University and an M.A. degree in geology from the University of Texas at Austin. He joined the Louisiana Geological Survey (LGS) in Baton Rouge after working for two years as a geologist for Conoco Minerals Inc. in the south Texas uranium district.

At LGS he has been involved in mapping and compilation of surface geology at scales ranging from 1:24,000 to 1:500,000, as well as other surface and subsurface investigations including stratigraphic configurations associated with Miocene growth faults; delineation of shale-filled channels in the Wilcox Group; surface and shallow-subsurface geology of emergent salt domes in coastal Louisiana; and structural geomorphology as reflected in stream nets and alluvial courses.