COMMENTS AND REPLIES

Online: *GSA Today*, Comments and Replies
Published Online: July 2009

Comment

Lithostratigraphy for Quaternary glacial deposits: "If it ain't broke, don't fix it!"

Mark D. Johnson, *Earth Science Centre, University of Gothenburg, Box 460, Göteborg, Sweden;* ***Carrie Jennings*** *and* ***Howard Hobbs,*** *Minnesota Geological Survey, 2642 University Ave., St. Paul, Minnesota 55114, USA*

Räsänen et al. (2009) claim that lithostratigraphic classification of Quaternary glacial deposits is so problematic that it is time to use allostratigraphy instead. Our immediate response from a Midwest perspective is—what problems? Formal lithostratigraphic classification of glacial deposits works. Since its initial use to define Pleistocene units in the Midwest (Willman and Frye, 1970), there has never been a serious reason to question this practice. Indeed, formal lithostratigraphies have been progressively established in most Midwestern states.

Räsänen et al. (2009) claim that Quaternary units are difficult to map. But in the Midwest, till sheets have been correlated based on texture and grain lithology for hundreds to thousands of kilometers, from the Canadian border through Minnesota to central Iowa, a distance equal to a till sheet stretching from central Finland to Lithuania.

Not only is formal lithostratigraphy possible and successful in the Upper Midwest, it is useful! Minnesota consulting geologists commonly use formal lithostratigraphic terms in their reports. The current development of the Minnesota lithostratigraphy is a direct response to a need for better 3-D information (see http://www.onegeology.org).

Quaternary sequences are filled with unconformities, but it would prove difficult to decide in the field which unconformities are significant enough to define alloformations. Despite this, Räsänen et al. (2009) claim their combined use of allostratigraphy and lithostratigraphy (CUAL) approach is more "practical" and present an example from a complex, single exposure in Sweden. They identify unconformities and alloformations, but how would one recognize the same unconformities 20 km away or even half a kilometer? Presumably, by identifying, in their example, the Stallerhult till, the Ramslid till, and the Dalby till—that is, by doing lithostratigraphy.

Räsänen et al. (2009) imply that geologists are forced to choose among the seven or eight classification "approaches" they list. But this is wrong thinking; all sedimentary deposits have multiple characters. Units on Quaternary maps in the Upper Midwest commonly combine geomorphic, sedimentologic, *and* lithostratigraphic information. To restrict the characterization of glacial deposits to the allostratigraphic system is to gloss over the complex character of glacial deposits and the added information gained from using additional classifications.

We understand the problems in Finland, and we agree that formal lithostratigraphy, which works so well off the shield, may not be, in practice, *useful* in the shield areas. It is therefore odd that the authors choose examples to criticize from regions (The Netherlands, Britain, Minnesota) that are not on shields and where lithostratigraphy has proven to be successful.

We take issue with how Räsänen et al. (2009) characterize the lithostratigraphic work in the Midwest. We can report that the Minnesota Geological Survey (MGS) lithostratigraphic classification is not "freely" applied, nor does it use North American Code of Stratigraphic Nomenclature (NACSN) terminology "loosely." On the contrary, the MGS lithostratigraphy not only requires definition of the eleven factors in the NACSN code, but eight additional requirements in order to increase uniformity in how units are defined in Minnesota.

Additionally, Räsänen et al. (2009) display a commonly held misunderstanding when they describe the Illinois lithostratigraphy of Willman and Frye (1970), and by implication, Minnesota's, as a sensu latu approach. They claim this because our approaches allow for lithologic variability in the lithostratigraphic unit. However, lithostratigraphic units are defined on the basis of "lithic characteristics and stratigraphic position" (NACSN, 2005). Nowhere in the code is there a requirement for lithologic homogeneity! The Ordovician Saint Peter Sandstone of the Upper Midwest is quartz arenite in places and subarkose elsewhere—one doesn't change the formation status for the feldspar percentage. The till layer they show (their Fig. 2) could actually be defined as one lithostratigraphic unit; it is a *layer*, and its lithology can be characterized. It may not be a very useful or practical unit, but it would strictly meet the code.

We could not disagree more that an allostratigraphic classification is easier to correlate with global climate changes. In Minnesota alone, there are over 30 till units associated with Marine Isotope Stage 2, and the unconformities separating these units are more likely the product of ice dynamics and have little bearing on regional climate forcing.

On a positive note, we understand that alloformations can be of use in defining Quaternary glacial and related sequences. In the Baltic, seismic profiles shown by Räsänen et al. (2009) clearly show unconformities but yield little material characteristics, so alloformations seem appropriate. However, if these deposits were on land, as in Minnesota, the material character would be observable, the unconformities less so, and lithostratigraphy more practical.

In short, although we see a potential role for allostratigraphy in Quaternary deposits, there is no reason to discard our successful and useful Midwest stratigraphies: If it ain't broke, don't fix it.

REFERENCES CITED

North American Commission for Stratigraphic Nomenclature, 2005, North American Stratigraphic Code: AAPG Bulletin, v. 89, p. 1547–1591.

Räsänen, M-E., Auri, J.M., Huitti, J.V., Klap, A.K., and Virtasalo, J.J., 2009, A shift from lithostratigraphic to allostratigraphic classification of Quaternary glacial deposits, GSA Today, v. 19, no. 2, p. 4–11, doi: 10.1130/GSATG20A.1.

Willman, H.B., and Frye, J.C., 1970, Pleistocene stratigraphy of Illinois: Illinois State Geological Survey Bulletin 94, 204 p.