In Search of a Practical Correlative Conformity

EMBRY, Ashton, Geological Survey of Canada, 3303 33 St NW, Calgary, AB, Canada, T2L 2A7,
aembry@nrcan.gc.ca

Sloss originally defined a sequence in 1949 as a stratigraphic unit bounded at the top and bottom by unconformities. With this definition a sequence could be traced only as far as the extent of its bounding unconformities. In 1977 Vail and colleagues proposed a new definition of a sequence: “a stratigraphic unit composed of genetically related strata bounded at the top and bottom by unconformities or their correlative conformities.” With the inclusion of the concept that sequence boundaries be extended basinward along “correlative conformities”, the definition provided for a sequence that potentially could be delineated over an entire basin and not just on the basin margins where most unconformities occur. From the time this revised definition of a sequence was proposed, there has been a great deal of discussion on what specific types of stratigraphic surfaces can be used for a correlative conformity.

There seems to be widespread agreement that sequence boundaries should coincide with subaerial unconformities and shoreface ravinement surfaces that have eroded through subaerial unconformities. Such unconformable stratigraphic surfaces occur mainly on basin margins and most disappear towards the center of a basin. The extension of a sequence boundary into the conformable succession of the more central regions of a basin has been the subject of both confusion and debate. Six different approaches have been used for delineating the “correlative conformity” portion of a sequence boundary in a conformable succession. These are:

1) Coincident with a time line equivalent to the start of base level rise.
2) Coincident with a time line equivalent to the start of base level fall.
3) Coincident with the regressive surface of marine erosion
4) Coincident with the base of the first high-energy depositional unit
5) Coincident with the slope-onlap surface
6) Coincident with the maximum regressive surface

It is important to critically examine these approaches to determine which are practical and usable and which are impractical and best forgotten.

To be considered practical, a correlative conformity must meet four criteria. These are:

1) It should be a stratigraphic horizon that can be delineated by objective scientific criteria compatible with the tenets of sequence stratigraphy. Thus it must represent a change in depositional trend and be recognized mainly by sedimentological analysis.
2) It should join with the basinward terminus of the unconformable portion of the sequence boundary so as to form a single, continuous boundary.
3) It should be widespread in most basins.
4) It should have relatively little diachroniety.

The practicality of each of the six approaches to delineating a correlative conformity has been evaluated with the four criteria listed above. Use of the time line coincident with the start of base level rise is not practical because such a horizon is purely hypothetical and cannot be objectively recognized with sedimentological criteria. The time line coincident with the start of base level fall is impractical for the same reason and also fails because it does not join with the end of the unconformable portion of the boundary.

The regressive surface of marine erosion is not a suitable candidate because it is highly diachronous, occurs over a limited portion of a basin and does not join the basinward end of the unconformity. The base of the first high-energy depositional unit is also not a practical horizon for a correlative conformity because such a surface is highly diachronous. Furthermore it does not join the basinward edge of the unconformity.

The slope-onlap surface develops only in basins with a shelf-slope break and thus is not developed in ramp settings. For this reason alone it is not suitable for a correlative conformity. Notably it also is impractical because it does not join the basinward termination of the unconformity.

The maximum regressive surface meets all the criteria for practicality in most instances. It is readily delineated with sedimentological criteria. It is widespread throughout the conformable succession. It has low diachroniety. And in almost all cases it joins the basinward termination of the unconformity. Thus a maximum regressive surface which separates regressive strata below from transgressive strata above seems to be the only practical candidate for the “correlative conformity” portion of a sequence boundary.

An important corollary of this analysis is that in most instances a lowstand system tract and a falling sea level system tract cannot be delineated with any semblance of scientific objectivity. From a practical point of view, only two systems tracts can be delineated for a sequence with common sense boundaries. These are a transgressive system tract and a regressive systems tract.