The Correlative Conformities

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The value of sequence stratigraphy in regional stratigraphic analysis greatly increases if the sequences used in such analysis can be extended over the entire region or sedimentary basin under study. This allows to better decipher the geological history of the region or basin and to determine the timing of the processes of deposition, burial, and deformation of the sedimentary section. To do this, the unconformities bounding the sequences in their basin-flank position need to be extended into the area of apparent continuous deposition in the central part of the basin along what have been called in sequence-stratigraphy procedure the correlative conformities of the bounding unconformities of the sequences.

Unfortunately, what a correlative conformity is, and how it can be recognized and mapped has nowhere been clearly and precisely defined. Closest are the statements of Mitchum, Vail, and Thompson (1977, p. 55) that “the conformable part of a sequence boundary is practically synchronous because the hiatus is not measurable”, and that “the boundaries of a depositional sequence are conformable and, therefore, synchronous in many places”.

We need, therefore, to ask ourselves: What is a correlative conformity? How is it recognized and mapped? How much use has it received in practical stratigraphic work?

A correlative conformity is here defined as a synchronous stratigraphic surface, a surface or interface the same age everywhere, what has been called a chronohorizon. “Correlative” refers to chronocorrelation. It originates at the horizon in the stratigraphic section where the corresponding unconformity bounding a sequence dies out or can no longer be recognized at the degree of resolution of the available stratigraphic correlation tools, and extends into the area of apparent continuous deposition in the central part of a basin. A correlative conformity cannot be defined except as an extension of a defined unconformity, it *needs* to tie to the termination of the corresponding unconformity, it cannot be identified “in isolation”.

As chronohorizons, there is nothing physically distinctive about the correlative conformities of the unconformities bounding a sequence except that they represent certain instants in time. Conceptually, they are ideal, interpretive surfaces depending for their definition, characterization, recognition and tracing on the availability and degree of resolution of reliable diagnostic criteria of dating and chronocorrelation (time correlation, synchroneity). However, when such precise diagnostic criteria are available, the recognition and mapping of the correlative conformities as chronohorizons away from the horizons where the corresponding bounding unconformities of a sequence die out, into and through the area of apparent continuous deposition, can be accomplished with a high degree of objectivity.

Most effective criteria for chronocorrelation are:

1) Good-quality, high-resolution seismic reflections believed to represent synchronous surfaces.
2) Biostratigraphic methods that can best be used as guides to time correlation—principally those dealing with the ranges or lineages of open-marine, short-range planktonic organisms. All biostratigraphic units, however, may diverge from time horizons for many reasons.
3) Isotopic dating of those rocks amenable to such methods of numerical age determination.
4) Geomagnetic polarity reversals. These reversals, however, are binary and repetitive in character, and specific ones cannot be identified without assistance from other methods, such as biostratigraphy or isotopic dating.
5) Stable isotopes analyses.
6) Tracing of beds, particularly distinctive marker beds, or wireline-log markers believed to be essentially synchronous. Individual volcanic-ash beds, for example, may be excellent guides to time-correlation over extensive areas.
7) Finally, the possibility cannot be discarded that new methods of chronocorrelation, not even imagined today, may become available in the future that can make important contributions to the objective recognition and mapping of correlative conformities

The combination of two or more of these methods improves the effectiveness of the identification and tracing of correlative conformities—each one would serve to support or contradict the dating and correlation indicated by the others; if all, or most, agree, the probability of sound and objective dating and chronocorrelation would be considerably increased. Synchroneity, however, can be approached only with diminishing accuracy as a chrono-horizon is traced away from where it is defined, in the case of a correlative conformity from where the corresponding unconformity dies out basinward or can no longer be recognized at the resolution of the available dating and correlation tools.

The precise and objective recognition and mapping of the correlative conformities can best be attained when good quality, high-resolution reflection seismic information is available. Their recognition and mapping by other methods of dating and chronocorrelation—high-resolution biostratigraphy, isotopic dating, geomagnetic data, tracing of beds wireline-log markers—presents considerable more difficulty. Even in the case of good subsurface information, the tracing and mapping of the correlative conformities requires that wells are sufficiently close together so that potentially synchronous marker beds can be traced from well to well with reasonable assurance.

This difficulty in recognizing and mapping the correlative conformities of the unconformities bounding sequences, other than when good-quality seismic information is available, is clearly reflected in the literature on sequence stratigraphy: very few "nonseismic" sequence-stratigraphy investigations have extended the sequences under discussion along the correlative conformities of their bounding unconformities into and through basinal areas where deposition appears to be continuous, and none so far reviewed has defined the correlative conformities, and has discussed the criterion or criteria for recognizing and mapping them The identification, description, and mapping of the sequences under discussion has been limited in nearly all cases to the areas where the sequences are bounded by unconformities.

The extension and mapping of sequences into the areas of apparent continuous deposition along the correlative conformities of their bounding unconformities is a very desirable objective of regional stratigraphic analysis, an objective that stratigraphers should always strive for, but one that should be undertaken only where reliable diagnostic criteria for chronocorrelation (synchroneity) are available.

Reference

Mitchum, R.M., Jr., P.R. Vail and S. Thompson, III, 1977, Seismic stratigraphy and global changes of sea level, Part 2: The depositional sequence as a basic unit for stratigraphic analysis, *in* Seismic stratigraphy—applications to hydrocarbon exploration, C.E. Payton, ed.: AAPG Memoir 26, p. 53-62.