Review of the Concept of and Recommended Terminology for Unconformity-Related Units

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Introduction. After the publication of the second edition of the International Stratigraphic Guide in 1994, which made only brief reference to sequence stratigraphy, the International Subcommission on Stratigraphic Classification (ISSC) in view of the worldwide acceptance and use of sequence stratigraphy and its significant role in revitalizing stratigraphy, appointed in late 1995 a working group to review the basic concepts and terminology not only of sequence stratigraphy, but of all unconformity-related units. Following is a summary of its discussions and recommendations.

First, a brief historical review. Geologists have long recognized unconformities, disconformities, and evident gaps in the stratigraphic succession as some of the fundamental features of stratigraphy. Little effort was made, however, to recognize unconformity-bounded units as distinct stratigraphic units with their own specific terminology until Sloss, Krumbein, and Dapples proposed in 1949 the term "sequence" for them. Sloss in 1963 defined sequences as "rock-stratigraphic units of higher rank than group, megagroup, or supergroup, traceable over major areas of a continent and bounded by unconformities of interregional scope."

The great improvement in the resolution of seismic data during the 1960s and 1970s allowed Peter Vail and his EXXON co-workers to recognize in seismic sections truncations, overlaps, and other stratal relationships and, consequently, the detection and mapping of unconformities, the location of their basinward termination, and the extension of the unconformities along seismic reflectors beyond their termination into areas of apparent continuous deposition. On the basis of this new capability, Mitchum, Vail, and Thompson redefined sequence in 1977 as "a stratigraphic unit composed of a relatively conformable succession of genetically related strata and bounded at its top and base by unconformities or their correlative conformities", the basic unit of seismic stratigraphy. What the correlative conformities were and how they could be recognized and mapped was not clearly specified.

This definition of "sequence" survived when seismic stratigraphy developed into sequence stratigraphy with the recognition of sequences on the basis of other stratigraphic data: subsurface wireline logs and samples, and outcrops.

These two somewhat different definitions of "sequence," however, were not the only way in which the term had been used in stratigraphy. It had been frequently used, for instance, to refer to just any informal succession of strata.

Recognizing the usefulness of stratigraphic units bounded by discontinuities in the stratigraphic record, but not wanting to use the term "sequence" because of its various previous use, the North American Commission on Stratigraphic Nomenclature (NACSN) proposed in the 1983 North American Stratigraphic Code the terms "allostratigraphic units" ("allogroup", "alloformation", "allomember") for stratiform bodies of sedimentary rock defined and identified on the basis of their bounding discontinuities in the stratigraphic record.

The ISSC, for similar reasons, used the term "synthem" of Chang (1975) in a note published in 1987 and in the second edition of the International Stratigraphic Guide (1994) for its unconformity-bounded units. Like the NACSN, the ISSC did not favor the extension of the unconformity-bounded units beyond the basinward termination of the bounding unconformities.

The terminology dilemma. While the Working Group fully recognized the indisputable importance of unconformity-related units in stratigraphic work, it was faced by the existence of different schemes of nomenclature for essentially similar units: the sequences of Sloss, the sequences of seismic and sequence stratigraphy, the allostratigraphic units, and the synthems. Three of them—the sequences of Sloss, the allostratigraphic units and the synthems—are identical types of units; the sequences of seismic and sequence stratigraphy differ from the others only in that they may be extended beyond the basinward termination of their bounding unconformities.

We asked ourselves the following questions:

1) Were these four different terminologies for unconformity-related units necessary?
2) Was the inclusion of the correlative conformities in the definition of the sequences of seismic and sequence stratigraphy significant enough to justify a separate terminology?
3) Are the sequences of seismic and sequence stratigraphy objective units where bounded by unconformities but interpretive when bounded by the corresponding correlative conformities?

To answer these questions, it was necessary to examine and discuss the concept, definition, and procedures for the recognition and mapping of the correlative conformities, the feature that apparently made the sequences of seismic and sequence stratigraphy different from the other three kinds of unconformity-related units.

The correlative conformities. The only previous indications of the nature of the correlative conformities were statements by mitchum, vail, and thompson in 1977 that " the conformable part of a sequence boundary is practically synchronous because the hiatus is not measurable" and "the boundaries of a depositional sequence are conformable and, therefore, synchronous in many places."

The Working Group agreed to a more precise definition of a correlative conformity as a synchronous stratigraphic surface—a chronohorizon—that originates at the horizon in the stratigraphic section where the corresponding unconformity bounding a sequence dies out and extends into the area of apparent continuous deposition in the central part of a basin. The diagnostic criteria for the recognition and mapping of a correlative conformity are those commonly used for dating and chronocorrelation: good-quality, high-resolution seismic reflections and biostratigraphic data, geomagnetic polarity reversals, tracing of beds and stratigraphic markers in the surface or the subsurface, etc.

When these diagnostic criteria are available, the recognition and mapping of correlative conformities as chronohorizons can be accomplished with a high degree of objectivity. When such criteria are not available, the correlative conformities cannot be recognized and the sequence becomes an unconformity-bounded unit identical to the sequences of Sloss, the allostratigraphic units, and the synthems. In either case, the sequences of seismic and sequence stratigraphy are reasonably objective stratigraphic units.

The preferred terminology. In selecting the preferred terminology for naming unconformity-related units, it is important not to lose touch with reality—words are means of communication; those in common use, even if not well defined, are preferable to those that have received only limited use. In our case, the test of usage tells us that the allostratigraphic units and the synthems have received very limited acceptance and use in stratigraphic work, 18 and 26 years, respectively, after they were first proposed. It would be unrealistic to believe that they will be received with any more enthusiasm in the future. "Sequence," on the other hand, is widely used today—though not always correctly.

The Working Group, therefore, favors to abandon the use of the terms "allostratigraphic units" and "synthem," and to unify the terminology of unconformity-related units by recognizing a single term—"sequence"—for all such units. To successfully accomplish this unification it is obviously necessary to propose a clear and precise definition of "sequence"; a definition sufficiently flexible to make the term useful at various levels of knowledge, under different circumstances, for different purposes and for all rock ages and sedimentary environments. It is our hope that this definition of "sequence" will be broadly accepted and used making possible successful international communication and more effective stratigraphic work.

Definition of sequence. Nine members of the Working Group favor a bipartite terminology for sequences: a descriptive unit—stratal sequence—and an interpretive unit—depositional sequence. This terminology will be discussed later in the conference by Nicholas Christie-Blick.

Six other members—Jan Hardenbol, Henry Posamentier, Amos Salvador, Peter Vail, John Van Wagoner, and Paul Weimer—prefer the following single definition of sequence:

A sequence is a stratigraphic unit composed of a relatively conformable succession of genetically related rocks bounded by discontinuities in the stratigraphic record (unconformities) representing subaerial or submarine erosion and/or nondeposition that are believed to have local or regional stratigraphic significance. A sequence can be extended beyond the basinward limits of its bounding unconformities, when desirable and possible, along their corresponding correlative conformities.

The recognition of the correlative conformities is not always possible and it is not essential, therefore, in the definition, characterization, and mapping of a sequence.

If the cause of the bounding unconformities of a sequence can be properly interpreted, and if it is judged to be valuable or necessary in the definition of the sequence, it should be clearly stated and the evidence for such an interpretation should be clearly discussed.

References

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