NEWSLETTER ON CARBONIFEROUS STRATIGRAPHY

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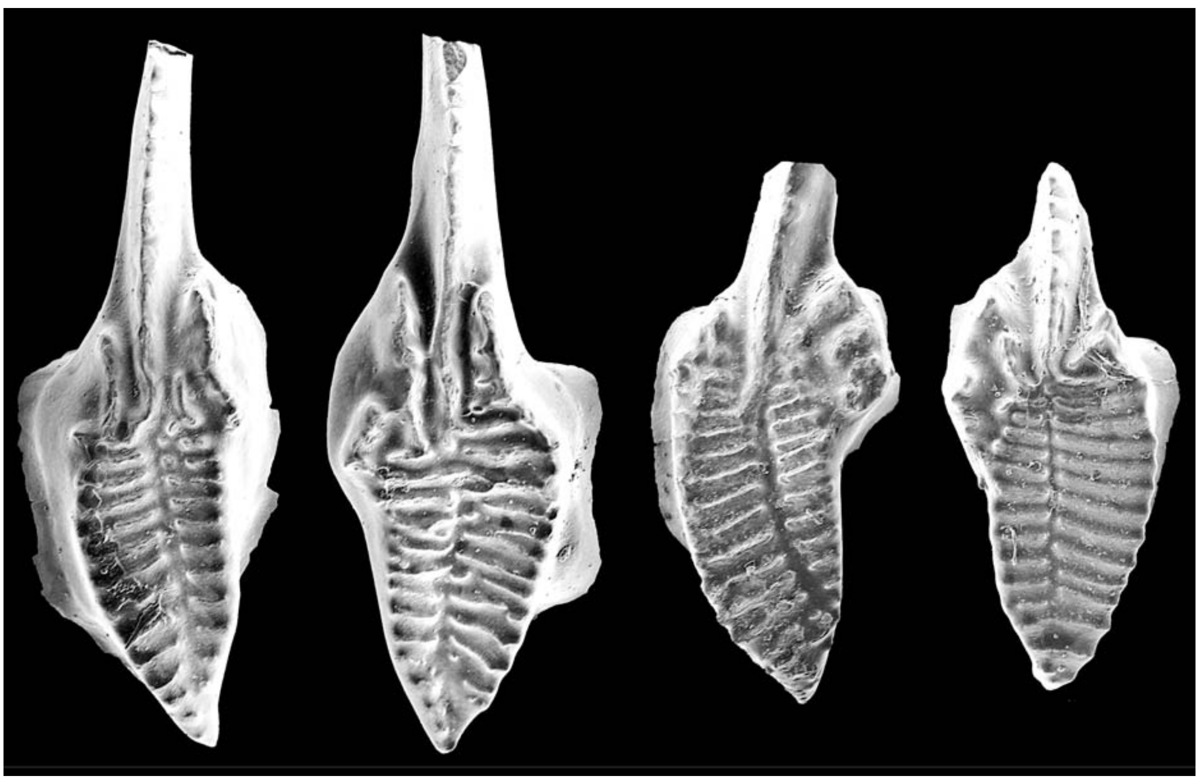

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I.U.G.S. SUBCOMMISSION ON CARBONIFEROUS STRATIGRAPHY

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Are regional stages necessary?

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The bipartition of the Carboniferous System adopted by the International Commission of Stratigraphy for the world stratigraphic chart is impractical in Gondwana. Correlation with the Paleoequatorial realm, from the Late Viséan to the Early Permian inclusive, is not possible by paleontologic means because of endemism of the biota. As Heckel (2001) noted, Angara and Gondwana "will need to retain regional subdivisions above the upper part of the Mississippian." This is especially the case in Argentina, where absolute ages are insufficient and somewhat imprecise, and do not give the certainty of paleontologic methods. Moreover, dating sequences of this interval frequently initiates endless discussions about their position within the world stratigraphic scale, especially of those units that are suspected to contain the Mid-Carboniferous and Carboniferous-Permian boundaries. For practical reasons, it would be more desirable, and reliable, to refer these sequences to regional stages, rather than attempting debatable correlations with the paleoequatorial standards.

The Gondwana glaciations are the most outstanding events of the Late Paleozoic. During this "ice age" climatic changes and sea-level fluctuations were the most important factors that induced the origin, evolution, and extinction of endemic taxa (Roberts, 1981; González, 1997), and marine faunas reflect variations of sea-water temperature. The best known of these are closely associated with glaciations, such as the Middle Carboniferous *Levipustula* fauna and the Early Permian *Eurydesma* fauna. However, other less well known assemblages are also indicators of temperature.

Marine sequences show a changing succession of lithofacies and biofacies that were clearly linked to paleoclimatic events. They suggest that major climatic changes occurred rapidly in terms of geologic time. The most significant of these occurred at the beginning and end of the "ice age," and at the beginning and end of the Upper Pennsylvanian interglacial. Minor variations in temperature caused discrete glaciations, but these were not so significant as to greatly affect faunal composition. After each major climatic change, a distinct faunal assemblage flourished during lapses of more or less stable, glacial or non-glacial, climatic conditions, until a new climatic change occurred. In the Carboniferous-Permian sequences of Argentina, five Major Faunal Groups can be distinguished which are closely associated with each climatic stasis. These have proved to be effective biostratigraphic units at a regional scale. Based on these Major Faunal Groups, I proposed (González, 1993) a preliminary sequence of regional stages for the Carboniferous and Early Permian. These can be matched with Australian faunas, which are, in turn, constrained by absolute age dates (Roberts et al., 1995; Claoué-Long et al., 1995) and allow a reliable correlation with the paleoequatorial standards. In this regard, the Mid-Carboniferous boundary occurs somewhere within the Serpukhovian-Bashkirian *Levipustula* Zone.

Both paleoclimatic events and their associated faunas are adequate for the subdivision of the lapse between the Late Mississippian and the Early Permian in the South American Gondwana area.

A significant advance was achieved during the First Meeting on Upper Paleozoic Chronostratigraphy of South America, held in Gramado, Brazil, in 2004. On this occasion, a concrete position was finally adopted following a proposal by Carlos Azcuy (this issue), which led to the formation of working groups that will address problems of South American Gondwana biostratigraphy. The faunal subdivision proposed in 1993 may serve as a starting point for future discussions on regional stages.

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Carboniferous Correlation Table (CCT) Karbon-Korrelationstabelle (KKT)

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Since the early attempts at a stratigraphic subdivision of Carboniferous rocks, many correlation charts of questionable merit have been proposed for the different biostratigraphic zonations and lithologic successions of the Carboniferous. For this purpose, the results of the Congresses on Carboniferous Stratigraphy since 1927 proved to be quite helpful, but difficulties are still obvious (e.g., Paproth, 1969). In western Europe (i.e., the realm of the Carboniferous Limestone Shelf Facies), small-scale differences in litho- and biofacies complicate the task. In central Europe (i.e., the realm of the Kulm Facies), these attempts are hampered by extreme variations in thickness, sedimentary unconformities, magmatic extrusions, and tectonic influences. Additionally, gaps in knowledge and lack of paleontological revision of many fossil groups largely prevented the publication of reliable correlation charts. Consequently, many workers had to manage their own attempts or, for the Dinantian (i.e., the European Lower Carboniferous), use the table published by the Arbeitsgemeinschaft für Dinant-Stratigraphie (1971).

With support from the German Subcommission on Carboniferous Stratigraphy, the authors published a Carboniferous Correlation Table (CCT; Amler and Gereke [eds.], 2002, 2003) based on the same system and principles as the highly successful Devonian Correlation Table (Weddige, 1996). Unlike the Devonian, however, the Carboniferous disadvantageously lacks the framework of a high-resolution conodont zonation. Actually, a precise multi-stratigraphy is necessary to enable reliable and accurate correlation. Furthermore, the current international subdivision of the Carboniferous lacks ratified GSSPs, and the upper boundary of the system/period remains largely unknown.

In the first two issue of the Carboniferous Correlation Table published in *Senckenbergiana lethaea* (Frankfurt/Main) Vol. 82 (2002) and 83 (2003) we presented the biostratigraphic subdivision of the Mississippian in basinal (Kulm) facies with regional stratigraphic correlation columns for the Rhenish Basin (Amler and Gereke [eds.], 2002, 2003). Regarding the incomplete sedimentary sequence, no complete biozonation has yet been established for the Mississippian of central Europe, either because of fragmentary faunal or floral content or even general lack of biota. Local and regional biostratigraphic zonations of the Kulm sequence are based on goniatite successions, trilobites, and radiolarians (Korn, 1996; Hahn and Hahn, 1974; Braun and Gursky, 1991; Braun and Schmidt-Effing, 1993; and earlier references therein), but seem to be virtually unknown outside Germany. A lithologic and biostratigraphic correlation of Carboniferous limestone shelf and Kulm sequences is restricted to interfingering areas or large scale carbonate turbidites derived from the shelf edge that spread across the basin or, at least, parts of it (Paproth, 1969; Bender et al., 1993 and earlier references therein). However, serious correlation difficulties and uncertainties are still present due to the scarcity of common index fossils, contrasting with the fine-scaled conodont zonation of the Upper Devonian, where correlation problems occur only in pure red shale sequences.

The following parts, which are currently under preparation for a 2005 issue, will include the subdivisions of the shelf facies as well as those of the Pennsylvanian. We would like to encourage all our colleagues working in bio- and lithostratigraphy or worldwide correlation to create and provide us with their own columns for publication in forthcoming issues.

The rules and instructions largely follow those compiled by Weddige (1996, p. 268; 2000, p. 685) for the Devonian Correlation Table. We would like to stress that each column represents an individual element, is registered individually under the name of the compiler, and must be cited as such. Consequently, the compiler, who does not necessarily need to be the author of the zonation, is responsible for the respective column (see Weddige, 2000, p. 686). In each subsequent issue of the CCT previously published columns may appear in a revised version. Commentaries to individual columns may be published as separate "Annotations" in *Senckenbergiana lethaea*.

M.G. had the idea of applying the concept of the successful Devonian Correlation Table to the Carboniferous. First drafts of columns were compiled by M.A. and M.G. in cooperation with the authors. The final arrangement and layout of the columns was carried out by M.G. after extensive coordination with the contributing authors. As the representative of the German Subcommission on Carboniferous Stratigraphy, M.A. is responsible for the contined publication of future issues of the CCT. Special thanks for information and critical comments are due to Dieter Korn (Berlin), Dieter