New Stratigraphic Rank for the Carboniferous, Mississippian, and Pennsylvanian in Kansas

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Abstract

A new classification for the Carboniferous System/Period is formally adopted by the Kansas Geological Survey (KGS), and Zeller (1968) is modified accordingly. The Carboniferous is the system/period between the Devonian and Permian, and the Mississippian and Pennsylvanian are subsystems/subperiods of the Carboniferous. The Mississippian is subdivided into Lower, Middle, and Upper Mississippian Series and the Pennsylvanian is subdivided into Lower, Middle, and Upper Pennsylvanian Series. Regional stage names remain unchanged.

Introduction

In an effort to standardize international stratigraphic nomenclature globally, the international geoscience community has embraced a new classification for the Carboniferous System/Period that includes subsystem/subperiod, series/epoch, and stage/age names. This paper addresses the new classification scheme as it applies to Carboniferous nomenclature in Kansas, and subsequent revisions to Zeller (1968) that are hereby formerly adopted by the Kansas Geological Survey (fig. 1).

Discussion

Subsystems/Subperiods

The Mississippian and Pennsylvanian are now subsystems/subperiods of the Carboniferous System/Period. This decision was ratified by the ICS and IUGS and reported in the 2000 Newsletter on Carboniferous Stratigraphy (Metcalfe, 2000). The Global Stratotype Section and Point (GSSP) for the Mississippian–Pennsylvanian boundary was established at Arrow Canyon, Nevada (Lane et al., 1999; Richards et al., 2002).

Series/Epochs

The Mississippian Subsystem/Subperiod has been subdivided into Lower, Middle, and Upper Mississippian Series (Early, Middle, and Late Mississippian Epochs), and the Pennsylvanian Subsystem/Subperiod into Lower, Middle, and Upper Pennsylvanian Series (Early, Middle, and Late Pennsylvanian Epochs). This was ratified by the ICS and IUGS and reported in the 2004 Newsletter on Carboniferous Stratigraphy (Work, 2004).

Stages/Ages

The stage/age names used in Russia and Europe were ratified by the ICS and IUGS (Work, 2004) as the official global stage/age names for the Carboniferous. The stage/age boundaries coincide with the series/epoch boundaries (see fig. 1), in ascending order: Lower Mississippian = Tournaisian; Middle Mississippian = Visean; Upper Mississippian = Serpukhovian;
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**FIGURE 1**—Carboniferous nomenclature changes to Zeller (1968) that are formally adopted by the KGS. Left column: Zeller (1968). Center column: This paper, changes are highlighted in red. Right column: ICS nomenclature; stage boundaries with asterisks have not been ratified by the ICS/IUGS.

Lower Pennsylvanian = Bashkirian; Middle Pennsylvanian = Moscovian; and Upper Pennsylvanian = Kasimovian plus Gzhelian.

Global Stratotype Sections and Points (GSSPs) have been established for the base of the Tournaisian Stage/Age (and coincident base of the Lower Mississippian Series/Epoch, Mississippian Subsystem/Subperiod, and Carboniferous System/Period) (Paproth et al., 1991; also see the discussion about biostratigraphic problems associated with this GSSP in Kaiser, 2009); the Visean Stage/Age (and coincident base of the Middle Mississippian Series/Epoch) (Work, 2008; Ogg et al., 2008); and the base of the Bashkirian Stage/Age (and coincident base of the Lower Pennsylvanian Series/Epoch and Pennsylvanian Subsystem/Subperiod) (Lane et al., 1999; Richards et al., 2002). GSSPs are still pending for the base of the Serpukhovian, Moscovian, Kasimovian, and Gzhelian stages/ages. More information on Carboniferous GSSPs is available at http://stratigraphy.science.purdue.edu/gssp.

Regional stage/age names are still valid in the regions in which they were developed (Heckel and Clayton, 2006a, 2006b; Ogg et al., 2008) until all of the international stage/age names are officially ratified and correlations of these boundaries into the regions have been established.

In Kansas, the regional stage/age names (in ascending order, Kinderhookian, Osagean, Meramecian, and Chesterian in the Mississippian Subsystem/Subperiod; and Morrowan, Atokan, Desmoinesian, Missourian, and Virgilian in the Pennsylvanian Subsystem/Subperiod) are retained; their global equivalents, however, can only be approximated at this time. Heckel and Clayton (2006a, fig. 1, p. 404), Heckel and Clayton (2006b, fig. 1, p. 394), and Ogg et al. (2008, fig. 8.6, p. 81) show the approximate equivalency of global stage boundaries to regional stage boundaries in North America (fig. 2). With the KGS now recognizing a Middle Mississippian Series/Epoch, it is important to note that, currently, the Middle Mississippian is thought to include the upper Osagean, Meramecian, and lower Chesterian stages/ages (Heckel and Clayton, 2006a, 2006b; Ogg et al., 2008).

FIGURE 2—Approximate equivalency of global subdivisions to regional stage subdivisions in North America (specifically midcontinent United States) (modified from Heckel and Clayton, 2006a, fig. 1, p. 404; and Heckel and Clayton 2006b, fig. 1, p. 394). The position of the Moscovian–Kasimovian boundary (dashed line) has been uncertain, but recent work (Villa and Task Group, 2008) suggests the boundary may be close to the Desmoinesian–Missourian boundary level.

Summary of Formally Adopted Carboniferous Stratigraphic Nomenclature Changes

The following changes are adopted by the Kansas Geological Survey. Zeller (1968) is modified accordingly (see fig. 1).

1. Carboniferous will be the system/period name for the strata in Kansas between the Devonian and Permian Systems/Periods.
2. Mississippian and Pennsylvanian will be subdivisions of the Carboniferous in Kansas and have the rank of subsystem/subperiod.
3. The Mississippian Subsystem/Subperiod contains three series: Lower, Middle, and Upper Mississippian. Corresponding epochs are Early, Middle, and Late Mississippian.
4. The Pennsylvanian Subsystem/Subperiod contains three series: Lower, Middle, and Upper Pennsylvanian. Corresponding epochs are Early, Middle, and Late Pennsylvanian.
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This paper was completed by current members of the Kansas Geological Survey’s Stratigraphic Nomenclature Committee, which was re-established in July 2005 to address stratigraphic issues and establish formally accepted stratigraphic nomenclature for Kansas. The Stratigraphic Nomenclature Committee is the official arbiter of stratigraphic nomenclature and issues in Kansas, subject to review by the State Geologist. More information about the Committee and Kansas stratigraphic nomenclature is available at http://www.kgs.ku.edu/General/Strat/index.html.

The Kansas Geological Survey (KGS) recognizes Zeller (1968) as the current accepted guide and chart for Kansas. Nomenclature changes will follow the North American Stratigraphic Code (2005), and changes will conform to international stratigraphic nomenclature standards as they apply to Kansas.

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