# NOVEMBER 2012 REPORT OF TASK GROUP TO ESTABLISH THE MOSCOVIAN–KASIMOVIAN AND KASIMOVIAN–GZHELIAN BOUNDARIES

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## Moscovian–Kasimovian Boundary

### Introduction

During the last few years, the task group has thought the first appearance datums (FADs) of *Idiognathodus sagittalis* Kozitskaya, 1978 and *Idiognathodus turbatus* Rosscoe and Barrick, 2009a have good potential as markers for the base of the Kasimovian (Villa and task group, 2008; Ueno and task group, 2009, 2010, 2011). Their occurrence (near base of Khamovnikian Substage, the second substage of the Kasimovian in current definition) is approximately one substage higher than the traditional base of the Kasimovian (base of Krevyakinian Substage). Nevertheless, raising the boundary level one substage higher would facilitate global correlation and most task-group members consider it appropriate to narrow the focus of study to an interval that encompasses the FADs of these conodonts. Until now, however, no formal proposal for the marker species that will define the base of the Kasimovian Stage has been presented and voted on.

### Progress in North America

Jim Barrick reported that *I. turbatus* is easily recognized and widespread across North America in lower Missourian (Khamovnikian) strata. Although transitional forms from the ancestor *Idiognathodus swadei* Rosscoe and Barrick, 2009a to *I. turbatus* occur in successive minor and intermediate cyclothems (Rosscoe and Barrick, 2009b), the vertically discontinuous nature of the marine intervals prohibit selection of a GSSP in the Midcontinent region of the U.S.A. In contrast to *I. turbatus*, nothing seems to match well with *I. sagittalis* in the North American conodont collections. Barrick suggests that more detailed work is needed on the taxonomy and morphological characterization of *I. sagittalis* from Eurasia before it can be used as a reliable biostratigraphic index for the base of the Kasimovian.

### Progress in South China

Qi Yuping, in collaboration with James Barrick, continued their study of the Moscovian-Kasimovian transition in the Naqing (Nashui) section (Barrick *et al*., 2010) in southern Guizhou province, South China. From that section, they collected a series of closely spaced samples that preserve the transition from *I. swadei* to *I. turbatus* without apparent interruption. The transition is so complete that determining the exact level at which the oldest *I. turbatus* occurs is difficult (+/−10 cm). Because the transition is so well developed, the Naqing section is a good candidate for the GSSP, if one wants to rely on a transitional series of morphotypes. The section is strongly condensed, so the transitional interval is thin, which could prove to be problematic. Qi and Barrick plan to prepare a proposal using the first evolutionary appearance of *I. turbatus* as the index for the base of the Kasimovian.

### Progress in Spain

Elisa Villa reported that the University of Oviedo is devoted to the study of the Moscovian-Kasimovian boundary in the Cantabrian Mountains and is continuing intensive research of the Carboniferous limestones outcropping in the Ándara Massif of the Picos de Europa Mountains. In that area, a continuously exposed carbonate succession, which is more than 300 m thick, comprises strata from the upper Moscovian (Myachkovian) to the lower-middle Kasimovian. The particularly well-exposed Castillo Del Grajal and Morra de Lechugales sections exhibit the most favorable conditions for establishing the biostratigaphic distribution of relevant fusuline and conodont taxa (see preliminary report by Villa *et al*., 2009b for main sedimentological and biostratigraphic characteristics of both sections).

In addition, the Spanish team are investigating the Vegas de Ándara section (also in the Ándara Massif), where late Moscovian to middle Kasimovian strata are present. Recent investigations by the Spanish group confirmed the completeness of the fusuline record in the area and facilitated the discovery of beds providing assemblages of the *Fusulinella schwagerinoides*, *Protriticites*, and *Montiparus* zones. A thick stratigraphic interval shows the gradual transition from *Fusulinella* to *Protriticites* species. Apart from species belonging to the *Fusulinella-Protriticites-Montiparus* lineage, the sections also yielded species belonging to *Fusiella*, *Pseudotriticites*, *Ozawainella*, *Pseudostaffella* (*Quasistaffella*), and *Schubertella*, as well as some forms questionably and tentatively assigned to primitive *Quasifulina*. A systematic study of these fusulines is currently in progress.

Sampling of Podolskian (middle Moscovian) to Khamovnikian beds in the Vegas de Ándara and the Castillo de Grajal sections are being undertaken to analyze the succession of the conodont faunas (J. Sanz and S. Blanco, in progress). These studies include the systematics of abundant *I. sagittalis* specimens collected from the base of the Khamovnikian Substage and their relationship with much scarcer *I. turbatus* and *I. swadei*.

*Idiognathodus sagittalis*, one of the two best potential indices for the lower Kasimovian boundary, occurs within other sections in the Cantabrian Mountains such as the Las Llacerias (Méndez, 2006). To confirm the potential of *I. sagittalis* for global correlation, the study of its variability (preferably in the type bed in Ukraine) and more illustrations documenting its characteristics at various occurrences are necessary. Nevertheless, the occasional presence of *I. turbatus* (a species originally described from the Midcontinent region of U.S.A.) in the Castillo de Grajal section together with the first occurrence of *I. sagittalis*, reinforces the biostratigraphic significance of *I. turbatus* because the latter species may assist with correlating *I. sagittalis* occurrences with strata in the Midcontinent region of the U.S.A.

Intensive sampling for conodonts in Spain has revealed that only some open-marine to deep-water lithofacies provide a significant number of specimens. At several localities, new samples were collected from beds yielding scarce but important taxa. Such is the case of the Krevyakinian beds (currently the lower substage of Kasimovian) from the Morra de Lechugales section, which contain a middle-sized element of *Idiognathodus* sp. 1 of Goreva *et al.* (2009), the proposed ancestor of *I. sagittalis*.

**Progress in Russia**

Alexander Alekseev, together with Natalia Goreva, Tatiana Isakova, and Olga Kossovaya, are continuing their paleontological examination of specimens from the Stsherbatovka section in the southern part of the Oka-Tsna Swell on the left bank of the Oka River in the Ryazan Region. The section was measured in an abandoned quarry and intensively surveyed by them during 1990s. Good morphotypes of *I. sagittalis-I. turbatus* were discovered by recent examination of conodont collections from the section. Unfortunately the abandoned quarry is old and the outcrops no longer exist but can be excavated.

**Ukraine**

During the last fiscal year, Tamara Nemyrovska and Katsumi Ueno, in collaboration with Thasinee Charoentitirat (Chulalongkorn University, Thailand), continued with on going fieldwork in the Donets Basin on the strata within the N and O suites exposed at Kalinovo, and also at a new section in the Annovka area.

**Kasimovian–Gzhelian Boundary**

The task group to establish the Kasimovian-Gzhelian boundary selected the first appearance datum (FAD) of the conodont *Idiognathodus simulator* (Ellison, 1941) *sensu stricto* in its potential lineage *Idiognathodus eudoraensis - I. simulator* as the event marker for defining the base of the Gzhelian Stage (Heckel *et al*., 2008; Villa *et al*., 2009) and is directing research toward selecting a suitable section for the GSSP in China, Russia and North America. Encouraging progress has been made on locating a suitable candidate section for the GSSP

through intensive searching and the resulting substantial increase of boundary-related information. To date, however, the only section that has been formally proposed as a potential candidate for the basal Gzhelian GSSP is the Usolka section in the southern Ural Mountains of Russia (Chernykh *et al*., 2006; Davydov *et al*., 2008). During a 2009 field meeting in Russia, the section was examined by a team of SCCS members and was found to be poorly exposed and in need of additional study. Since that trip, Davydov and colleagues have initiated additional work on the Usolka section.

**Progress in North America**

Heckel *et al.* (2011) published a paper documenting the conodont-based correlation of lower Missourian (Kasimovian) to lower Virgilian (lower Gzhelian) Conemaugh marine units in the Appalachian Basin with the Midcontinent cyclothems. Their study illustrates the value of using the first appearance datum of *I. simulator* for identifying the base of the Gzhelian Stage, and it notes the similarity of some morphotypes of an unnamed early Missourian Appalachian relative of *Idiognathodus cancellosus* to the Russian species *Idiognathodus neverovensis*, which was described from early Kasimovian strata of the Moscow Basin. In addition, the paper provides a stronger framework for correlating the Appalachian terrestrial succession with the global marine successions.

During recent studies of *I. simulator*, Jim Barrick confirmed that its FAD works well as a biostratigraphic indicator for the base of the Gzhelian. He further noted that forms like *I. simulator* occur globally, but the species should be constrained better taxonomically to permit more reliable correlation. On the other hand, he recognized in the North American Midcontinent succession that *Idiognathodus eudoraensis* Barrick, Heckel and Boardman 2008, the potential ancestor of *I. simulator*, is mostly restricted to one cyclothem (Stanton/Eudora) of the upper Missourian regional stage (upper Kasimovian). A few isolated similar specimens have been recovered from the succeeding cyclothems below the FAD of *I. simulator* in the Ordead/Heebner cyclothem in the lower Virgilian (Gzhelian), which means a significant gap occurs in the record from *I. eudoraensi*s to *I. simulator* in the North American Midcontinent region. The number of specimens available between the two stratigraphic levels is insufficient to provide substantial information about the details of the transition. Without additional specimens, it is not be possible to establish the GSSP in the region.

For a project on Pennsylvanian paleoceanic circulation and geochemistry, Jim Barrick is measuring and sampling a series of sections through the Heebner Shale (level of holotype of *I. simulator*) from Oklahoma to Nebraska. The work will provide large collections of conodonts (many will be used by geochemists), and will enable him to conduct a more detailed analysis of morphological variation within the species in different geographic and environmental settings in the North American Midcontinent.

**Progress in South China**

During the last fiscal year, Qi Yuping and Jim Barrick continued with their intensive study of the conodonts across the Kasimovian-Gzhelian boundary in the Naqing section (Nashui section) in southern Guizhou province of South China (Barrick *et al*., 2010) using closely-spaced samples. In that section, *Idiognathodus simulator* appears abruptly in a diverse conodont fauna, but the immediately underlying beds have yielded few conodonts. Forms ancestral to *I. simulator* occur in strata a few meters lower in the section but are not especially common; consequently, the section does not appear to be a good candidate for the boundary stratotype.

**Progress in Russia**

In the Moscow Basin, Alexander Alekseev has been studying the Kasimovian-Gzhelian boundary in the Rusavkino quarry. In that quarry, *I. simulator* had been discovered in an earlier study (Alekseev and Goreva, 2007) but the locality was recently re-sampled for conodonts. In the new collections, Alekseev and colleagues found an *I. eudoraensis* morphotype from the middle part (Member 2) of the Rusavkino Formation, which is below an important gap in the succession

and has been correlated to the uppermost Kasimovian. A close form even occurs in the underlying Troshkovo Formation. Because the Moscow Basin provides good sections through the Kasimovian-Gzhelian boundary level, Alekseev and his colleagues plan to prepare a formal proposal for the GSSP at base of the Gzhelian based on either the Rusavkino quarry section or the stratotype of the Gzhelian Stage in the abandoned Gzhel quarry (Alekseev *et al*., 2009).

Alexander Alekseev and his colleagues from Moscow, together with Olga Kossovaya, continued with their investigation of the Yablonevyy Ovrag quarry section in the Zhiguli Mountains, Samarskaya Luka. This completely exposed section in the Samara Bend of the Volga River about 800 km east of Moscow extends from the upper Kasimovian up to the Sakmarian Stage of the Permian. The section is the hypostratotype of the Gzhelian and shows a nice basal Gzhelian conodont assemblage with *I. simulat*or; however, conodonts are scarce in strata below the level containing *I. simulator* and *I. eudoraensis* has not been found. Related to the work at the Yablonevyy Ovrag quarry, they visited the Kholodny Log section on the Kosva River in the Perm region in 2010. At the latter locality, they found an interesting interval close to the Kasimovian-Gzhelian boundary but conodonts (including *Streptognathodus pawhuskaensis*) and fusulines were not abundant enough to precisely locate the boundary.

Chernykh (2012) published an important monograph on Gzhelian conodonts from the Urals in which he established the Gzhelian biostratigraphy of the region based on a sequence of species consisting of *Streptognathodus firmus, S. simulator, S. vitali, S. virgilicus, S. simplex, S. bellus, S. wabaunsensis*, and *S. isolatus*. Chernykh used the first appearance of *S. simulator* (=*Idiognathodus simulator* (Ellison, 1941)) for defining the base of the Gzhelian. S. *firmus* is the zonal species of the underlying strata, but *S. simulator* is not its evolutionary descendant.

Vladimir Davydov and his colleagues recently re-measured and resampled the Usolka section, formally proposed as a GSSP candidate section (Chernykh *et al*., 2006; Davydov *et al*., 2008), in the South Urals for conodonts. The resulting conodont collection was studied by Jim Barrick and Guzel Sungatulina (Kazan University, Russia). Unfortunately, the new conodont collections through the Kasimovian-Gzhelian transitional lack numerous elements and taxa. Moreover, they were not able to reproduce the lineage of *Streptognathodus praenuntius* to *S. simulator* reported in earlier studies of the Usolka section (Davydov *et al*., 2008). Thus the Usolka section requires additional sampling and study before it can be considered as a viable candidate for the GSSP at the base of the Gzhelian.

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