

# NOVEMBER 2012 REPORT OF TASK GROUP TO ESTABLISH THE VISÉAN-SERPUKHOVIAN BOUNDARY

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## Introduction

During the November 1<sup>st</sup> 2011 to October 31<sup>st</sup> 2012 fiscal year, the task group made substantial progress toward establishing a GSSP for the Viséan-Serpukhovian Stage boundary. An index for boundary definition has been selected, but not voted on by the task group and SCCS for final approval, and work is well advanced at the two prime GSSP candidate sections: the Verkhnyaya Kardailovka in the southern Ural Mountains of Russia and the Nashui section in southern Guizhou Province, China. Work is continuing on other potential candidate sections for the GSSP in the Cantabrian Mountains of northwest Spain. For boundary definition, the group is using the first evolutionary appearance of the conodont *Lochriea zieglerei* Nemirovskaya, Perret & Meischner, 1994 in the lineage *Lochriea nodosa* (Bischoff, 1957) –*Lochriea zieglerei*. *L. zieglerei* appears in the Brigantian Substage somewhat below the current base of the Serpukhovian as defined by its lectostratotype section in the Zaborie quarry near the city of Serpukhov in the Moscow Basin, Russia (Kabanov, 2003, 2004; Kabanov *et al.*, 2009, 2012). Task-group members are conducting research on biostratigraphy, sedimentology and lithostratigraphy, stable-isotope geochemistry and magnetic susceptibility at several locations in Western Europe, Russia, China and North America.

The most important accomplishments were the publication of a comprehensive study of the foraminifers spanning the Viséan-Serpukhovian boundary at several sections in South China including the Nashui section in southern Guizhou Province (Groves *et al.*, 2012), the completion of the preliminary phase of an ammonite study across the boundary level in the Verkhnyaya Kardailovka section, one of the best candidate sections for the GSSP at the base of the Serpukhovian (Nikolaeva, in press), and completion of a comprehensive bed-by-bed sedimentologic and geochemical analysis of the Serpukhovian Sage in its type area, the Moscow Basin of Russia (Kabanov *et al.*, 2012). The main field program for the task group was held in the southern Urals of Russia but ongoing studies of upper Viséan to Serpukhovian successions in Western Europe, western North America, and South China continued.

## Meetings

### 34<sup>th</sup> International Geological Congress in Brisbane, Australia

Several task-group members attended the congress in Brisbane (5<sup>th</sup> - 10<sup>th</sup> of August 2012) and gave project-related presentations (Alekseev, *et al.*, 2012; Aretz *et al.*, 2012; Nikolaeva *et al.*, 2012; Richards *et al.*, 2012) in various Symposia including 35.7 "The Devonian-Carboniferous-Permian Correlation Chart" chaired by Manfred Menning.

### Progress in southern Urals,

During August 2012, a team of task-group members (Alexander Alekseev, Elena Kulagina, Svetlana Nikolaeva, Barry Richards, and Uriy Gatovsky) worked at the condensed, deep-water, carbonate section along the Ural River opposite the village of Verkhnyaya Kardailovka on the eastern slope of the southern Ural Mountains in Russia. Nikolaeva and her colleagues have worked on the Kardailovka section for several years and published syntheses about the ammonoids, conodonts, foraminifers and ostracodes (Nikolaeva *et al.*, 2005, Nikolaeva *et al.*, 2009b; Pazukhin *et al.*, 2010). Their syntheses demonstrate the first evolutionary appearance of *L. zieglerei* occurs in the lower part of the limestone-dominant component of the section immediately above an interval containing elements transitional between *L. nodosa* and *L. zieglerei*.

In August 2011, the lower 22 m of the Verkhnyaya Kardailovka section including the boundary level was extensively excavated with backhoes and front-end loaders. Additional excavation work across the boundary was completed in August, 2012. Following the excavations in 2012, the interval spanning the Viséan-Serpukhovian Boundary was systematically sampled for conodonts. Conodont samples had been collected from the section on several prior occasions but additional sampling was required to more precisely tie the conodont biostratigraphy into the new measurements and to confirm the FAD of *L. zieglerei* in the recently excavated boundary interval. In August 2011, the limestone-dominant component of the section was measured and sampled bed-by-bed for lithology and geochemical samples from about 12 m to 35 m above the section's base. The underlying deposits are dominated by thin-bedded to laminated shale, siltstone and volcanic ash that are not measurable at a bed-by-bed level of detail. During 2012 the sampling for lithology and geochemistry was completed into the lower part of the Bashkirian.

Svetlana Nikolaeva made large collections of ammonites from the newly excavated boundary interval at Verkhnyaya Kardailovka in August 2012 and presents her preliminary results in the Newsletter on Carboniferous Stratigraphy (Nikolaeva, in press). Her results are summarized here. Three ammonoid assemblages are recognized in the Viséan – Serpukhovian boundary beds in the Verkhnyaya Kardailovka section and are assigned to: the *Goniatites* Genozone (Upper Viséan), *Hypergoniatites*–*Ferganoceras* Genozone (Upper Viséan and Lower Serpukhovian), and the *Uralopronorites*–*Cravenoceras* Genozone (Lower Serpukhovian).

It was shown (Nikolaeva *et al.*, 2009a) that the base of the Serpukhovian, as provisionally defined by the FAD of the conodont *Lochriea zieglerei*, lies within the *Hypergoniatites* – *Ferganoceras* Genozone, and more precisely in the Dombar Hills of Kazakhstan within its upper *Dombarigloria miranda* Zone (Nm1a2). The underlying *Pachylyroceras claudi* Zone (Nm1a1) is entirely Viséan, whereas the *Dombarigloria miranda* Zone (Nm1a2), is partly Viséan and partly Serpukhovian. This position of the FAD of *L. zieglerei* is supported by the new data from the Verkhnyaya Kardailovka section. In that section, the documented first appearance of *L. zieglerei* is in sample 013 (Bed 21), which lies within the *Hypergoniatites*–*Ferganoceras* Genozone (Nikolaeva *et al.*, 2009b; Pazukhin *et al.*, 2010).

#### **Progress in southern Guizhou province, Nashui section**

In the Nashui section (by village of Naqing) near the city of Luodian in southern Guizhou province, the Viséan-Serpukhovian boundary is currently placed at 60.1m above the base of the original section measured by Qi and Wang (2005), which is equivalent to a position 17.94 m above the base of the new section measured and permanently marked by aluminum pins glued into drill holes by the task group in 2008. In the Nashui section, conodonts within the *Lochriea nodosa* – *Lochriea zieglerei* lineage are well preserved and abundant (Qi, 2008); elements transitional between *L. nodosa* and *L. zieglerei* are plentiful, occurring in several samples. The conodonts do not allow direct correlation from the Nashui section to the nearby shallow-water Yashui section because of their paucity in the neritic to restricted-shelf facies at the latter locality. The Yashui section was measured to determine the relationship of the coral and foraminiferal zones to the *L. nodosa* – *L. zieglerei* transition. During 2012, John Groves and colleagues completed their study of the foraminifers across the boundary interval in the section (Groves *et al.*, 2012). Unfortunately, the association of foraminifers from a 20-meter-thick interval centered about the boundary at Nashui lack species diagnostic of the boundary but contain ones whose previously established ranges were known to extend from the upper Viséan into the lower Serpukhovian.

#### **Progress southern Guizhou province, Yashui section**

The Yashui section, situated near the city of Huishui in Guizhou province, is important because it contains abundant rugose corals and foraminifers (Wu *et al.*, 2009; Groves *et al.*, 2012) and is dominated by shallow-marine neritic to supratidal facies. A major reason for

studying the section is to determine the relationship of the coral and foraminiferal zones to the *L. nodosa* – *L. zieglerei* transition in south China. Conodont samples were collected from the section in 2008-2009 but the *L. nodosa* – *L. zieglerei* transition could not be precisely located. The section provides an excellent opportunity to see what the shallow-marine and supratidal platform facies are like in southern Guizhou Province. John Groves and his colleagues (Groves *et al.*, 2012) completed a comprehensive study of the foraminifers. They found that the base of the Serpukhovian could be approximated using foraminifers but a precise correlation with the FAD of *L. zieglerei* in the Nashui section could not be established because of the lack of foraminiferal indices for the boundary in the Nashui section and the paucity of conodonts through the boundary level at Yashui.

The foraminiferal successions across this boundary in the type area of the Serpukhovian Stage in the Moscow Basin of Russia (Kabanov *et al.*, 2009; Gibshman *et al.*, 2009), the Uralian region of Russia (Nikolaeva *et al.*, 2005; 2009a,b) and in the central United States suggest that the appearances of *Asteroarchaediscus postrugosus* (Reitlinger, 1949), *Janischewskina delicata* (Malakhova, 1956), “*Millerella*” *tortula* Zeller, 1953 and *Eolasiiodiscus donbassicus* Reitlinger, 1956 are useful auxiliary indices to the base of the Serpukhovian. The stage boundary at Yashui is provisionally identified at 41.6 m above the base of the section on the appearance of *Janischewskina delicata*. “*Millerella*” *tortula*, another possible index to the base of the Serpukhovian, appears at 49 m above the base of the section (Groves *et al.*, 2012). *Asteroarchaediscus postrugosus* and *Eolasiiodiscus donbassicus*, useful markers for the base of the Serpukhovian elsewhere in Eurasia and North America, have not been observed at Yashui.

#### **Progress Moscow Basin, type area of Serpukhovian**

Recent biostratigraphic and sequence stratigraphic studies in the type area of the Serpukhovian in the Moscow Basin (Kabanov *et al.*, in press) reveal that the first appearance of *Lochriea zieglerei* is in the uppermost Venevian Substage of the Viséan (about 3 m below its top) rather than in the lowermost Tarusian Substage of the Serpukhovian as previously reported. Nikolaeva *et al.* (2002) and Kabanov *et al.* (2009) reported that in the Zaborie quarry section, lectostratotype of the Serpukhovian Stage, *L. zieglerei* appears with *Lochriea senckenbergica* Nemirovskaya, Perret & Meischner, 1994 in the basal bed but not a first evolutionary appearance. The latter occurrence was in the lowermost Tarusian slightly above the Venevian, traditional top of the Viséan in the Moscow Basin. Once the GSSP has been established using the FAD of *L. zieglerei* for boundary definition, the base of the type Serpukhovian must be shifted slightly downward from its current position at the base of the Tarusian.

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