FIRST RECORD OF GZHELIAN FUSULINACEANS FROM THE CARBONIFEROUS OF NORTHERN SPAIN

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ABSTRACT

Several fusulinacean species of Gzhelian age have been found in a section close to the village of Asiego, in the northern part of Picos de Europa Massifs (Cantabrian Mountains). These specimens, which were collected in limestone beds from the upper part of the Puentellés Formation, belong to the genera Triticites, Rauserites, Jigulites, Ferganites and Quasifusulina and are the youngest fusulinaceans recorded in the Carboniferous of the Cantabrian Mountains. Among these microfaunas, Jigulites sp. bears the main stratigraphic significance since the Jigulites species are considered to be restricted to the Gzhelian stage. Therefore, the discovery of these species proves the presence of Gzhelian marine deposits in the area.

Keywords: Fusulinaceans, Gzhelian, Cantabrian Mountains, Spain.

RESUMEN

En las proximidades de Asiego, localidad situada al norte de los Picos de Europa (Cordillera Cantábrica, Norte de España), se han hallado en varias capas de calizas, atribuidas a la parte alta de la Formación Puentellés, diversas especies de fusulináceos pertenecientes a los géneros Triticites, Rauserites, Jigulites, Ferganites y Quasifusulina. De todas las formas encontradas, Jigulites sp. es la más significativa desde el punto de vista estratigráfico, dado que las especies de este género poseen una distribución restringida al Gzheliense.

En conjunto, las microfaunas de Asiego presentan rasgos que las convierten en los fusulináceos más jóvenes encontrados hasta el momento en el Carbonífero de la Cordillera Cantábrica y constituyen la prueba de la existencia de depósitos marinos del Gzheliense en esta área.

Palabras clave: Fusulináceos, Gzheliense, Cordillera Cantábrica, España.

INTRODUCTION

The Carboniferous of the Cantabrian Zone (Lotze, 1945) (Fig. 1) comprises thick successions of sedimentary rocks whose age ranges from Tournaisian to Kasimovian. These deposits have been studied in detail since the early fifties and so their stratigraphy and fossil content are, in general, well-known. The exception, however, is the youngest marine deposits of the so-called Gamonedo-Cabrales area, situated in the northern part of the Picos de Europa unit (Fig. 1), which only recently has become the focus of intensive attention.

The Gamonedo-Cabrales area is a sector of the Cantabrian Zone of special interest because it preserves late Hercynian synorogenic and postorogenic successions. However, the complex structure of the area is still under study, and the fusulinid associations in the limestone beds are important clues to unravel its tectonic history.

The uppermost Carboniferous strata of this area are the Puentellés (Martínez García, 1981) and Cavandi formations (Martínez García and Wagner, 1971). The Puentellés Formation rests unconformably on older Carboniferous rocks and includes thick limestone beds. The overlying Cavandi Formation consists of siliciclastic turbidites. The Puentellés Formation bears much higher interest for palaeontological and biostratigraphic studies, because the fossils in the Cavandi Formation are reworked.

At its type section (near Panes), the Puentellés Formation consists of two parts: the lower part is a succession of shales and sandstones, including a coal-seam, and marks the unconformable boundary between this and the underlying Picos de Europa Formation; the upper part consists of some 400 m of limestones and argillaceous limestones, usually fine-grained and dark-coloured. According to Martínez García and Rodríguez Fernández (1984), the Puentellés Formation thins towards
the west, being represented by only a few meters of limestones near Arenas de Cabrales, in the Gamonedo-Cabrales area.

The fusulinaceans from the upper part of the Puertellé Formation allowed van Ginkel (1971) to establish a Late Kasimovian age (Dorogomilovsky) for those beds, and this was confirmed in subsequent studies by Truyols et al. (1984) and Villa (1995). The terrestrial deposits at the base of the Puertellé Formation yielded some floral remains of Stephanian B age (Martínez García and Wagner, 1971, Wagner and Martínez García, 1998).

The Cavandi Formation rests on the Puertellé Formation with apparent conformity, and consists of 240 m of alternating mudstones, calcareous sandstones, thin beds of fine-grained carbonate debris-flows, and turbiditic sandstones with alternating mudstones at the top. Its age can only be established indirectly from data obtained in the underlying Puertellé Formation.

The fusulinacean fauna from the Puertellé Formation studied by van Ginkel (1971) corresponds to two schwagerinids species of the genera Montiparum and Ferganites, which were initially described as Triticites (Montiparum) fischi van Ginkel sp. nov., and Triticites ohiensis bensi van Ginkel subsp. nov. However, a later revision by Villa (1995) showed that Triticites ohiensis bensi could in fact be assigned to Ferganites ferganensis (Miklucho-Maklay). Intensive sampling of the Puertellé Formation in the last few years reveals that both Montiparum fischi and Ferganites ferganensis are widespread in these uppermost Carboniferous strata, although, as was already pointed out by van Ginkel, Montiparum fischi occurs in slightly older strata than Ferganites ferganensis.

**Figure 1.** Situation of the locality of Asiego in the Cantabrian Zone.
THE CARBONIFEROUS STRATA OF ASIEGO

The locality of Asiego is situated near the village of Carreña de Cabrales, in the Gamonedo-Cabrales area. Some isolated rocks crop out along the road from Carreña to Asiego (Fig. 2), on the southern slope of the Casaño River valley. These strata dip southwards, consist mainly of marly limestones and limestones (sometimes with silicified fauna), and are overlain by sandstones and shales. The relation of these strata with the Puentellés Formation, which is exposed on the northern slope of the Casaño valley, and clearly dipping northwards, remains unclear.

Several samples collected in three limestone beds (ASG-1, ASG-3, and ASG-4; Fig. 2b) have provided various fusulinaceae species. Listed from bottom to top, these faunas are:

- **ASG-4**
  - *Quasifusulina longissima* (Möller)
  - Rauzerites sp.
  - Ferganites sp.

- **ASG-3**
  - *Quasifusulina longissima* (Möller)
  - Jigolites sp.

- **ASG-1**
  - *Triniticites aff. acutus* Dunbar and Condra
  - Rauzerites cf. erraticus (Rozovskaya)

This fusulinaceae fauna, whose characteristics and stratigraphic significance will be discussed below, suggests a probable early Gzhelian age for the Asiego beds. This is younger than would be expected for the Puentellés Formation. However, it seems only reasonable to assume that the limestones situated in the surroundings of Asiego represent the top of Puentellés and that the overlying sandstones and shales correspond to the base of the Cavandi Formation.

The fusulinaceans from the Asiego beds are comparable to the uppermost Carboniferous fusulinaceans of the Russian Platform, Urals and Middle Asia, as described by Rauser-Chernousovska (1938), Rozovskaya (1950, 1952, 1958, 1975), Bensh (1972), Chuvashov et al. (1986), Isakova (1986), Konovalova (1991), Remizova (1995), among others. Because previously the Puentellés Formation, including the upper part, has always been dated as Kasimovian, especial attention will need to be paid now to the characteristic fusulinacean assemblages that allow dating it as either Kasimovian or Gzhelian.

FUSULINACEAN BIOZONES OF THE UPPER KASIMOVIAN AND LOWER GZHELIAN DEPOSITS IN RUSSIA

The Kasimovian and Gzhelian stages were established in strata of the Russian Platform, where they have been subdivided into several smaller units, called “horizons” according to Russian terminology. These horizons, represented in Fig. 3, are considered chronostratigraphic units, although bearing an informal status. Out of the four Kasimovian horizons (Krevyakinsky, Khamovnichesky, Dorogimolovsky and Yauzsky), the Yauzsky horizon is sometimes difficult to discern. On account of that, some authors (e.g. Rotai, 1979) include it as part of the Dorogimolovsky, which leaves the Kasimovian with three horizons only.

Similarly, the two lower horizons of the Gzhelian (the Retchisky, formerly Russavskinsky, and the Amerovsky) are sometimes taken as two separate horizons (e.g. Rauser-Chernousovska et al., 1979) whilst some other times they are considered as just one (e.g. Eino, 1996). The Amerovsky is followed by the Pavlo-Pasadsky and the Neginsky horizons.

Within these two stages, several fusulinacean biozones have been established, characterizing the horizons mentioned above (Fig. 3). However, this paper will focus just on the uppermost biozone of the Kasimovian and the two lower biozones of the Gzhelian, since this is the interval within which the fusulinaceans from Asiego fit. The fusulinaceans from older or younger levels have rather different features and, therefore, have been excluded from this discussion.

The highest Kasimovian fusulinacean biozone is the C-B Zone, or the *Triniticites quasiarcticus-Triniticites acutus* Zone (formerly *Triniticites arcticus-Triniticites acutus* Zone), which is roughly equivalent to the Dorogimolovsky and Yauzsky horizons together. *Triniticites quasiarcticus* is the new name given by Solovieva (1987) for *Triniticites arcticus* (Schellwien, 1908) identified by Rauser-Chernousovska, 1938]. The most relevant feature of this biozone is the abundance of typical *Triniticites*, represented.
by diverse species such as *Triticites acutus* Dunbar and Condra and *Triticites irregularens* (Schellwien and Staff). Advanced species of *Montiparax*, like *M. subcrassulus* Rozovskaya, are also common. Carboniferous strata of this bioregion in Middle Asia commonly show species belonging to the genus *Ferganites* too. Some rare specimens of this genus occasionally occur in the underlying bioregion.

The *Rauzerites* stockenbergi Zone (C,C) characterizes the Lower Gzhelian, comprising the Russanskyski plus the Amerevskyski horizons. Here the most relevant feature is the abundance of *Rauzerites*. *Rauzerites stockenbergi* (Rauscher-Chernousova), *Rauzerites parararcticus* (Rauscher-Chernousova), and *Rauzerites rossicus* (Schellwien) are some of the species mentioned by Rauscher-Chernousova et al., 1979, in this interval. However, the separation of *Triticites* and *Rauzerites* may sometimes be problematic, and some doubtful species occurring at the *Triticites parararcticus-Triticites acutus* Zone are often assigned to the genus *Rauzerites* [e.g. *Rauzerites variabilis* (Rozovskaya, 1950), and *Rauzerites bashkiricus* (Rozovskaya, 1950)]. Therefore, the first occurrence of *Rauzerites* does not seem a reliable criterion to mark the lowermost Gzhelian.

Above *Rauzerites* stockenbergi Zone, the *Jigulites jiguilensis* Zone (C,D) represents an interval coinciding with the Pavlo-Pasentsky horizon (Fig. 2). Some *Jigulites* like *J. jiguilensis* (Rauscher-Chernousova), *J. volgensis* (Rauscher-Chernousova) and *J. dagmarae* (Rozovskaya) are often assemblage components of this bioregion, although these species may be rare within the underlying *Rauzerites stockenbergi* Zone (see the stratigraphic ranges showed in Grigorieva et al., 1996). In any case, it seems clear that the first occurrence of *Jigulites* is undoubtedly in Gzhelian strata.

According to all this, *Triticites*, *Rauzerites* and *Jigulites* respectively appear as the most significant genera of the mentioned fusulinacean bioregions (C,B, C,C and C,D). The stratigraphic significance of these genera had already been pointed out by Rozovskaya (1948, 1950). At first, *Rauzerites* and *Jigulites* were considered subgenera of *Triticites*, which indicates how closely connected are all these taxa. *Montiparax* would be the common ancestor leading to *Triticites*, in one branch, and to *Rauzerites-Jigulites*, in the other branch. Davydov (1988) considered that both branches separated earlier and that *Prototriticites* would have been the common ancestor. A revision of this history placed the common ancestor (*Fusulinella*) even earlier (Davydov, 1990).

The three genera, *Triticites*, *Rauzerites*, and *Jigulites*, keep close morphological similarities. After Rozovskaya (1948), Davydov (1990), and the recently published reference book by Rauscher-Chernousova et al. (1996), it is accepted that *Rauzerites* differs from *Triticites* in that the former has more intensive septal folding. According to Rozovskaya (1948), the septal folding in *Rauzerites* tends to be more regular than in *Triticites*. However, Brench (in Rauscher-Chernousova et al., 1996) emended the original description of *Rauzerites* and stated that this genus has irregular septal folding, *Jigulites*, on the other hand, differs from the other two genera in its thicker wall, stronger and higher septal folding, and in having chomata developed only in the inner volutions and either absent or replaced by pseudochomata in the outer ones.

### THE FUSULINACEANS FROM ASIEGO

#### SYSTEMATICS

The fusulinaceans of Asiego constitute a noteworthy fauna as they include the most advanced fusulinacean fauna so far recorded in the Carboniferous of the Cantabrian Mountains (and therefore in the Carboniferous of Western Europe). These species, belonging to typical *Triticites*, large *Quasifusulina*, *Rauzerites*, *Ferganites*, and *Jigulites* are described briefly below.

Measurements of the following characters are determined: L: maximum length (in mm); D: maximum diameter (in mm); L/D: length to diameter ratio; no: number of whorls; d: outside diameter of the proloculus (in μ); w.th.: wall thickness (penultimate whorl/ultimate whorl) in μ; D: diameter of the fourth whorl (in mm); Rv: radius vector (in mm); Fr: form ratio (half length to radius vector ratio).

All material deposited in the Geological Department of the University of Oviedo, Spain.

Family *Schwagerinidae* Dunbar and Henbest, 1930

Genus *Triticites* Girty, 1904

**Type-species:** *Miliolites secalicus* Say, 1823.

*Triticites aff. acutus* Dunbar and Condra, 1927

Pl. I, figs. 1-9; Pl. II, figs. 1, 6

**Measurements**

<table>
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<td>1.16</td>
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Plate I. *Triticites aff. acutus* Dunbar and Condra. All x 15.

1 Specimen ASG-1A/3.
2 Specimen ASG-1/6.
3 Specimen ASG-1E/3.
4 Specimen ASG-1/5.
5 Specimen ASG-1/2.
6 Specimen ASG-1/1.
7 Specimen ASG-1/4.
8 Specimen ASG-1A/2.
9 Specimen ASG-1A/4.
ASG-1A/3 7.09 1.97 3.60 5.5 206 66/66 1.43 1.11 3.20
ASG-1A/4 10.20 2.48 4.12 6 240 83/88 1.28 1.28 4.00
ASG-1E/1 7.16 2.21 3.24 5.5 - 69/73 1.35 1.16 3.08
ASG-1E/2 4.88 1.69 2.89 4.5 - 54/64 1.50 0.90 2.71
ASG-1E/3 6.71 1.91 3.51 5.5 - 69/- 1.13 1.05 3.20
ASG-1E/4 6.60 1.73 3.82 5.0 206 49/83 1.13 0.94 3.52
ASG-1E/5 4.58 1.43 3.21 5 196 49/54 1.03 0.75 3.05
average 6.77 1.94 3.48 5.3 216 61/72 1.26 1.03 3.27
range 4.58-10.20 2.89-4.12 196-265 0.86-1.61 2.71-4.00

Remarks
This species has an elongate-fusiform shape, pointed poles, and weak septal folding along the central part of the shell. The present specimens from Asiego are, obviously quite close to the specimens which Russian authors usually assign to *Trinites acutus* Dunbar and Condra, 1927 (see Rauser-Chernousova, 1938; Rozovskaya, 1958; Grozdilova et al., 1975; Alksne, 1979; Konovalova, 1991). Still, there are several features which distinguish our *Trinites aff. acutus* from the American species described by Dunbar and Condra (1927): (1) the asymmetrically shaped and more weakly developed chomata; (2) the much wider aperture of the tunnel; (3) the larger maximum and average values of the diameter of the proloculum; (4) the smaller number of volutions. The same differences are apparent between the American type material and the Russian forms assigned to *T. acutus* as is well shown for the specimens of *T. acutus* described by Rozovskaya (1958) and by Konovalova (1991).

Very close to the Asiego forms is *Trinites subacutus* Mikhailova. This form, described from the northern Urals (Mikhailova, 1967), only differs from *T. aff. acutus* from the Cantabrian Mountains in having better developed chomata and perhaps a, on average, larger proloculus. Apparently, the same differences hold for *Trinites subacutus* Mikhailova and most of the specimens assigned by Russian authors to *T. acutus*.

On the other hand, our material, apart from specimens of *Trinites acutus* in the wider (Russian) sense, also contains specimens which, in Russian papers, are assigned to other species. For instance, our specimens figured in Pl. I, figs. 2 and 4, may be compared with *Trinites tabinicus* Alksne in terms of size, number of whorls, and L/D ratio. Our specimens in Pl. I, figs. 3, 7, and 8 resemble *T. oryshformis* Newell, as identified by Alksne (1979), on account of the small size of the proloculum and the type of septal folding. The specimen in Pl. I, fig. 9 is similar to *Rausertes rossicus* (Schellwien), especially with respect to the great L/D ratio and the large size of the shell (it should be noted, however, that in *R. rossicus* septal folding is much more intense).

Despite the similarity to various other species, the specimens from Asiego discussed here are considered to be conspecific and part of an assemblage in which the shells of its individuals vary notably in size and elongation. The assumed conspecificity is supported by their close resemblance with regard to other features, notably the septal folding, the type of the chomata, and the shape of the initial volution.

The species, which occurs in the Carboniferous of the former USSR, and which has been usually assigned to *Trinites acutus* Dunbar and Condra, is usually considered in Russian papers to be typical of the upper Kasimovian (Dorogomilovskiy and Yauzsky). However, according to Davydov (pers. comm.), it has also been found in the lower Gzhelian.

**Genus Rausertes** Rozovskaya, 1948

**Type-species:** *Rausertes stuckenbergeri* Rauser-Chernousova, 1938.

*Rausertes cf. erraticus* (Rozovskaya, 1952) Pl. II, fig. 3

**Measurements**
Sample No. L D L/D no d w. th. D4 Rv Fr
ASG-1/9 5.93 2.25 2.63 5.5 206 93/88 1.34 1.20 2.47

Remarks
This species has a relatively short and inflated shell, with rounded poles, rather intense septal folding, and a thick wall (93 μ in the penultimate whorl and 88 μ in the ultimate one). Specimen ASG-1/9 is similar to various schwagerinid species usually assigned to the genus *Rausertes*. Our specimen is particularly close to *Rausertes erraticus* (Rozovskaya) in the size of the shell, the expansion of the spiral (very tight in early whorls, becoming rapidly wider in subsequent whorls), and the diameter of the fourth whorl.

*Rausertes erraticus* was described by the C1-c Zone of the Carboniferous of the South Urals. According to Rozovskaya (1948), the species of *Rausertes* having the characteristic features mentioned above typically occur during a short time interval restricted to the Zone C1-c (= C1-C of Fig. 3), which is equivalent to the lower Gzhelian. In some Russian papers, however, the genus is shown to

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**Plate II**

1. Microstructure of the wall in *Trinites aff. acutus* Dunbar and Condra. Specimen ASG-1A/3. x 100.
5. *Jigullites* sp. Specimen ASG-3B/3. x 15.
8. *Fergranites* sp. Specimen ASG-4/2. x 15.
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<th>Foraminiferal zones</th>
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<td>Amerevsky Retchiski</td>
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<td>C3B Triticipes quasiarcticus-Triticipes acutus Zone</td>
<td>Yauzsky Dorogomilovsky</td>
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<td>C3A1 Prototribites pseudomontiparbus-Obsoletes obsoletus Zone</td>
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Figure 3. Stratigraphic units (foraminiferal zones and horizons) of the Kasimovian and Gzhelian stages in their stratotype area (Russian Platform). The shaded interval indicates the most probable correlation level of the Asiego beds.

Genus Jigulites Rozovskaya, 1948

Type-species: Triticipes jiguensis Rauser-Chernoussova, 1938.

Jigulites sp.
Pl. II, fig. 5

Measurements
Sample No. L D L/D no d w. th. D4 Rv Fr
ASG-3B/3 7.45 2.63 2.83 6.5 147 74/98 1.34 1.35 2.75

Remarks
Some features of the single specimen present (ASG-3B/3) show rather convincingly that it is assignable to the genus Jigulites. These characteristics are: a rapidly but regularly expanding spire, intensive septal folding with high loops along the entire shell, presence of chamata in the inner two and one-half whorls (developing into pseudochamata in the outer whorls), and a relatively thick spirotheca.

This is the first specimen of genus Jigulites recorded in the Carboniferous of the Cantabrian Mountains. In view of the fact that in the former USSR this genus does not appear until the Gzhelian, the present specimen has stratigraphic significance, since it strongly points to the possibility that fusulinaeans of such young age occur in the Cantabrian Mountains as well. This possibility is supported by the presence of Rausertes cf. erraticus (Rozovskaya), found at the same section in a level some 40 m above the present one.

Among the species of Jigulites described in previous papers, there are three which bear some resemblance with our form. These species, Jigulites formosus (Rozovskaya),

Plate III. Quassiusulina longissima (Möller). All for x 15.
1 Specimen ASG-3/6.
2 Specimen ASG-3/5.
3 Specimen ASG-3/2.
4 Specimen ASG-4/1.
5 Specimen ASG-3/3.
kaya), *Jiguletes jigulensis* (Rauser-Chernousova), and *Jiguletes volgensis* (Rauser-Chernousova), are quite close to our specimen in size, L/D ratio, and expansion of the volutions. Still, *Jiguletes formosus* has larger proloculus and probably more sharply pointed poles, *J. volgensis* seems to have weaker septal folding, whereas *J. jigulensis*, besides having more sharply pointed poles, also presents a less elongated shell.

The closest forms, however, seem to be two specimens from the lower Gzhelian of the South Urals studied by Davydov and figured in Chuvashov, *et al.* (1986; Pl. 11). These specimens have been identified by Davydov as *Jiguletes formosus formosus* Rozovskaya (*op. cit.* Pl. 11, fig. 10) and *Jiguletes aff. longus* Rozovskaya (Pl. 11, fig. 9). *Jiguletes* sp. from Asiego resembles both specimens in the general shape of the shell and the expansion of the spire, but the septal folding makes it closer to the former one.

Genus *Ferganites* Miklukho-Maklay, 1959

**Type-species:** *Triticites ferganensis* Miklukho-Maklay, 1950.

*Ferganites* sp.

**Measurements**

<table>
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<th>D</th>
<th>L/D</th>
<th>no</th>
<th>d</th>
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</table>

**Remarks**

These measurements, approximations only, refer to a single para-axial and broken specimen. Nevertheless, some typical features of *Ferganites*, like the subcylindrical form, the septal folding confined to the polar region, and the presence of axial fillings, can still be noted. In comparison with other species of *Ferganites* the L/D ratio is conspicuously low. However, similar low values have been measured in other, still unpublished, specimens of this genus found to the east of Asiego (Panes area).

Family Fusulinidae Möller, 1878

Genus *Quasifusulina* Chen, 1934

**Type-species:** *Fusulina longissima* Möller, 1878.

*Quasifusulina longissima* (Möller, 1878)

**Measurements**

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>L</th>
<th>D</th>
<th>L/D</th>
<th>no</th>
<th>d</th>
<th>w. th.</th>
<th>D4</th>
<th>Ry</th>
<th>Fr</th>
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<td>ASG-7/1</td>
<td>10.27</td>
<td>2.85</td>
<td>3.60</td>
<td>6.5</td>
<td>412</td>
<td>39/44</td>
<td>1.54</td>
<td>1.54</td>
<td>3.34</td>
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<td>ASG-7/2</td>
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<td>3.59</td>
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<tr>
<td>ASG-7/4</td>
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<td>-/39</td>
<td>1.24</td>
<td>1.13</td>
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</table>

**Remarks**

The present specimens conform to *Quasifusulina longissima* (Möller) with respect to the large size of the shell, the diameter of the proloculum, and the rather regular folding of the septa. This similarity notwithstanding, in the Asiego specimens, the shape of the shell shows a higher degree of variability than previously described species of this genus.

In this respect, it should be noted that but for one of the specimens (Pl. III, fig. 1), which shows the typical *Quasifusulina longissima* rounded poles, the majority present somewhat extended and pointed poles (e.g., Pl. III, figs. 3, 5). However, considering the great similarity shown by many other characters, it does not seem likely that the differences of polar ends should indicate the presence of more than one species but, rather, the intraspecific variability of this feature. A recent paper by Watanabe (1997), points out the great variability of this species, affecting not only the shape of the poles but also other morphologic characters.

Also *Quasifusulina eleganta* Shlykova has a very long test and shows pointed poles in some specimens. Still, this species has various differences which separate it from the Asiego specimens of *Quasifusulina longissima*. The most important are a slightly smaller test, greater L/D ratio, more irregular septal folding, smaller proloculum, and more tightly coiled spiral.

Until now, the genus *Quasifusulina* in the Cantabrian Mountains was known to occur only in the Zone of *Montiparbus* of the Las Llacertas section. The species occurring in that section are considered primitive members of *Quasifusulina* (see Villa and van Ginkel, 1997). The Asiego specimens, on the other hand, clearly possess the characteristics of highly evolved species of this genus. In addition, with regard to the Cantabrian Mountains, these specimens of *Quasifusulina* are the largest fusulinacean foraminifers described thus far. According to Watanabe (1996), a morphological variation of the *Quasifusulina longissima* lineage is observed in the Upper Carboniferous of Japan, being the largest tests (forms belonging to *Quasifusulina longissima ultima* Kammer) typical of strata of early Gzhelian age. *Q. longissima ultima* is similar to *Q. longissima* from Asiego in all characters except in the development of the axial fillings, which are slightly weaker in the subspecies described by Kammer (1958). It could be possible then that the materials from Japan and from Asiego belong to different subspecies, but also that both forms represent the same evolutionary step in the *Quasifusulina longissima* lineage.

*Quasifusulina longissima* has both a wide geographic range and long time range. It has been frequently cited in the late Carboniferous and the early Permian of various areas of the euro-asianic continent (see comments by Isakova, 1978).
CONCLUDING REMARKS

The limestone beds of Asiego most probably belong to the top of the Puenteilles Formation. This, we believe, shall be confirmed by the present geologic studies in the area.

The fusulinaceans recently discovered in the Asiego beds are of special interest because they are the youngest fusulinacean fauna thus far recorded in the Cantabrian Mountains. One form belongs to the genus *Jigulites*, which is the first reference to this genus in the Cantabrian Mountains. In addition to *Jigulites*, the fauna contains the first typical representatives of the genera *Rausertites* and *Quasifusulina*.

The association of fusulinacean foraminifers found at Asiego proves for the first time the presence of marine beds of the highest Carboniferous Gzhelian Stage in the Cantabrian Mountains and in the Iberian Peninsula. Considering the most probable affinities of the *Jigulites* and *Rausertites* species from Asiego with forms described in other areas, these beds are correlated with the lower Gzhelian.

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