

Middle and upper Lochkovian (Lower Devonian) at Segre 4 section

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Locality - Along the former national road N-260.

Lithostratigraphic unit - Rueda Fm.

Age - Lochkovian (Lower Devonian).

What to see - Well-exposed middle and upper Lochkovian strata in a continuous sequence.

How to get there

The locality is accessible through the dirty road that corresponds to the former National N260 from La Seu d'Urgell to Puigcerdá. The section is east-west oriented (Fig. 1).

Historical outline

Valenzuela-Ríos initially measured this section on the western limb of the anticline and recognised the Lochkovian strata of the Rueda Fm. Subsequently, Calvo and Valenzuela-Ríos did a detailed conodont sampling and together with Liao reported this section in professional meetings (Calvo & Valenzuela-Ríos, 2012; Valenzuela-Ríos et al., 2014; 2015).

Lithology and fossil content

The base and top of the section are faulted. The section has a thickness of 8 m of well-bedded grey limestone interbedded with black and grey marl and shale. Upwards the beds thicken, fresh-rock-colour is lighter and a pseudonodular aspect becomes apparent (Fig. 2). Orthoconic cephalopods, crinoids, ostracods and small brachiopods are frequent.



Figure 1. Location map of Segre 4 section (Se 4).

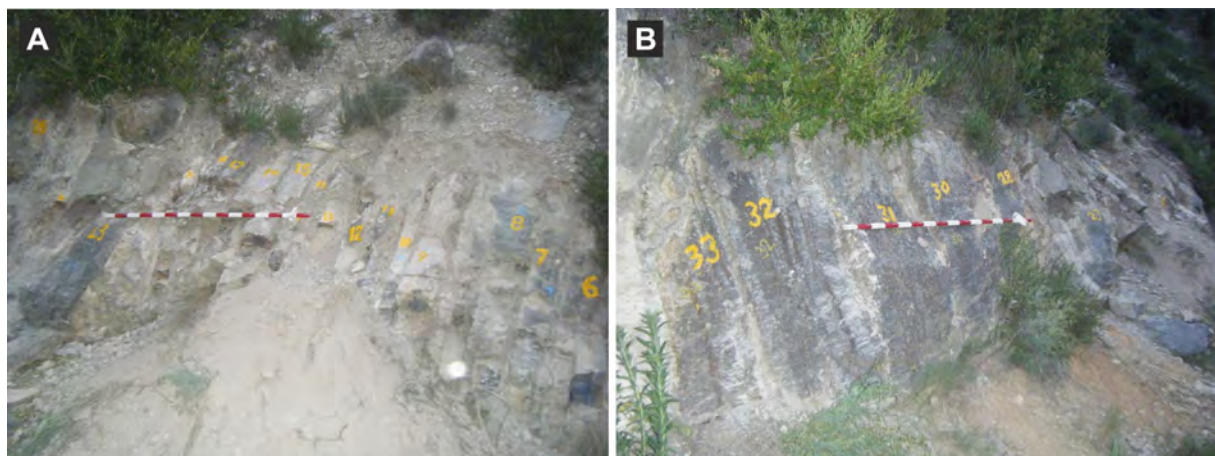


Figure 2. General view and details of the Segre 4 section. **A.** Lower part of the section (Beds 6-26). **B.** Upper part of the section (Beds 20-33).

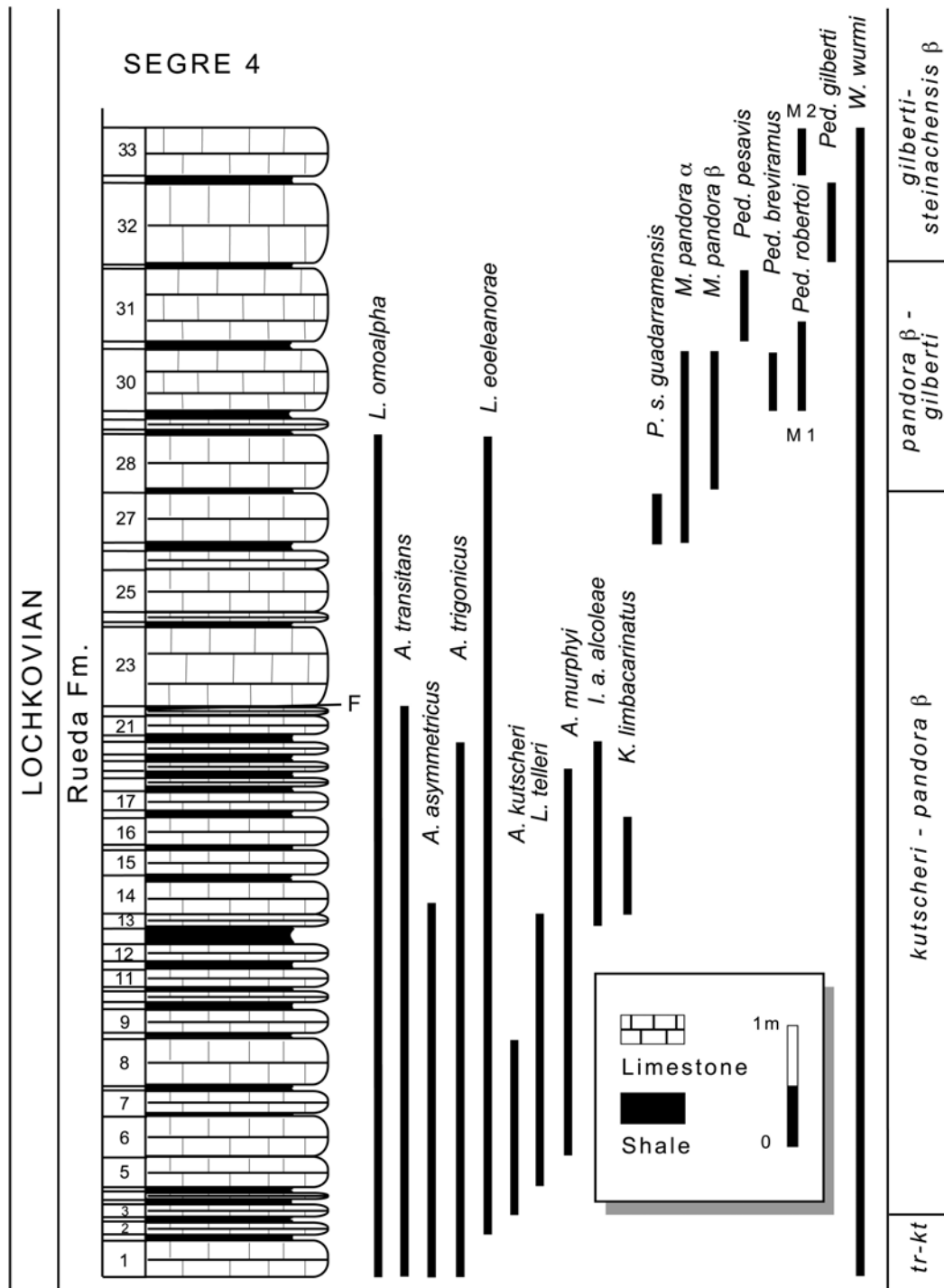


Figure 3. Stratigraphic column of the Se 4 section and conodont distribution.

Figure 4. Conodonts from the Se 4 section. 1. *Ancyrodelloides asymmetricus* (Bischoff & Sannemann), Pa element, 1a upper view, 1b lower view; sample Se 4/10. 2. *Anc. kutscheri* Bischoff & Sannemann, Pa element, 2a upper view, 2b lower view; sample Se 4/6a. 3. *Anc. murphyi* Valenzuela-Ríos, Pa element, upper view, sample Se 4/6a. 4. *Anc. transitans* (Bischoff & Sannemann), Pa element, 4a upper view, 4b lower view; sample Se 4/15. 5. *Anc. trigonicus* Bischoff & Sannemann, Pa element, 5a upper view, 5b lower view; sample Se 4/2. 6. *Kimognathus limbacarinatus* Murphy & Matti, Pa element, 6a upper view, 6b lower view, sample Se 4/14b.

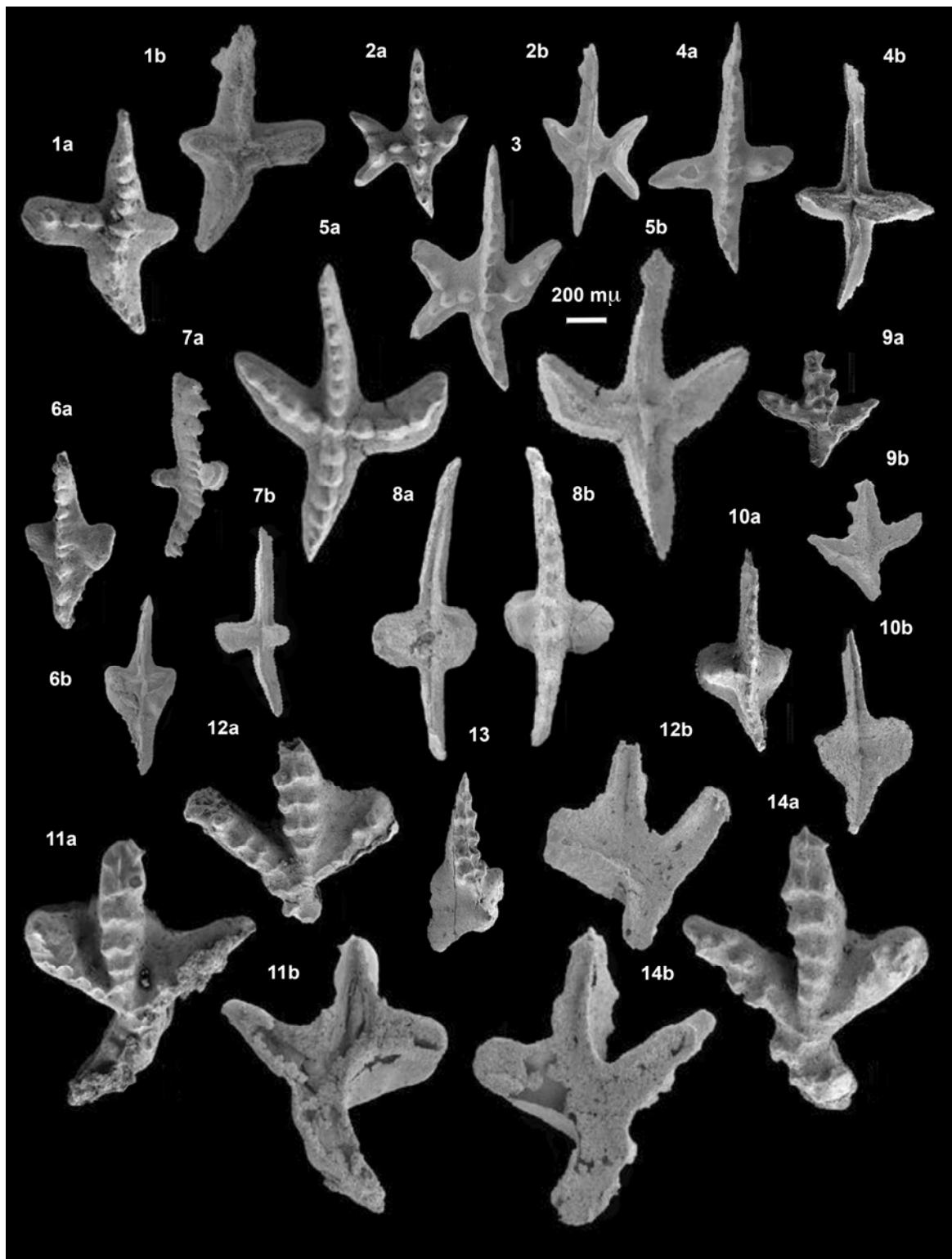


Figure 4. continued.

7. *Lanea telleri* (Schulze), Pa element, 7a upper view, 7b, lower view, sample Se 4/5. **8.** *Lanea omoalpha* Murphy & Valenzuela-Ríos, Pa element, 8a lower view, 8b upper view, sample Se 4/1a. **9.** *Pedavis breviramis* Murphy & Matti, I element, 9a upper view, 9b lower view, sample Se 4/30. **10.** *Masaraella pandora* beta (Murphy et al.), Pa element, 10a upper view, 10b lower view, sample Se 4/30. **11.** *Pedavis pesavis* (Bischoff & Sannemann), I element, 11a upper view, 11b lower view, sample Se 4/31. **12.** *Ped. gilberti* Valenzuela-Ríos I element, 12a upper view, 12b lower view, sample Se 4/31. **13.** *Icriodus angustoides alcoleae* Carls, I element, upper view, sample Se 4/28. **14.** *Ped. robertoi* Valenzuela-Ríos, I element, 14a upper view, 14b lower view, sample Se 4/31.

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Palaeoenvironment

The sediments of the Rueda Fm. were deposited in a hemipelagic carbonate ramp (Sanz-López, 2002). The sediments represented in this section probably belong to shallow water facies, below storm wave base.

Fossil content

37 conodont samples have been collected from the Segre 4 section from all the limestone levels. The preservation is mostly good. Conodont colour is black corresponding to a Color Alteration Index (CAI) of 5.

19 taxa belonging to nine genera (*Icriodus*, *Ancyrodelloides*, *Lanea*, *Kimognathus*, *Pedavis*, *Pelekysgnathus*, *Masaraella*, *Wurmiella* and *Zieglerodina*) have been identified (Figs. 3, 4).

Biostratigraphy

The sequential entry of key species of the genera *Ancyrodelloides*, *Masaraella* and *Pedavis* enables recognition of middle and upper Lochkovian biozones. The lowest bed yielded already *A. trigonicus* allowing partial identification of the upper part of *trigonicus-kutscheri* Zone (Beds 1-2). The *kutscheri-pandora* beta Zone extends from Bed 3-27. In the upper half of this zone the entries of *K. limbacarinatus* (Bed 14a), *I. angustoides alcoleae* (Bed 15) and *Pel. guadarramensis* (Bed 27) are relevant records. The lower boundary of the upper Lochkovian is at Bed 28 with the entry of *M. pandora* beta. The *pandora* beta-*gilberti* Zone comprises Bed 28-31. The last Lochkovian *gilberti-steinachensis* beta Zone is partly identified from Bed 32 to 33.

Additional remarks

The records of several species of *Ancyrodelloides* (*A. transitans*, *A. trigonicus*, *A. asymmetricus*, *A. kutscheri* and *A. murphyi*), *Lanea* (*L. omoalpha*, *L. eoeleonorae* and *L. telleri*) and *Pedavis* (*Pd. breviramus*, *Pd. pesavis*, *Pd. robertoi* morphs 1 and 2 and *Pd. gilberti*) are important. The sequential entries of these taxa are extremely relevant for subdividing middle and upper Lochkovian strata and practising detailed correlations.

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