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Givetian to Famennian conodonts (Middle-Upper Devonian) at CP section

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Locality - Along the former national road N-260.
Lithostratigraphic unit - Comabella Fm., La Mena Fm., Barousse Fm.
Age - Givetian-Famennian (Middle-Upper Devonian).
What to see - Well-exposed Givetian, Frasnian and Famennian strata in an almost continuous sequence moderate folded and with several faults, compiled from several outcrops.

How to get there

The locality is accessible through the paved road that corresponds to the former National N260 from La Pobla de Segur to Sort. Most of the studied rocks are along the road, but some strata are studied in the hill. The section is reversed and south to north oriented (Fig. 1).

Historical outline

Schmidt (1931) drafted a geological scheme of the section that was, subsequently used by Ziegler (1959) in orienting his conodont sampling for the Upper Devonian. Boersma (1973) measured and sampled the Compte Fm. and its three members (A-C), that roughly corresponds to the Comabella Fm. (Member A), La Mena Fm. (Member B) and Barousse Fm. (Member C). His conodont record spans from the *Icriodus obliquimarginatus* Zone (assigned then to Lower Givetian) through the *Scaliognathus anchoralis* Zone (Tournaisian). A Geological survey accomplished by Valenzuela-Ríos in the 90's demonstrated the presence of several minor faults in the section and the preliminary sampling proved already the richness of the conodont record. Subsequently Liao & Valenzuela-Ríos (2008) and Liao (2014) detailed the conodont sequence that served as a basis for the establishment of the Pyrenean upper Eifelian-lower Frasnian conodont-based composite standard. Because this section has the most detailed Givetian conodont range chart, the Compte section was chosen as the standard reference section for this graphic correlation method (Gouwy et al., 2016).

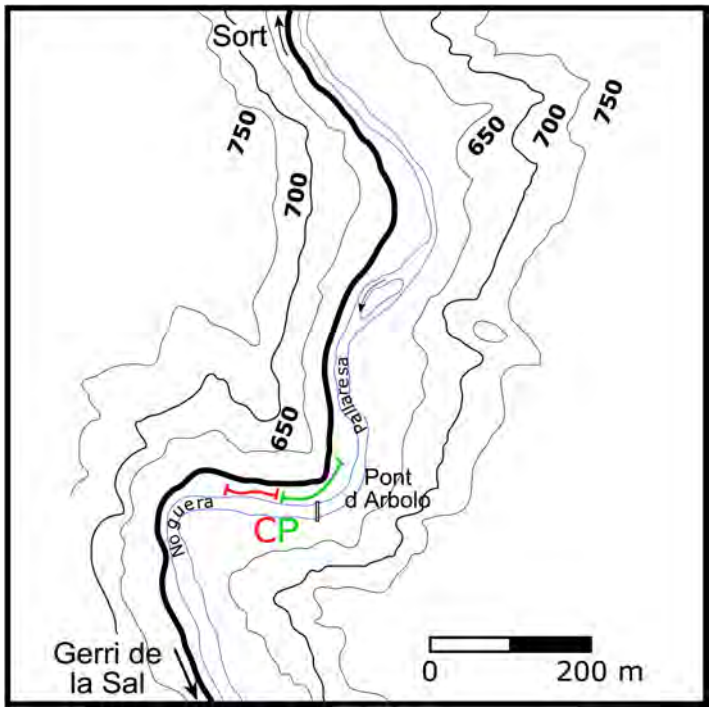

Figure 1. Location map of CP section.

Lithology and fossil content

The section has a thickness of about 107 m of which only the lower 52 m have been detailed sampled for conodonts. This lower part fells completely with the Comabella Fm. which consists of variegated (pink, red, blue and green) nodular limestones and bedded limestones with beds up to 90 cm thick (Fig. 2); some decimetric marly limestones, and a sandy level appear around 30 m above the base of

the section. Limestones of La Mena Fm show its characteristics red nodular appearance ("griotte"). The limestones of the Barousse Fm. turns to grey colours in predominantly thick beds with nodular and breccioid levels.

Crinoid ossicles and stems, ostracods, trilobites, dacryoconarids, brachiopods, bivalves and cephalopods are often found in this section.

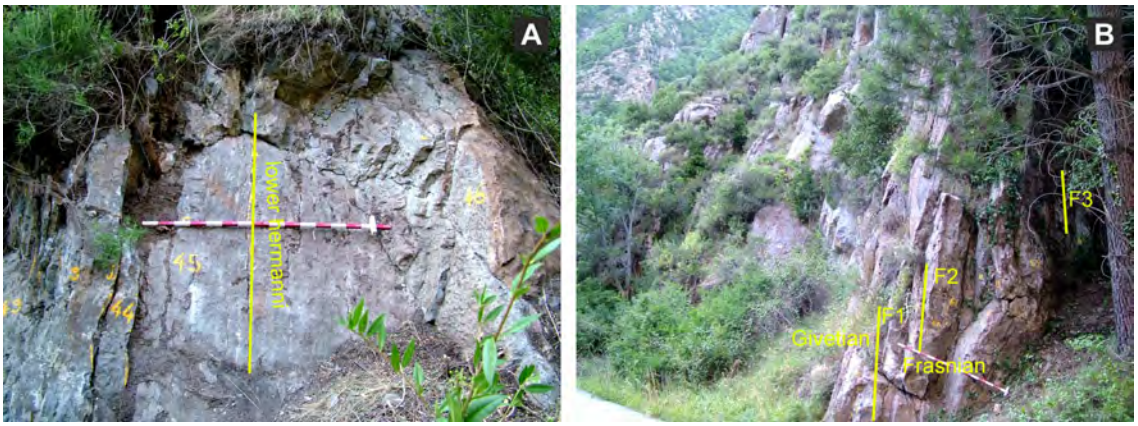

Figure 2. General view and details of the CP section. **A.** uppermost part of the *ansatus* Zone, *semialternans/latifossatus and hermanni* Zones. **B.** Details of the upper Givetian (upper *disparilis* and *norrisi* Zones) and the Lower Frasnian (F1-F3 Zones). Givetian/Frasnian boundary and Upper/Middle Devonian Series boundary at Bed 59.

Palaeoenvironment

The depositional setting of Comabella Fm was most probably a pelagic marine environment located in an outer carbonate platform or ramp. The presence of hardgrounds indicates a very calm environment and occasionally the sedimentation rate was very low, even with interruptions in the sedimentation. Some pulses from a more energetic to a calmer environment are inferred in several stratigraphic intervals. La Mena condensed red nodular limestones ("Griotte") correspond to a hemipelagic condensed carbonate ramp. The Barousse Fm. was deposited in a deep carbonate ramp with low rate of subsidence (Sanz-López, 2002).

Fossil content

181 conodont samples have been collected from the CP section in several campaigns from almost all the limestone levels in the lower 52 m. Besides a few widely spaced samples up to La Mena Fm. were taken. Barousse Fm. has not been sampled yet. The preservation is mostly good. Conodont colour is black corresponding to a Color Alteration Index (CAI) of 5.

74 conodont taxa belonging to 11 genera (*Polygnathus, Icriodus, Tortodus, "Ozarkodina", Schmidtognathus, Mesotaxis, Klapperina, Skeletognathus, Ancyrodella, Ancyrognathus* and *Palmatolepis*) have been identified (Figs. 3-6).

Biostratigraphy

The Givetian and early Frasnian detailed biostratigraphy of the CP section has been thoroughly described in two works (Liao & Valenzuela-Ríos, 2008; Liao 2014). Recently, the application of the graphic correlation method projected the position of the lower beds into the late Eifelian (Gouwy et al., 2016). Previous survey sampling by Valenzuela-Ríos demonstrates the presence of conodonts up to the lower Famennian. Boersma (1973) reported higher records, up to the Tournaisian.

In the lower part of the section (Beds -6 to 1) a precise zonation cannot be established. However, the Pyrenean composite standard would place Beds -6 to -3 in the upper Eifelian *ensensis* Zone with caution, and the succeeding Beds would correspond to the *hemiansatus* Zone. However, definitive conodont record is still missing. The base of the *rhenanus/varcus* Zone is identified with the entry of the index *P. rhenanus* in Bed 5. This level corresponds with the base of the middle Givetian as well.

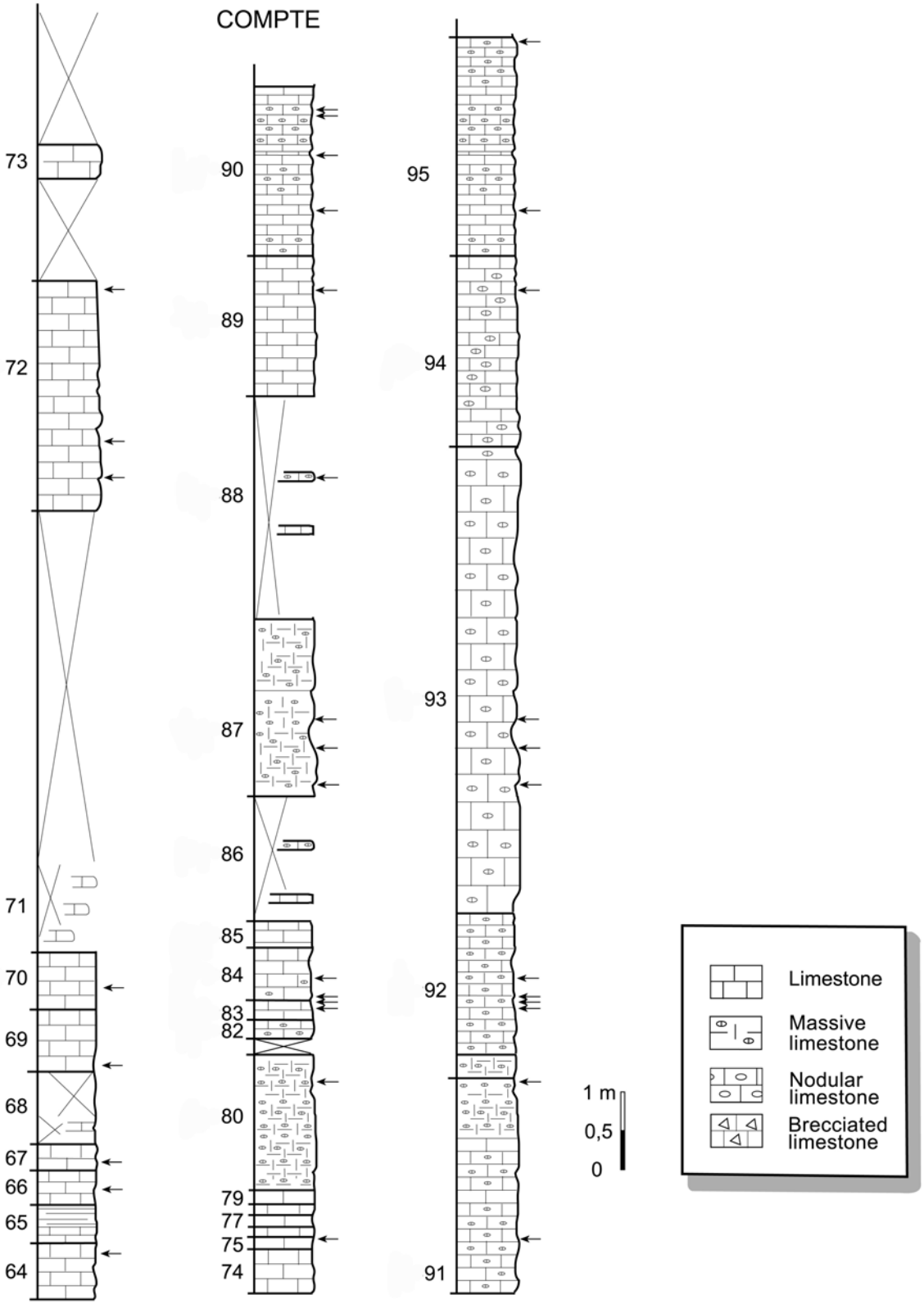

Figure 3. Stratigraphic column of the CP section, Beds 64-95.

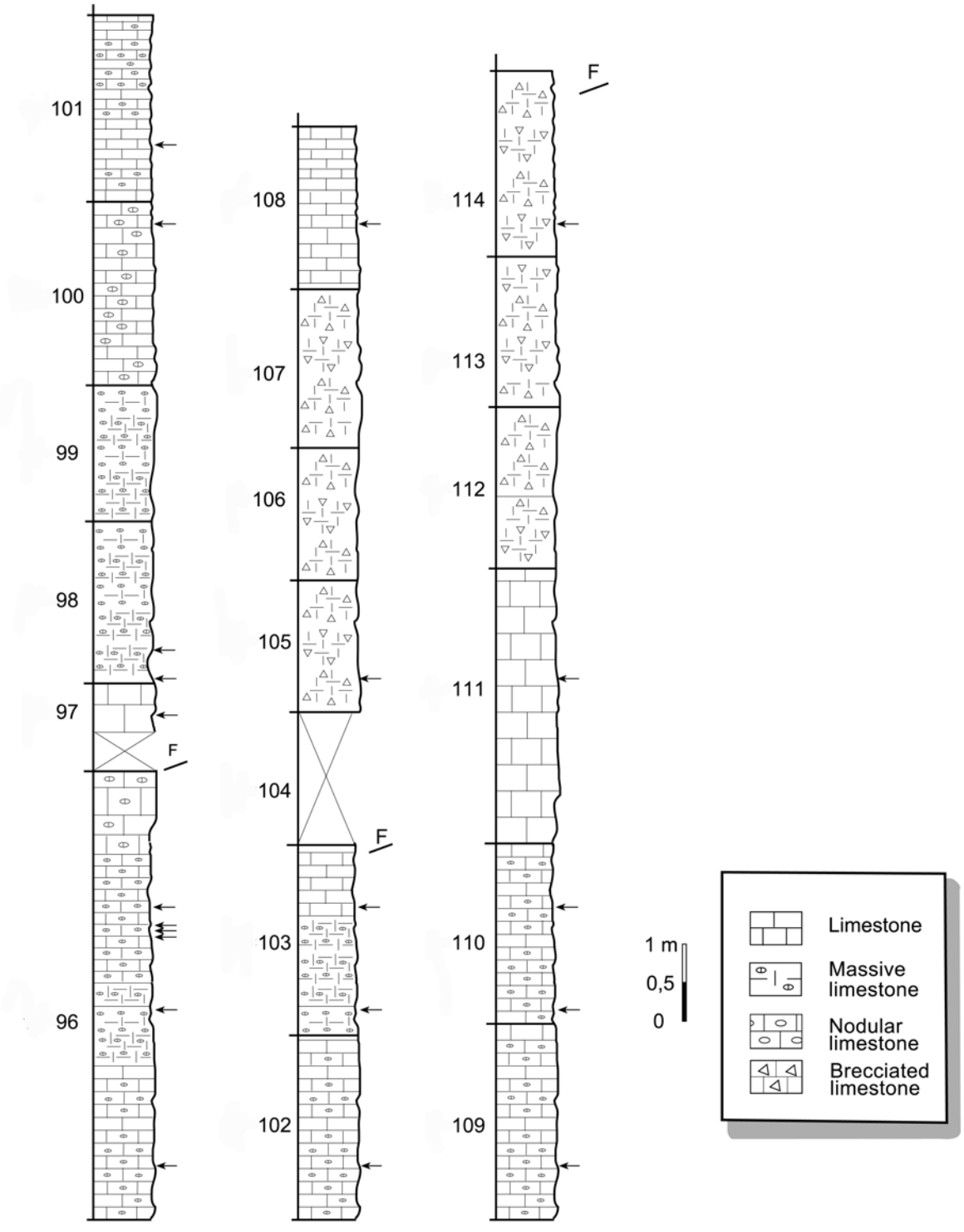

Figure 4. Stratigraphic column of the CP section, Beds 96-114.

The entry of *P. ansatus* in Bed 9 defines the base of the *ansatus* Zone. The joint entry of *P. latifossatus* and "*Oz. semialternans*" in Bed 45c identifies the base of the *semialternans-latifossatus* Zone. The entry of *Schmidtognathus hermanni* in Bed 46a identifies the base of the Lower *hermanni* Zone and accordingly of the upper Givetian. The entry of *P. cristatus ectypus* in Bed 46g aligns with the base of the Upper *hermanni* Zone. The entry of *Klapperina disparilis* at the top of the thick Bed 46 indicates the base of the *disparilis* Zone. The record of *P. dengleri* in Bed 51 indicates the Upper

disparilis Zone. The base of the *norrisi* Zone is recognised in Bed 58b with the entry of the index *Skeletognathus norrisi*. The base of the Frasnian, and consequently of the Upper Devonian Series and of the F1 Zone is recognised by the entry of *Ancyrodella pristina* in Bed 59. The lowest occurrence of *A. soluta* in Bed 60b indicates the beginning of F2 Zone. The next F3 Zone starts in Bed 64 with the entry of *A. rotundiloba alata*. From here up the sampling is discontinuous and only a few relevant references can be made. Bed 80 is placed in the upper part of the Frasnian with *P. schindenwolfi*. About 11 m above this bed, conodonts of the middle *crepida* Zone (= *Pa. termini*) are recorded.

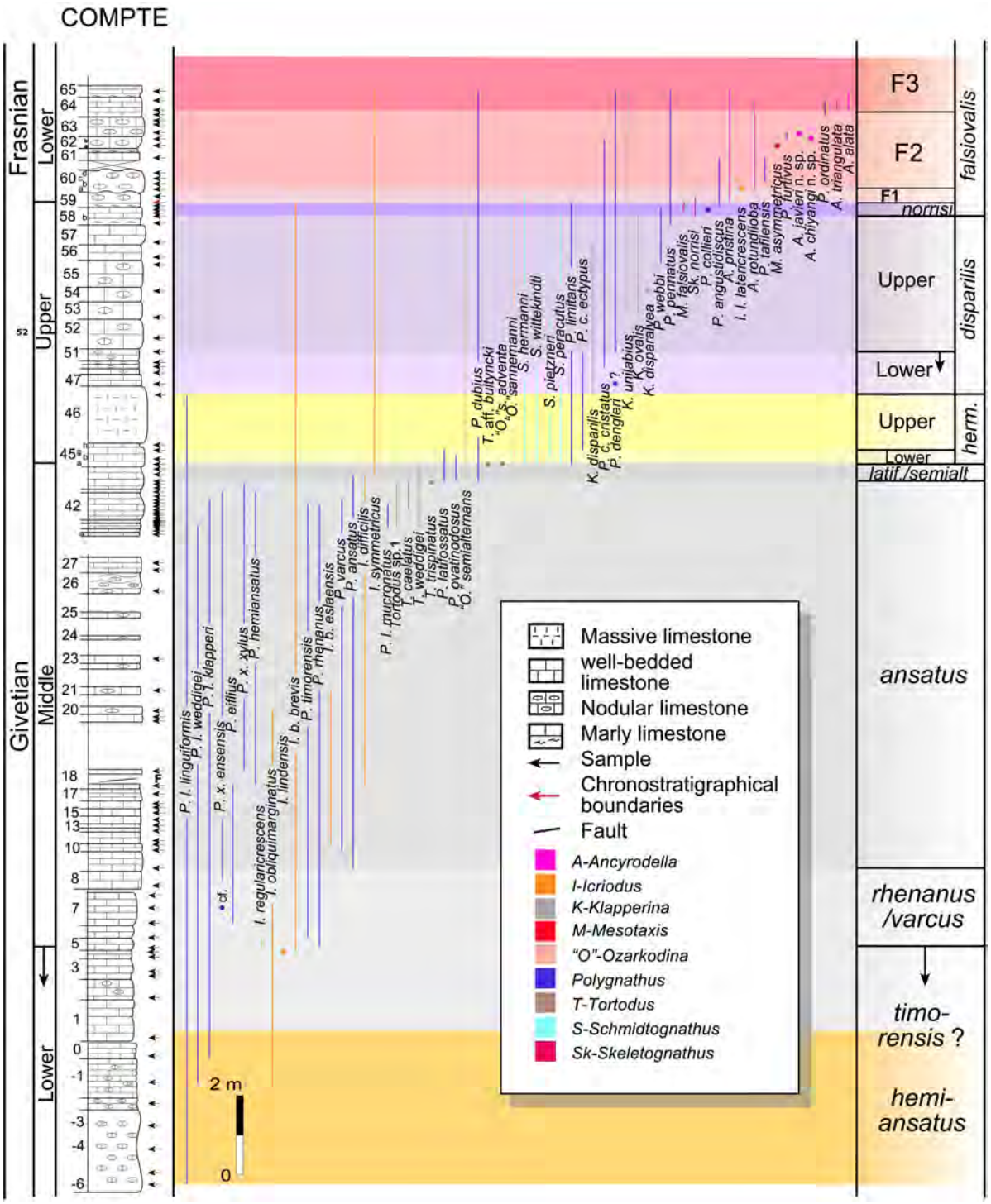

Figure 5. Conodont distribution in CP section.

Acknowlegements

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Figure 6. Conodonts from the CP section.
1. *Polygnathus timorensis* Klapper et al, Pa element, MGUV 5973, 1a) upper view, 1b) lower view, sample CP/6. **2.** *Icriodus obliquimarginatus* Bischoff & Ziegler, I element, MGUV 5975, 2a) upper view, 2b) lateral view, sample CP/20. **3.** *P. hemianasatus* Bultynck, Pa element, MGUV 5982, 3a) lower view, 3b) upper view, sample CP/18b. **4.** *P. rhenanus* Klapper et al, Pa element, MGUV 5977, 4a) upper view, 4b) lower view, sample CP/5. **5.** *P. ansatus* Ziegler & Klapper, Pa element, MGUV 5976, 5a) upper view, 5b) lower view, sample CP/9. **6.** *Tortodus weddigei* Aboussalam, Pa element, MGUV 5986, upper view, sample CP/41b. **7.** *T. trispinatus* Aboussalam, Pa element, MGUV 5987, upper view, sample CP/45b. **8.** *P. latifossatus* Wirth, Pa element, MGUV 5989, 8a) upper view, 8b) lower view, sample CP/45c. **9.** *Schmidtognathus hermanni* Ziegler, Pa element, MGUV 5993, 9a) lower view, 9b) upper view, sample CP/46a. **10.** *P. limitaris* Ziegler et al., Pa element, MGUV 5994, upper view, sample CP/46a. **11.** *Sch. pietzneri* Ziegler, Pa element, MGUV 5996, 11a) upper view, 11b) lower view, sample CP/46b. **12.** *P. cristatus* Hinde transitional form to *Klapperina disparilis* Ziegler & Klapper, Pa element, MGUV 5998, 12a) upper view, 12b) lower view, sample CP/46 (190-200). **13.** *Kl. disparilis* Ziegler & Klapper, Pa element, MGUV 5347, 13a) upper view, 13b) lower view, sample CP/47. **14.** *P. dengleri* Bischoff & Ziegler, Pa element, MGUV 6135, 14a) upper view, 14b) lower view, sample CP/51. **15.** *Mesotaxis falsiovalis* Sandberg et al., Pa element, MGUV 6003, upper view, sample CP/58b. **16.** *Skeletognathus norrisi* (Uyeno), Pa element, MGUV6004, upper view, sample CP/58b. **17.** *Sk. norrisi* (Uyeno), Pb element, MGUV6005, lateral view, sample CP/58b.

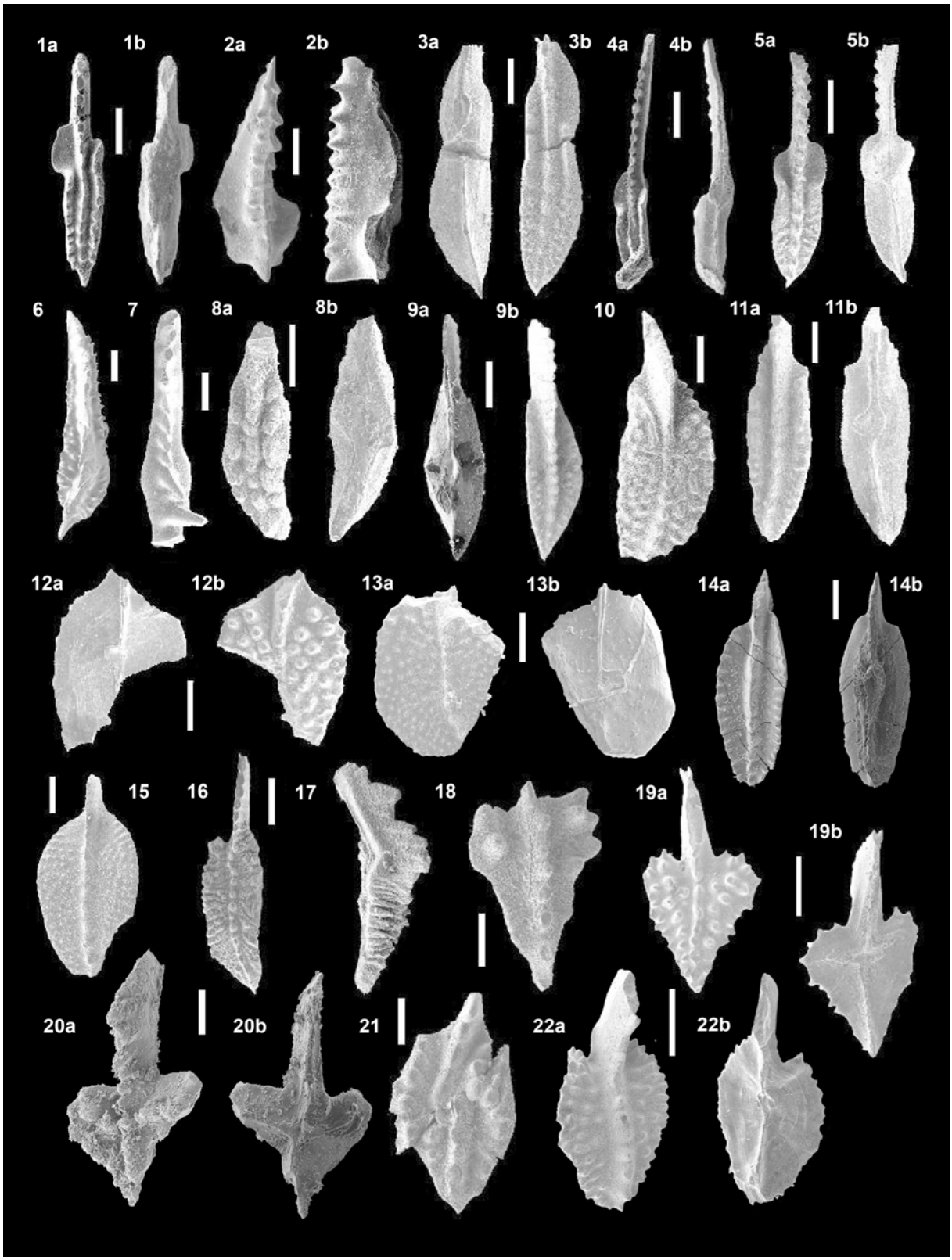

Figure 6. continued.
18. *Ancyrodella pristina* Khalymbadzha & Chernysheva, Pa element, MGUV6008, upper view, sample CP/59. **19.** *Anc. rotundiloba* Glenister & Klapper, Pa element, MGUV 6010, 18a) upper view, 18b) lower view, sample CP/60b. **20.** *Anc. rotundiloba alata* Glenister & Klapper, Pa element, MGUV 6130, 20a) upper view, 20b) lower view, sample CP/64. **21.** *P. collieri* Huddle, Pa element, MGUV6008, upper view, sample CP/59. **22.** *P. furtivus* Ji, Pa element, MGUV 5357, sample CP/62b.