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Late Devonian in the Barranco del Molino (Tabuenca) Iberian Chains (NE Spain)

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Locality *- Along the road A-1301 connecting Ainzón-Illueca, Km 10,5 to Km 14 (Tabuenca, Zaragoza Province).*
Lithostratigraphic units *- Rodanas Fm., Bolloncillos Fm., Hoya Fm., Huechaseca Fm.*
Age *- Lower Frasnian to Upper Famennian (Upper Devonian).*
What to see *- General stratigraphic siliciclastic Upper Devonian succession of more than 1300 m thick. Hard grounds sensu lato developed in quartz sandstone and slump levels of Rodanas Fm. Spectacular slide surface and outstanding rich microfossils shales of the Bolloncillos Fm. The Frasnian/Famennian interval.*

Introduction: The Devonian of the Iberian Chains

The intensive and detailed studies carried out by Carls and his German and Spanish disciples for the last 50 years (see historical review in Carls, 1999, and Carls and Valenzuela-Ríos, 2002) in the Upper Palaeozoic of the Iberian Chains (IC) have demonstrated the worldwide importance of Devonian strata from the Axial Depression of the Río Cámaras (ADRC) (mainly for Early Devonian to middle Givetian); other areas of special relevance for Devonian strata are the surroundings of Nigüella, which represent the northeastermost outcrop of Lochkovian to Early Emsian strata of the IC (Valenzuela-Ríos, 1984, 1989; Carls and Valenzuela-Ríos, 1998), several areas in the Montalbán Anticline, which expose Emsian to Frasnian and Carboniferous strata, and finally there is an area showing very thick Late Devonian strata, the Tabuenca area (Gozalo, 1994; Gozalo et al., 2001; Dojen et al., 2004). The purpose of this paper is to analyse the Late Devonian succession and its important ostracods, conodonts and other fossil record in the Tabuenca area.

Outcrops of pre-Mesosoic rocks in the IC occur in the core of alpine anticlines or anticlinorial structures, often bounded by high-angle reverse faults (Ábalos et al., 2002). These palaeozoic materials have been included into three geological units, Badules Unit, Mesones Unit and Herrera Unit (Lotze, 1929; Carls, 1983; Gozalo and Liñán, 1988). Devonian outcrops are limited to five areas in the Eastern IC that belong to the Herrera Unit (Fig. 1), which is made up of late Cambrian to late Carboniferous rocks. From south to north these areas are: Cabezos Altos and Anadón-Huesa Devonian outcrops both in the Montalbán Anticline, Axial Depression of the Río Cámaras (ADRC), Nigüella and Tabuenca-Rodanas areas.
The largest and more important area for Early to Middle Devonian rocks and faunas is the ADRC; to this, the Nigüella area adds important Early Devonian faunas, which are relevant for palaeogeographical connections between the IC and the Rhenohercynicum (Carls and Valenzuela-Ríos, 1998). Middle Devonian strata are best represented in the ADRC and in the Montalbán Anticline. At the Montalbán Anticline, Late Devonian is partly known from disconnected sections; however, a continuous section of about 1.300 m of siliclastic rocks is documented in the Tabuenca area (Gozalo, 1994; Gozalo et al., 2001).
The known thickness of Devonian strata is close to 4000 m (Carls, 1988, 1999; Carls and Valenzuela-Ríos, 2002; Carls et al., 2004), but there is not a single outcrop, or larger area, to show a complete Devonian sequence. Thus, the stratigraphic column has to be built up from numerous, short and finely biostratigraphically worked out sections, which have to be subsequently correlated. The correlation labour partially benefits from the horizontal stability of faunas and faunal horizons, especially in the Early Devonian. Most of the rock sequence is composed of siliciclastic rocks (shales, fine-grained sandstones and quartzites); carbonate rocks (shelly limestones and marls) are common, but thinner.

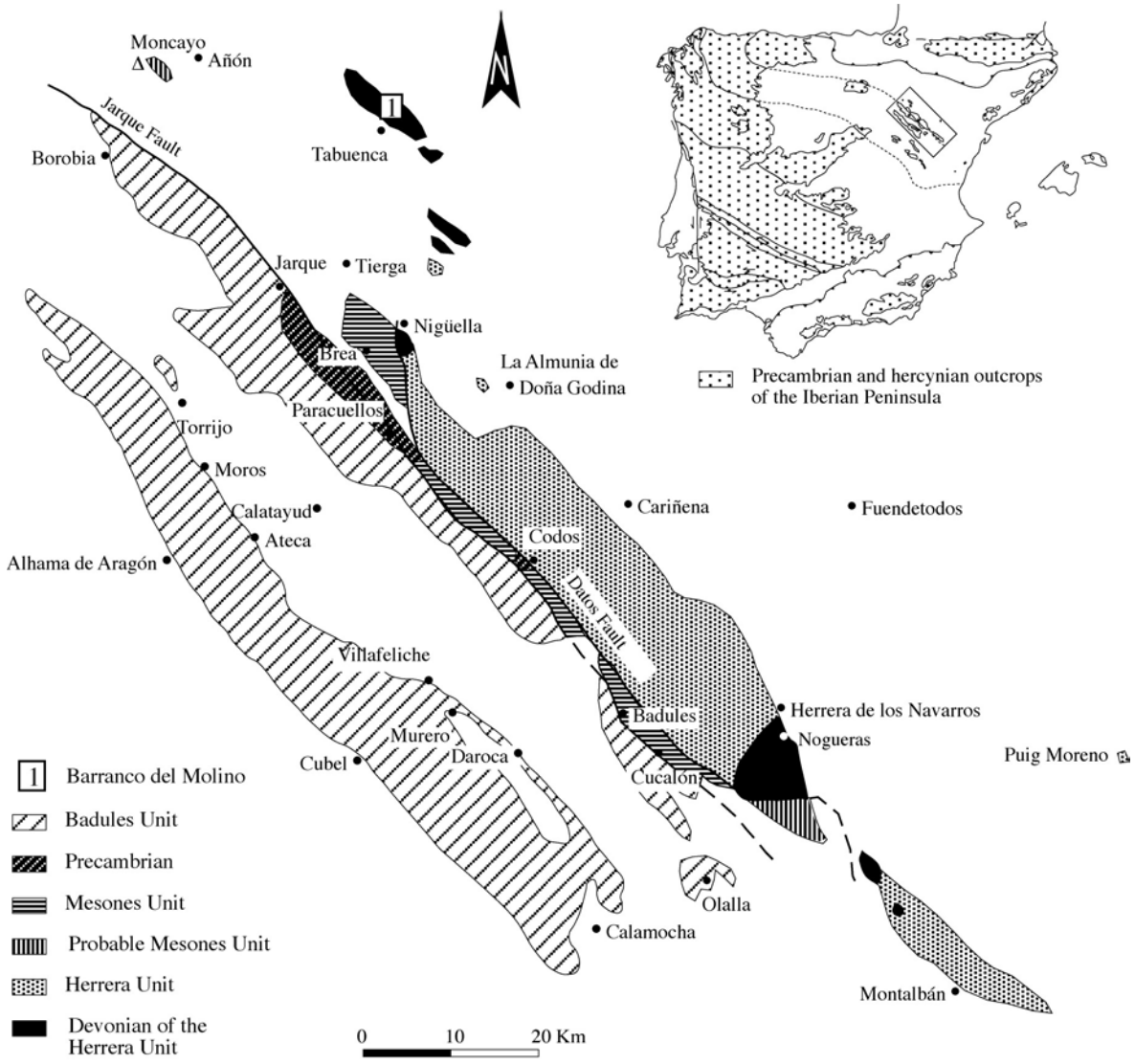

Figure 1. Precambrian and Palaeozoic Units of the Iberian Chains (based on Carls, 1983, and Gozalo and Liñán, 1988) with indication of Devonian outcrops (based on Carls & Valenzuela-Ríos, 2002) and location of the studied area (1).

This sequence was mainly deposited on a shallow neritic marine environment. Most of the strata are fossiliferous; among the fossil groups the neritic turbidicolous brachiopods lineages stand out. In some cases, pelagic faunas from black shales and limestones provide a high potential for correlations between neritic and pelagic environments. The correlations have been based on conodonts, brachiopods, trilobites, dacryoconarids, ostracods and ammonoids; microichtyoliths are less commonly used.

The following formations can be recognized in ascending order in the ADRC and in the Montalbán Anticline: Luesma, Nogueras, Santa Cruz, Mariposas, Castellar, Ramblar, Loscos, Peña Negra, Molino, Monforte, Moyuela, Recutanda, Barreras, Salobral, Cabezo Agudo, Huesa, Bandera and Fuenpudrida Fms. (Carls and Valenzuela-Ríos, 2002). In the Tabuenca area the following continuous Upper Devonian succession is observed Rodanas, Bolloncillos, Hoya and Huechaseca Fms. (Gozalo, 1994; Gozalo et al., 2001).

The Upper Devonian of Tabuenca: Lithology and fossil content

The Upper Devonian of Tabuenca (Fig. 2) comprises a thick siliciclastic sequence of more than 1,300 m. The more abundant fossil group is the ostracoda in the Rodanas and Boloncillos formations, but is scarce at the lower and upper parts of the Hoya Fm. Also there are an important record of the other fossil groups as tentanculitids, conodonts, ammonoids, bivalves, brachiopods, trilobites, machaeiridia, etc.

The main outcrops at Tabuenca are sitted on the local road that runs from Tabuenca to Ainzón. There, the section Barranco del Molino 1 (BM1) that has been detailed studied by Gozalo (1986, 1994) stands out. In this section, 17 palaeontological levels have been studied, being ostracods very abundant in some of them. Also, additionally six partial sections have been studied in this region (Gozalo, 1994).

Fossils, which have mainly been found in the shaly levels, are frequently preserved as a moulds, and this fact force us to obtain latex or silicone moults for studying them.

The Rodanas Fm.

The Rodanas Fm. measures 450 m and it is subdivided into two parts. The lower part consists of 300 m of a siliciclastic alternance being quartzitic sandstones the predominant rocks; individual beds are from 0.5 to 3 m thick. The upper surface of the quartzitic sandstones beds commonly shows an irregular relief, bioturbation and is covered by a ferric patina; they are considered as hard grounds. Shales intercalations are scarce and very thin (decimetric up to, occasionally metric). By means of ostracods (Gozalo and Sánchez de Posada, 1986; Gozalo, 1994) and ammonoids (*Schindewolfoceras* cf. *chemungense, Aulatornoceras (Truyolsoceras)* sp. A and *Tornoceras uniangulare* ssp., *sensu* Montesinos and Gozalo, 1987), a Frasnian age, *torleyi-cicatricosa* interval is assigned to the base of Rodanas Fm. These faunas hint at a deep sublittoral, or event circalittoral environment; above it, very important siliciclastic sedimentation, indicative of shallower environments, was developed. Faunas from the highest part indicate sublittoral environments. Probably, the lowermost shale levels belong to another formation, but they crop only in this point out, and their definitive stratigraphic assignation remains uncertain.

The Ostracod species from this lower part are *Falsipollex tabuencensis*, *Parabolbinella* cf. *postaculeata*, *Hollinella (Keslingella)* cf. sp. D, *Skalyella* sp., ?*H. (K.)* aff. *samarensis*, *Rozhdestvenkayites sencielensis casier, Amphissistes* cf. *parvulus*, *Sinessites*? *Micronodus*, *Healdia* sp., *Bythocyproidea weyanti*, *Polyzygia neodevonica aragonensis, Svantovites spinosus*, *Microcheilinella postfecunda*, *Tricornina (Ovornina)* sp., *Franklinella (F.) calcarata*, and *Cryptophyllus* cf. *materni*.

The upper part consists of 150 m of a detrital alternance. It differs from the lower part in the higher content of lutites that make more than 50% of the thickness. Also, some calcareous levels appear in the upper part. Quartzitic sandstones are of the same kind than in the lower part, but thinner (0.3-1.5 m thick). In the upper half carbonate sediments occur (dolomite and marls). Between 55 and 75 meters above the base of this upper part, several slumps have been observed. Numerous ostracods, tentaculitids, trilobites, bivalves, conodonts and Machaeridia have been found (Gozalo, 1994; Gozalo et al., 2001).

The Ostracod species from the upper part of Rodanas Fm. in BM1 are *Parabolbinella lethiersi*, *Hollinella (Keslingella) lignani, H. (K.)* aff. *praecursor*, *H. (K.)* cf. sp. D, *Rozhdestvenkayites sencielensis casieri, Amphissistes* cf. *parvulus*, *A.* aff. *remesi*, *Sinessites*? *Micronodus*, *Bythocyproidea weyanti*, *Favulella* aff. *spissa*, *Polyzygia neodevonica aragonensis, Quasillites ovetensium*, *Ponderodictya blessi*, *Microcheilinella postfecunda, Entomozoe (Nehdentomis) tenera, E. (N.) pseudorrichterina, Bertillonella (Bertillonella) trappi*, *Franklinella (F.) calcarata, F. (Arnoldiella) trispinosa*, and *Cryptophyllus* cf. *materni*. Furthermore, we have found the following species in the nearest section Barranco del Filluelo 1 (BF1: Gozalo, 1994): *Roundyella* aff. *pokornyi*, *Favulella spissa*, *Polyzygia neodevonica neodevonica, Craspedographylus*? sp., *Svantovites inops*, *S. magnei* and *Bertillonella (Rabienella) cicatricosa*.

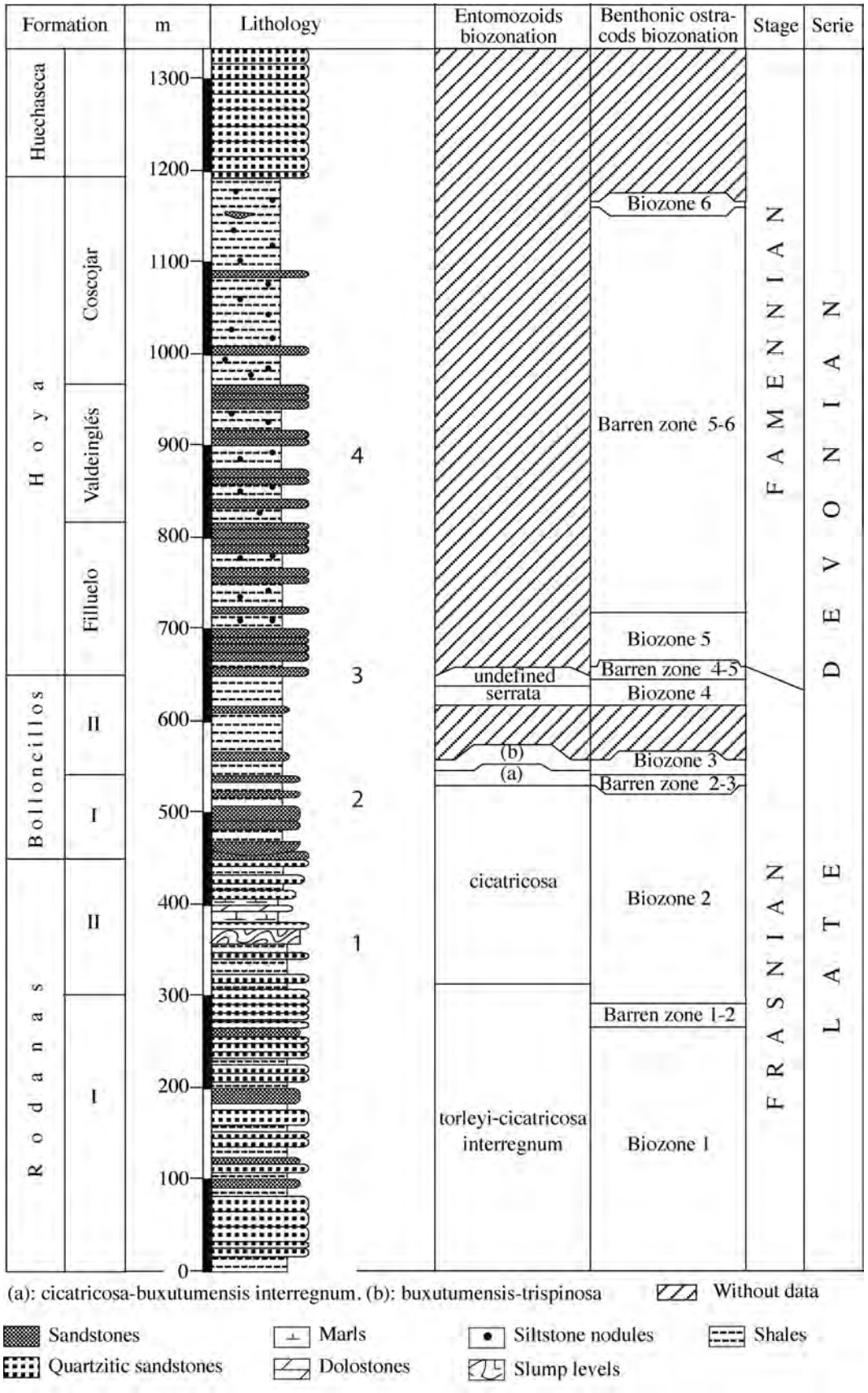

Figure 2. Late Devonian synthetic column of Tabuenca, and the benthonic and entomozoid ostracod biozonations (Gozalo, 1994; Gozalo et al., 2001). 1-4 stratigraphical points of interest.

Based mainly on ostracods, the lower part is also assigned to the *torleyi-cicatricosa* Interval and the rest to the *cicatricosa* Zone (Fig. 2). Faunal assemblages indicate always a sublittoral environment with a slow deepening. The upper part represents the unique carbonate episode of the whole sequence.

The Bolloncillos Fm.

The Bolloncillos Fm. consists of 200 m of detritic rocks and has been subdivided into two parts. The lower part is 90 m thick and consists of an alternance of coarse to fine grain sandstones and lutites, being the former predominant. Channels structures showing cross-bedding appear at the basal part. Sandstone beds are 0.5-2 m thick. Lutitic levels increase their thickness upward from 0.5 to 2 m; they consist of an alternance of fine sandstone and lutites, being the latter predominant. A rich ostracod fauna, together with some conodonts (*Palmatolepis gigas*, *Ancyrognathus* cf. *ancyrognathoideus* and *Ancyrodella* sp., *sensu* Valenzuela-Ríos *et al*, 2002), trilobites, tentaculitids (*Styliolina* spp. and *Homoctenus* spp.), and ammonoids indicate that the lower beds belong to the *cicatricosa* Zone and the upper ones to the *cicatricosa-buxutumensis* interval (Gozalo, 1994). Recently, it has been found a palynological assemblage in this levels at the Santurario de la Virgen de Rodanas area of the Frasnian *ovallis-bulliferus* zone (Rial et al., 2016). The beginning of this formation represents a shallowing, that was followed by a deepening, but environments keep always within the sublittoral.

The ostracod species are *Parabolbinella lethiersi*, *Hollinella (Keslingella) lignani, Rozhdestvenkayites sencielensis casieri, Amphissistes* cf. *parvulus*, *Sinessites*? *micronodus*, *Bythocyproidea weyanti, Quasillites ovetensium, Ponderodictya blessi, Microcheilinella postfecunda, Entomozoe (Nehdentomis) tenera, E. (N.) pseudorrichterina, Richterina (Volkina) zimmermanni*, *Posadaella alcaldei*, *Bertillonella (Bertillonella) trappi*, *Bertillonella (Rabienella) cicatricosa*, *Franklinella (F.) calcarata, F. (Arnoldiella) trispinosa*, and *Cryptophyllus* cf. *materni*.

The upper part is 110 m thick. The amount of lutites increases and metric levels of sandstones disappear. The top beds are clearly lutites. Rich ostracod fauna, tentaculitids and conodonts indicate an age between the *cicatricosa-buxutumensis* interval and above the *serrata* zone. Topmost levels did not yielded fauna and they can either belong to the Frasnian or to the Fammenian (Montesinos et al., 1990; Gozalo, 1994; Valenzuela-Ríos et al., 2002). The presence of organic matter together with *Chondrites*? would indicate a poorly oxygenated benthos, or even below the minimum oxygenation zone.

The ostracod taxa in the lower part of this 110 m thick sequence are *Parabolbinella lethiersi*, *Hollinella (Keslingella)* aff. *radiata, Adelphobolbina* sp., *Rozhdestvenskayites sencielensis casieri, Kummerowia blessi, A.* cf. *cantabricus*, *A*. aff. *cononodus*, *Amphissites* cf. *parvulus*, A. aff. *remesi, A. saalfeldensis valdeonensis, A. inflatus, A. (Ectodemites)* sp., *Bythocyproidea weyanti*, *Favulella lecomptei brevis, Jenningsina (Aragonella) carlsi, Craspedographylus*? sp., *Microcheilinella postfecunda, Entomozoe (Nehdentomis) tenera, E. (N.) buxutumensis, Richterina (Volkina) zimmermanni, Bertillonella (Bertillonella) trappi*, *Franklinella (F.) calcarata, F. (Arnoldiella) trispinosa*, and *Cryptophyllus* cf. *materni*. Ostracod taxa from the upper part are *Parabolbinella*? cf. *vomis*, *Kullmannissites* aff. *kullmanni, Entomozoe (Nehdentomis) tenera, E. (N.) pseudorrichterina, Richterina (Volkina) zimmermanni*, *Entomoprimitia (E.) inconstans*, *Bertillonella (Bertillonella) trappi*, *Bertillonella (Rabienella) serrata*, and *Franklinella (F.) calcarata.*

The Hoya Fm.

The Hoya Fm. is 545 m thick and it has been subdivided into three members that from base up are Filluelo Mb., Valdeinglés Mb. and Coscojar Mb.

The Filluelo Mb. consists of 165 m of a detritical alternance. Coarse to middle grain sandstone with some microconglomerates are predominant. Beds are 1-3 m thick but without large lateral continuity and with irregular surfaces. Lutitic levels are mostly silty, have thickness around 1 m and are more abundant and thicker to the upper part of the member. Most of the beds are barren, and fauna is restricted to the lower 70 m where ostracods, conodonts, bivalves, brachiopods and specially the

ammonoid *Falcitornoceras* enable recognition of the Famennian (Montesinos et al., 1990). These sediments were deposited in restricted sublittoral environments (Gozalo et al., 2001).
The very scarce Famennian ostracods taxa are: *Hollinella (Keslingella)* sp., *Coryellina* sp., *Tmemolophus sequeirosi*, *Knoxites perplexa vini* and *Glyptopleura?* sp.

The Valdeinglés Mb. is 160 m thick and consists of a sandstone-lutite alternance. Its limit with the underlain Filluelo Mb. is based on the augment of lutitic material and in a change of colour (white to green and brown colours). Sandstones are coarse to medium grain-size; there are scattered conglomerate levels with 2-4 mm pebbles. Beds have thickness between 0.5-1.5 m. On some beds big medusoids with radial or flat ornamentation have been recorded (Gozalo et al., 2001). Clay rocks are the predominant lutites. Bed thickness increases to the upper part. In these levels, silty nodules are common.

The Coscojar Mb. consists of 220 m of lutites. Its lower limit is traced when sandstone beds thicker than 1 m disappeared. The lutites are mostly clay beds with some fine-grained sandstone interbedded (centimetre levels-to scattered decimetre levels). Silt nodules are common and can reach up to 10 cm diameter. At the top of the member there is a faunistic horizon with few ostracods, bivalves, and one trilobite, a *Trimerocephalus* sp. cranidium, that indicates a Famennian age, probably upper Famennian. The ostracod taxa found in the top of the Hoya Fm. are: Hollinellidae sp. indet., Primitiopsidae sp. indet. and *Marginoheladia* cf. *marginata*.

The Huechaseca Fm.
The Huechaseca Fm. consists of, at least, 140 m of middle to fine grain-size, well-sorted quartzitic sandstones. This formation is barren, but because of continuity with the underlain formation an upper Famennian age can be inferred. The top of this formation is unknown.

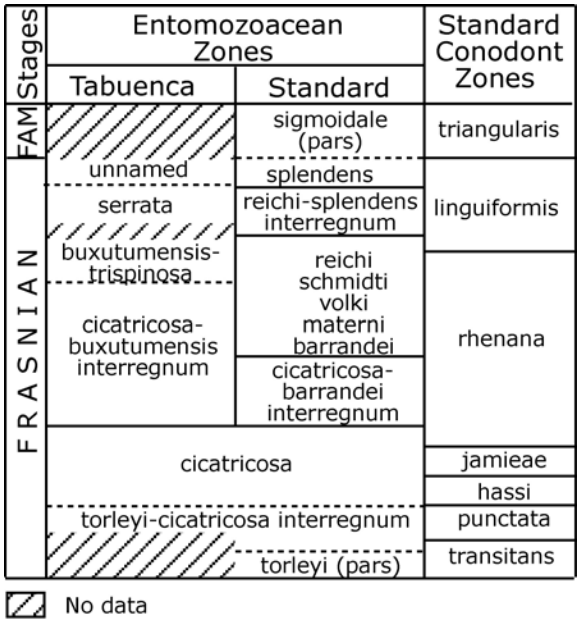

Figure 3. Correlation chart of entomozoacean (Tabuenca and standard) and conodont zonation within the Frasnian (modified from Gozalo, 1994, and Groos-Uffenorde and Rabien, 1996).

Biostratigraphy
The ostracod taxa diversity allows us to establish two different ostracods biozonation (see Gozalo, 1994), based on benthonic and entomozoacean ostracods, that were correlated with the ammonoids and conodonts zones (Gozalo, 1994, fig. 73). The benthonic biozonation has been developed for Frasnian and Famennian rocks, but it has only a local application.
In contrast, Entomozoacean have only been recorded in frasnian rocks from Tabuenca area, where Gozalo (1994) established five biozones (Fig. 3). This biozonation permits an accurate correlation with the European and Chinese entomozoacean biozonations (see Groos-Uffernorde and Wang, 1989; Groos-Uffernorde and Rabien, 1996; Groos-Uffenorde, et al., 2000); conodont joint records enables correlation with the conodont standard zonation (Valenzuela-Ríos et al., 2002).
The Frasnian/Famennian boundary is identified in two sections: Barranco del Molino 1 (BM1) and Collado de la Hoya (CH). The boundary lies close to the stratigraphic limit between the upper parts of the Bolloncillos Fm. and the lower parts of the Hoya Fm., which is marked by the change from green and grey shales, with some interbeded decimetric fine sandstones, to metric sandstone beds showing channel structures.

The uppermost fossil record from the Bolloncillos Fm. stems from 8 m below the top of this formation, and it is composed of entomozoids (see above), homoctenids (*Homoctenus krestrovnikovi, H. ultimus ultimus, H. ultimus* cf. *derkaouensis* and *H. deflexus*, *sensu* Montesinos et al., 1990), conodonts (*Ancyrognathus* cf. *coeni, A. triangularis* and *Ancyrodella curvata*, sensu Valenzuela-Ríos et al., 2002) and bivalves, which report a Frasnian age (levels BM1/32 and CH/6). The next level where we have found fossils lies 4 m above the base of the Hoya Fm., and contains ostracods, ammonoids, brachiopods, conodonts and bivalves. The presence of *Falcitornoceras falciculum* ssp. shows that this level is lower Famennian in age (BM1/34 and CH/9) (Montesinos et al., 1990; Montesinos and Sanz-López, 1999). These data indicate that the Frasnian/Famennian boundary lies between beds 32 and 34 at BM1 section, and between beds 6 and 9 at CH section.

Points of interest

Outcrops at Tabuenca are sitted on the local road that runs from Tabuenca to Ainzón (Fig. 4). There, we will inspect the section Barranco del Molino 1 (BM1) that has been detailed studied by Gozalo (1986, 1994). In this section 17 palaeontological levels have been studied, being ostracods very abundant in some of them. Fossils have mainly been found in the shaly levels; they are frequently preserved as a mould, and this fact force us to obtain latex or silicone moults for studying them.

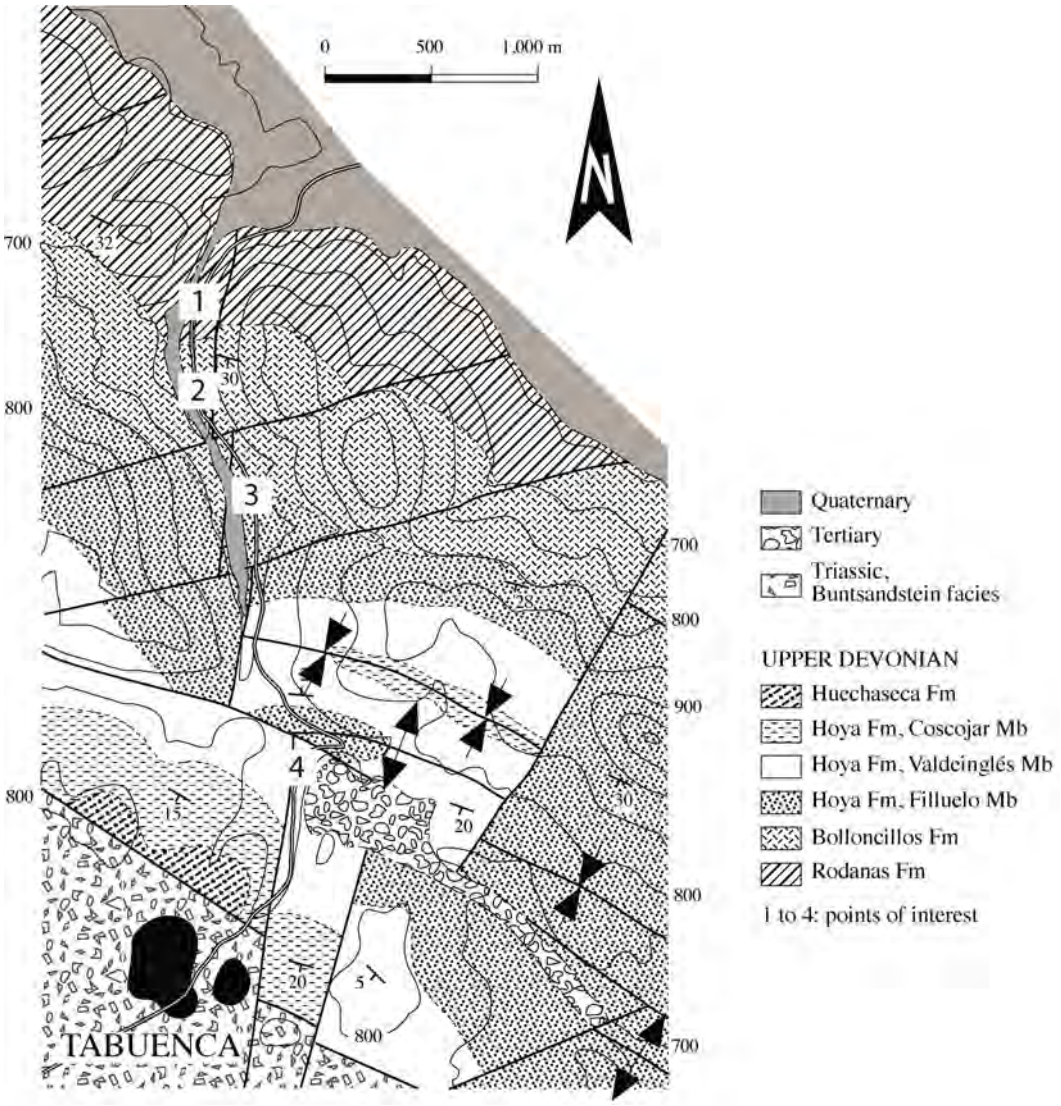

Figure 4. Geological map of the Barranco del Molino outcrops, showing the position of the (1-4) points of interest (from Gozalo et al., 2001).

1. Hard grounds sensu lato and slump levels in the member II of Rodanas Fm.

Location and age

Biozone 2 and *torleyi-cicatricosa* intreval to *cicatricosa* zones (Frasnian). Barranco del Molino 1 section, BM1/5 to BM1/17 levels.

We will see the boundary between members I and II of the Rodanas Fm., and recognize the characteristics hard ground sensu lato surfaces on the top of the quartzitic sandstone beds (Fig. 5.A). Between BM1/11 and BM1/14, beds are strongly distorted by slumps (Figs. 5.B, 5.C). The only, and few, Upper Devonian carbonatic materials from Tabuenca will be seen at this stop (Fig. 5.D).

What to collect

Ostracods, tentaculitids, brachiopods, bivalves, trilobites and machaeridians have been recorded from these levels.

Ostracod species: *Parabolbinella lethiersi*, *Hollinella (Keslingella) lignani, H. (K.)* aff. *praecursor*, *H. (K.)* cf. sp. D, *Rozhdestvenkayites sencielensis casieri, Amphissistes* cf. *parvulus*, *A*. aff. *remesi*, *Sinessites*? *micronodus*, *Bythocyproidea weyanti*, *Favulella* aff. *spissa*, *Polyzygia neodevonica aragonensis, Quasillites ovetensium, Ponderodictya blessi, Microcheilinella postfecunda, Entomozoe (Nehdentomis) tenera, E. (N.) pseudorrichterina, Bertillonella (Bertillonella) trappi*, *Franklinella (F.) calcarata, F. (Arnoldiella) trispinosa* and *Cryptophyllus* cf. *materni*.

2. Spectacular slide surface and outstanding rich microfossils shales of the Member I of Bolloncillos Fm.

Location and age

Biozone 2 and *cicatricosa* zone (Frasnian). Barranco del Molino 1 section, BM1/19 to BM1/21 levels.

We will observe the biggest surface bed of the region (Fig. 5.E), with trace fossils and several concave epireliefs, which interpretation is unknown (Fig. 5.F). The shale levels have very abundant fossils.

What to collect

Ostracods, tentaculitids, brachiopods, bivalves, trilobites, conodonts, ammonoids and machaeridians have been recorded from those levels.

Ostracod species: *Parabolbinella lethiersi*, *Hollinella (Keslingella) lignani, Rozhdestvenkayites sencielensis casieri, Amphissistes* cf. *parvulus*, *Sinessites*? *micronodus*, *Bythocyproidea weyanti, Quasillites ovetensium, Ponderodictya blessi, Microcheilinella postfecunda, Entomozoe (Nehdentomis) tenera, E. (N.) pseudorrichterina, Richterina (Volkina) zimmermanni*, *Posadaella alcaldei*, *Bertillonella (Bertillonella) trappi*, *Bertillonella (Rabienella) cicatricosa*, *Franklinella (F.) calcarata, F. (Arnoldiella) trispinosa* and *Cryptophyllus* cf. *materni*.

3. Frasnian Biostratigraphy and the Frasnian/Famennian boundary in Tabuenca

Location and age

Biozones 4 to 5, and *serrata* and a non-defined zone (Frasnian/Famennian). Barranco del Molino 1 section, levels BM1/30 to BM1/35.

We will inspect a sequence of 50 m corresponding to the lasts 30 m of the member II of the Bolloncillos Fm and the firsts 20 m of the Filluelo Mb of the Hoya Fm. Bolloncillos Fm. consists of green and grey shales, with some interbeded decimetric fine sandstones. The beginning of the Hoya Fm. is marked by a metric sandstone bed showing channel structures; above it follows an alternance of dark pelitic and sanstones levels.

The last fossils found at Bolloncillos Fm. stem from 8 m below the top of this formation; it is composed of entomozoids, homoctenids, conodonts and bivalves, which report a Frasnian age (level BM1/32) (Montesinos et al., 1990; Gozalo, 1994; Gozalo et al. 2001; Valenzuela et al., 2002). The next level where we have found fossils lies 4 m above the base of the Hoya Fm., and contains ostracods,

ammonoids, brachiopods, conodonts and bivalves. The presence of *Falcitornoceras falciculum* ssp. shows that this level is Lower Famennian in age (BM1/34) (Montesinos et al., 1990; Montesinos and Sanz-López, 1999). These data indicate that the Frasnian/Famennian boundary lies between beds 32 and 34 at BM1 section (Figs. 6.A-6.D).

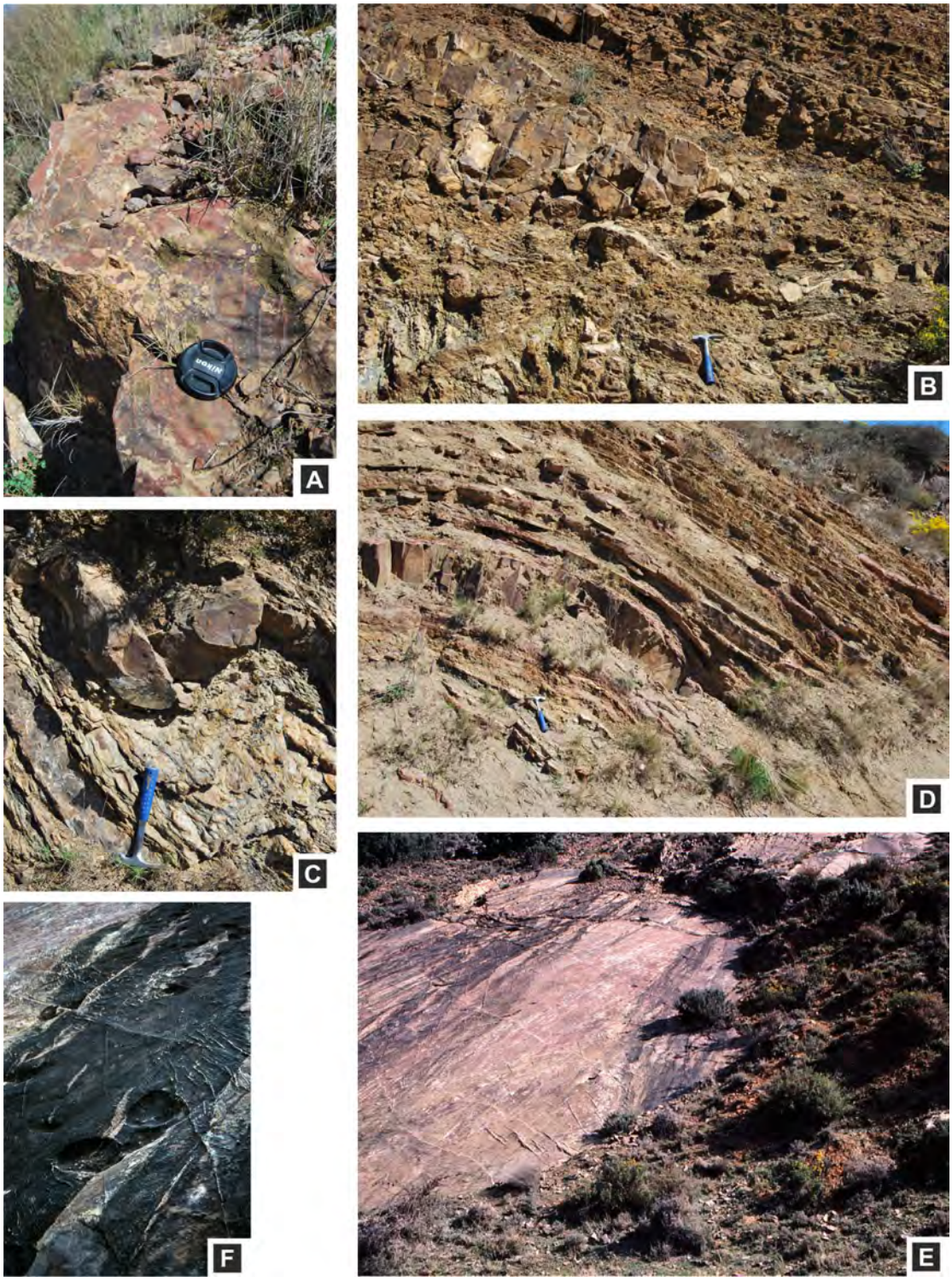

Figure 5. A. Hard ground sensu lato developed on quartzitic sandstone beds of the Rodanas Fm.; it shows an irregular relief, bioturbation and covered by a ferric patina. **B.-C.** Slumps levels from the Rodanas Fm. **D.** Carbonatic levels form the upper part of the Rodanas Fm. **E.** Sandstone surface bed of the Bolloncillos Fm. **F.** Concave epireliefs on the previous surface.

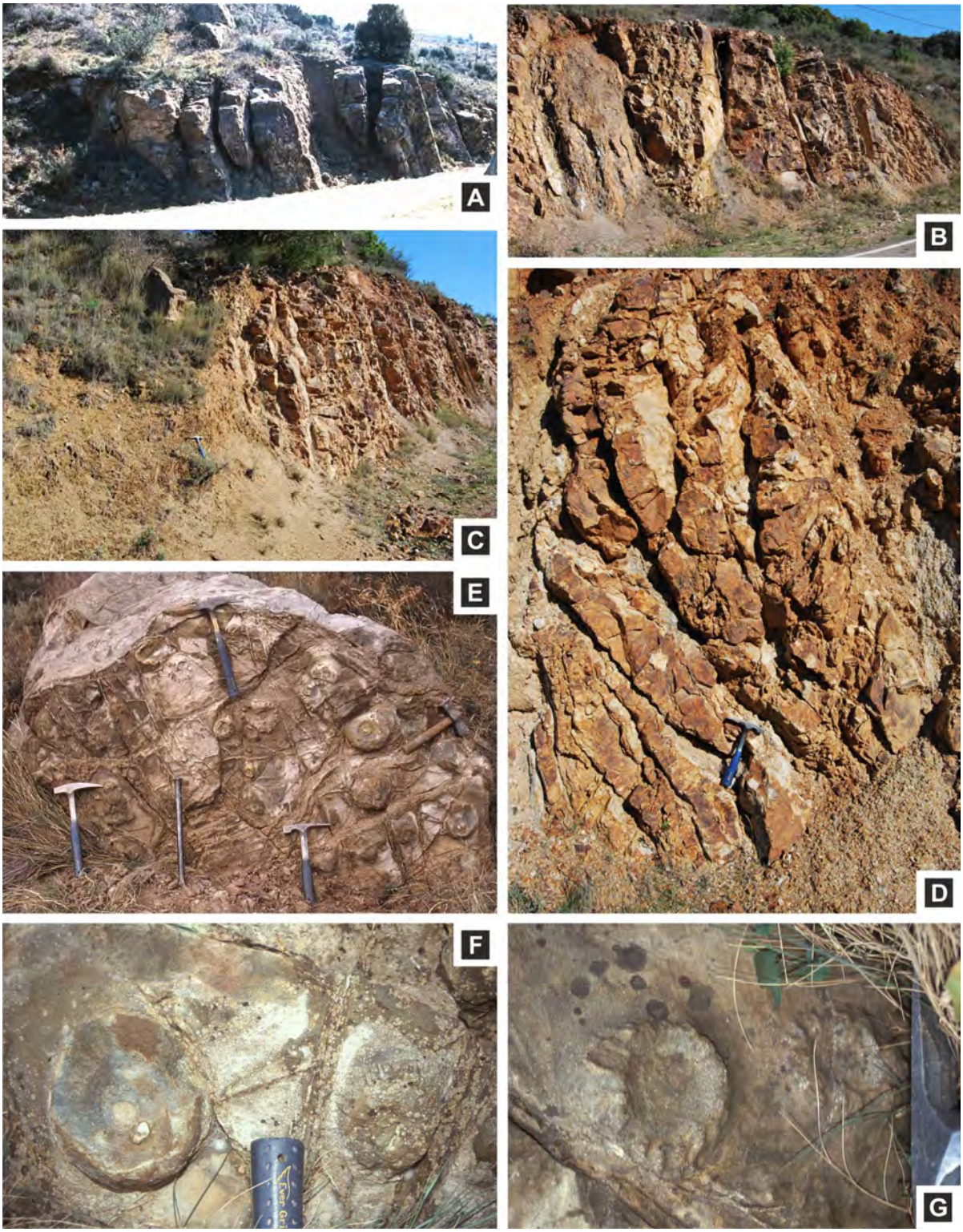

Figure 6. A. Boundary between the Bolloncillos and Hoya Fms, roughly coincident with the Frasnian/Famennian boundary in the region; photograph taken previous to road-works, which affected the outcrop. **B.-C.** The same levels today. **D.** Slump levels near the base of Hoya Fm. **E.** Block of coarse-grained sandstone with abundant convex epireliefs interpreted as medusoids (Valdeinglés Member, Hoya Fm.); this block now was placed in the *Parque de las medusas* (Tabuenca village). **F.** Detail of smooth medusoids. **G.** Detail of medusoids with radial ornamentation.

What to collect

Ostracods, tentaculitids, bivalves, conodonts, ammonoids and brachiopods have been recorded from those levels.

Frasnian ostracod species: *Parabolbinella*? cf. *vomis*, *Kullmannissites* aff. *kullmanni, Entomozoe (Nehdentomis) tenera, E. (N.) pseudorrichterina, Richterina (Volkina) zimmermanni*, *Entomoprimitia (E.) inconstans*, *Bertillonella (Bertillonella) trappi*, *Bertillonella (Rabienella) serrata* and *Franklinella (F.) calcarata.*

Famennian ostracod species (they are very scarce): *Coryellina* sp. and *Tmemolophus sequeirosi*.

4. Sightseeing of the Hoya and Huechaseca Fms.

Location and age

Biozones 5 to 6 (Famennian). Barranco del Molino 2 section.

This stop aims to give an overview of the Valdeinglés and Coscojar members, both of the Hoya Fm., and the Huechaseca Fm. The Valdeinglés Member is visible on the road and then by mechanical contact the Member Coscojar outcrops, on which the Huechaseca Fm, visible from the road on a nearby hill, is arranged accordingly.

The Parque de las medusas

The Parque de las medusas is a small garden in the Tabuenca village, where we can observe a fallen block of coarse-grained sandstones (Valdeinglés Member) (Fig. 6.E), on whose upper part are abundant convex epirrelieves, which seem to be imprints of medusoids of two types, some smooth and others with a radial ornamentation (Figs. 6.F, 6.G). These imprints have been found on several levels and when this happens they are present in large numbers. A possible interpretation of this phenomenon would be a beach-type reservoir in which numerous jellyfish have been stranded after a storm, as is the case today in some beaches (Gozalo et al., 2001).

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