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INTERNATIONAL CONFERENCE ON IBERIAN TERRANES AND THEIR REGIONAL CORRELATION

GEOTRAVERSE SOUTH (B-1) EXCURSION GUIDEBOOK

INTERNATIONAL CONFERENCE ON IBERIAN TERRANES AND THEIR REGIONAL CORRELATION

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GEOTRAVERSE SOUTH

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GEOTRAVERSE SOUTH

The purpose of this excursion is to make a quick geological reconnaissance of the main stratigraphic and tectonic characteristics of the terranes in the southern part of the Iberian Peninsula, starting with the Alcudian Terrane (days 1 and 2), Obejo-Valsequillo (day 2), Hornachos (day 2), Valencia de las Torres (day 3), Sierra Albarrana (day 3), Olivenza-Monesterio (days 4 and 5), Barrancos (day 5), Aracena (day 5), Pulo do Lobo (day 5), and South Portuguese (day 6), by visiting strategic outcrops where the main points and problems can be discussed.

DAY 1 (GARCIA HIDALGO, J.F., SAN JOSE, M.A. de, PEREJON, A., PIEREN, A.P. & HERRANZ, P., Instituto de Geologia Economica, C.S.I.C.-U.C.M., 28040 Madrid, Spain)

ITINERARY

Toledo (STOP 1-1) - Polan - Galvez - Navahermosa - Los Navalmorales - Los Navalucillos (STOP 1-2) - Robledo del Buey - Navaltoril - Las Hunfrias - Robledo del Mazo - Buenasbodas - La Nava de Ricomalillo (STOP 1-3) - Campillo de la Jara - Aldeanueva de San Bartolome - La Estrella - Fuentes (STOP 1-4) - La Estrella - Aldeanueva de San Bartolome - Villar del Pedroso (STOP 1-5) - Puente del Arzobispo - Valdeverdeja - Calzada de Oropesa - Navalmoral de la Mata - Almaraz - Tagus river bridge (Panoramic view, STOP 1-6) - Hostal Moya (STOP 1-7) - Casas de Miravete (STOP 1-8 optional) - Miravete Pass (STOP 1-9, optional, panoramic view) - Jaraicejo - Tozo river (STOP 1-10) - Trujillo.Overnight Trujillo.

OBJECTIVES AND PROBLEMS

The purpose of this days excursion is to show the stratigraphy of the Precambrian and Cambrian in the northern part of the Central Iberian Zone. The main problems are :

a) age of the migmatized sediments at Toledo and their stratigraphic and tectonic relationships to the Precambrian and Paleozoic sediments to the South.

b) sedimentary and tectonic model of the lower Alcudian succession.

c) evolution and mutual relationships of the different upper Alcudian successions.

d) Meaning and stratigraphic distribution of the Fuentes beds.

e)stratigraphic interpretation and paleogeographic distribution of the Pusa shales, and location of the Precambrian-Cambrian limit wthin them.

f) Distribution and biostratigraphic character of the lower Cambrian sediments.

g) Tectonosedimentary interpretation of the Cambro-Ordovician sequence and its regional distribution.

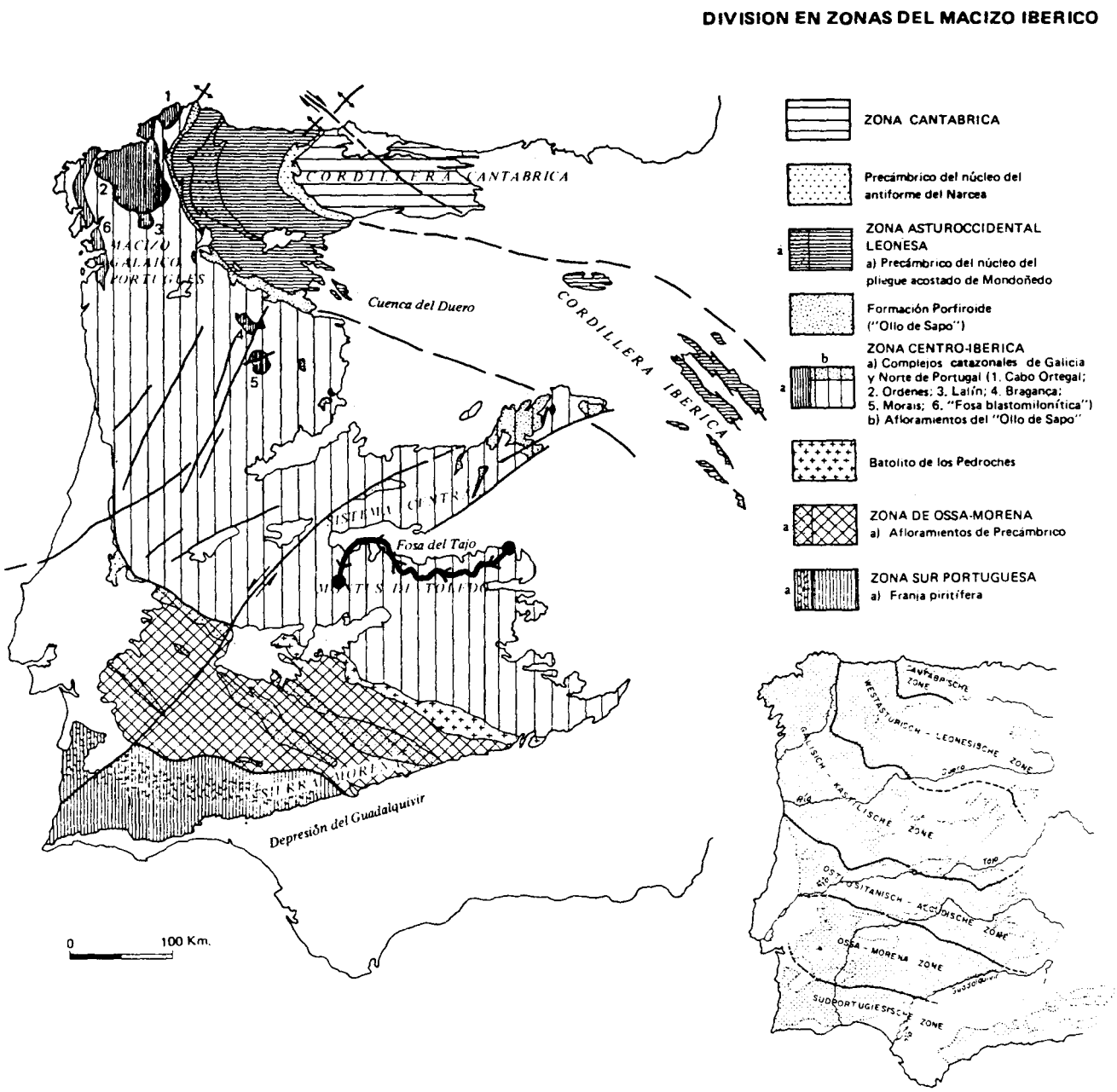
h) Tectonosedimentary interpretation and mutual relationships of the Paleozoic sequences.

INTRODUCTION

The visited area is included in the East Lusitanian Alcudian Zone of LOTZE (1945), and Central Iberian of JULIVERT, FONTBOTE, RIBEIRO & CONDE (1974). From the stratigraphic point of view, it is characterized by the unconformable "Armorican Quartzite" of early Ordovician age (Arenig) on top of Precambrian and Cambrian rocks, forming a thick succession that has been used as reference level for regional mapping, since they form upstanding ridges, allowing the distinction between pre-Ordovician, and Ordovician plus post-Ordovician materials. This region shows an alternance of Hercynian anticlines and synclines with NW-SE directions that progressively turn towards E-W when going to the East. The synclinal cores are occupied by lower Ordovician (plus sometimes, stratigraphic sequences of early Cambrian-late Ordovician age also unconformable and related to the Ordovician cycle) to Carboniferous successions, while the wide anticlinal areas are occupied by Precambrian and lower Cambrian rocks, usually of low metamorphic grade except near granitic intrusions where this can be exceptionnally high. The whole region was tilted towards the NW before the deposit of the Ordovician Quartzites, producing the appearance of older rocks towards the SW. For this reason we will see the stratigraphic section from top to bottom since we will cross it towards the Southwest, although only Precambrian and lower Cambrian rocks will be visited due to time requirements.

The "Toledo migmatites" (STOP 1-1) could represent the basement to the rocks mentionned below, although they are separated from them by an important mylonite band and a large granitic pluton (Sonseca Granite), both oriented E-W, and covered by Tertiary sediments to the E, N and W. Therefor, their actual stratigraphic and tectonic relationships and age are not known.

The lowest stratigraphic sequence in this area was described as "lower Alcudian" (HERRANZ et al 1977), its base and thickness being unknown, although it has been estimated as 6000 to 7000 thick (VILAS et al 1981). It is made up of schist and graywacke alternance with volcanic intercalations, and structurally characterized by the presence of tight folds with associated schistosity usually affected by a later folding. Intersection lineations between S_o and the first Hercynian schistosity are usually vertical (STOP 10).



B-1 Field Excursion: September 8th 1986 schematic itinerary, plotted on JULIVERT's (1983) figure, which includes two of the most typical Hesperian Massif divisions, JULIVERT et al. (1972), left side, and LOTZE (1945), right side.

Fig. 2.

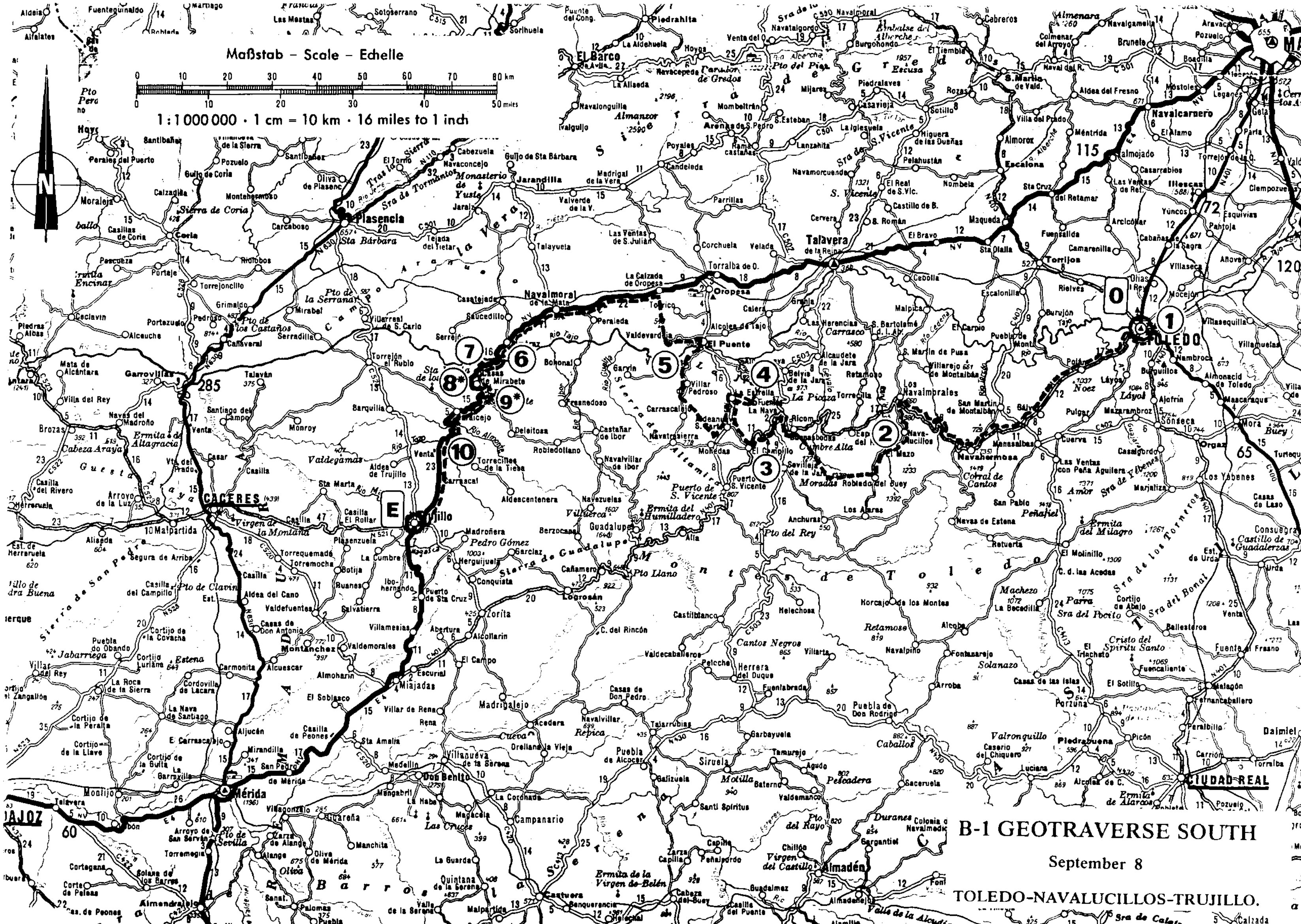


Fig. 3.- Itinerary and field stops of excursion day 1 from Toledo to Trujillo

conglomerates, sandstones, schists, graywackes and dolomites (SAN JOSE 1983). Two long tectonosedimentary episodes have been deduced in this succession, each composed in turn of two cycles (VILAS et al 1986). The second cycle of the last episode postdates the Alcudian.

The FIRST EPISODE begins with a first cycle of basill filling represented by turbidites, talus deposits, siliciclastic plattform deposits, and carbonate plattform deposits, with emersion evidenced by algal mound formation. The second cycle develops after a sedimentary interruption with progradation of shallow sediments on distal deposits of a siliciclastic plattform. It is finally aborted by another sedimentary interruption. The SECOND EPISODE starts by a first cycle of stronly erosional base with pebbles of the preceeding lithologies, produces by the fill of a turbitic trough with increasing distality, and is aborted by tectonic activity with predominance of vertical block movements, that terminates the upper Alcudian. The second cycle reflects a new filling episode commencing with turbidites followed by siliciclastic and then carbonate plattform deposits. It presents an unconformable base on the previous rocks. This last cycle can be separated into two parts:

a) lower ("Pusian", SAN JOSE 1983, 1984):

1.-"Fuentes beds"(MORENO 1975), made up of megabreccias, lutites, and conglomerates (STOP 1-4)

2.-Pusa shales (SAN JOSE et al 1974) including the Precambrian-Cambrian limit (BRASIER et al 1979, LINAN et al 1984)(STOP 1-2c)

b) upper (dated lower Cambrian)

1.-"Azorejo Sandstones" (SAN JOSE et al 1974), in continuity with the Pusa shales, and with trace fossils of lower Cambrian age. (STOP 2b & 2d)

2.- "Los Navalucillos Limestone" (GIL CID et al 1976), peritidal carbonate sequence (ZAMARREÑO et al 1976), of upper Ovetian age (Atdabanian-Botomian limit) (PEREJON 1984)(STOP 2a).

At least two differen sequences of upper Alcudian are separated by lateral facies changes. To the Southwest (Guadalupe-Ibor), plattform deposits predominate in which the following will be seen : talus deposits (first episode, first cycle, STOP 1-8). Carbonate plattform deposits (first episode, first cycle, STOP 1-7). Siliciclastic plattform deposits (first episode, top of second cycle, STOP 1-6). To the Northeast, turbiditic deposits predominate, that will be visited at STOPS 1-3 and 1-5 (second episode, second cycle).

STOP 1-1

Toledo. Circunvalation road on the left side of the Tagus River between the San Servando Castle and the New Alcantara Bridge. Roadcut in the East side of the road. Entrance to the Infantry Military Academy.

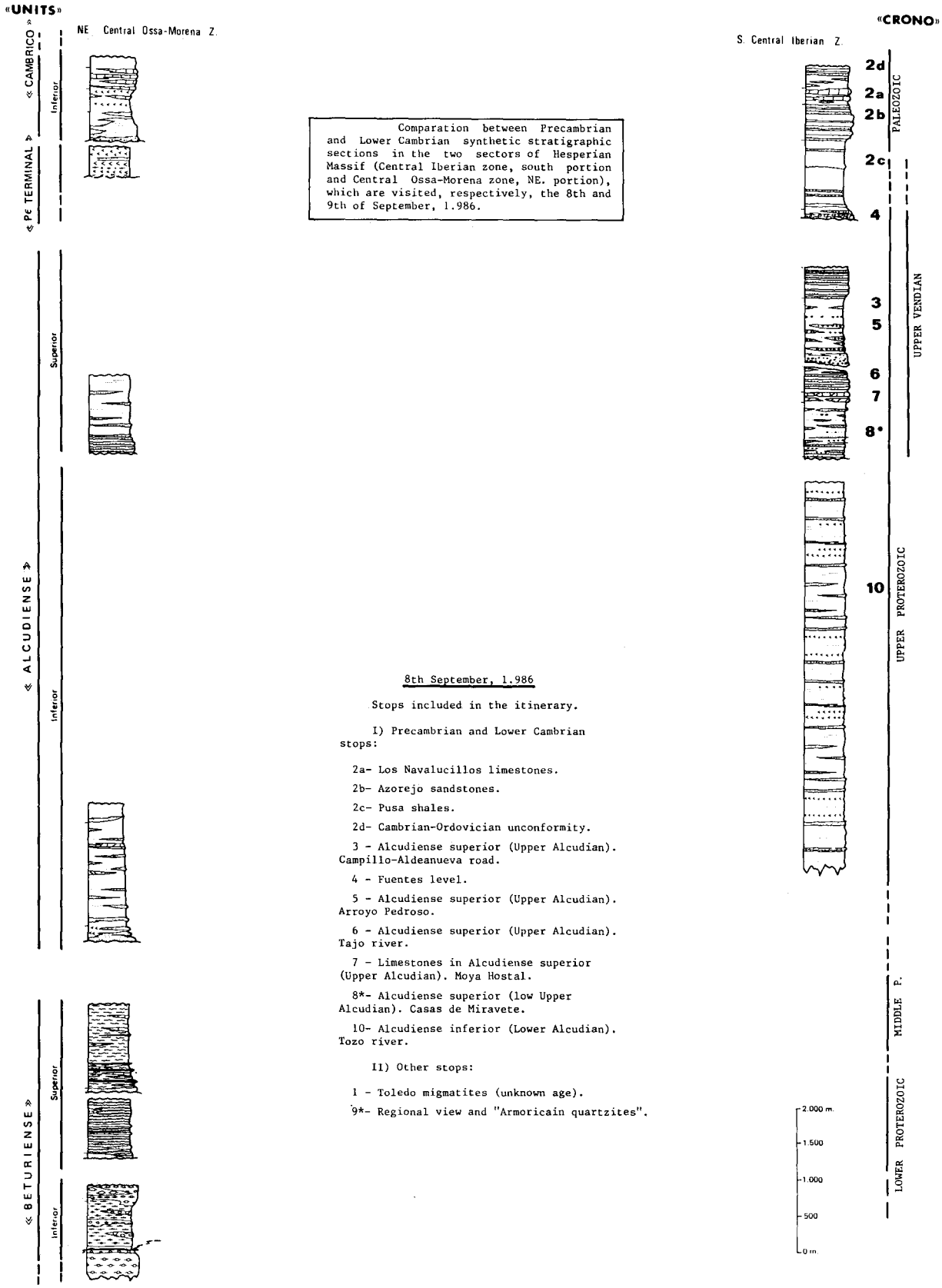
Ultrametamorphic rocks of the "migmatitic unit" of the "Toledo crystalline Massif" with folds of WNW-ESE to E-W direction that affect a previous metamorphic foliation. The migmatites are of arteritic type, the neosome being quatz-feldspathic and garnet-bearing, or agmatitic. Anatexitic zones are also distinguished, some with feldspar megacrystals and large garnet crystals, By studying the internal structure of xenoliths and megacrystals, MARTIN-ESCORZA & LOPEZ-MARTINEZ (1978) have deduced the existence of five or six deformation phases, two of them pre-metamorphic. Migmatization is supposed to have occured between F_2 and F_3, with a pre-kynematic pegmatoid phase that gave rise to the flattened feldspar megacrystals, and a later granitoid phase (APARICIO 1971).

STOP 1-2
Road from Los Navalucillos to Robledo del Buey, K. 2.900 to 8.600. Roadside quarries, roadcuts and river bed outcrops.

This locality is at the SE end of a Hercynian NW-SE anticline, cut by WNW-ESE faults. The Precambrian-Cambrian sequence , more than 1000 thick is seen in the fold core, as well as the Ordovician unconformity, with the upper part of the Pusa shales in the lower part, followed by the Azorejo sandstones, the Bandolazaro Member and a part of the Navalucillos Limestone.

2a) km. 2.900 to 3.200: Los Navalucillos Limestone, and upper part of the "Bandolazaro Mamber" with peritidal carbonate and terrigenous facies of the lower Cambrian in the core and SW limb of the WNW-ESE syncline, bound by a fault in the NE limb. 140 m of limestones are shown, more or less recrystallize and dolomitized, in strata 0.5 to 1.0 m thick, dark colored with thin sandstone and calcareous siltstone intercalations, more abundant towards the base in which lutites with calcareous lenses and calcarenitic channels with transported trilobites and archaeocyats predominate, followed by the underlying fine-grained clastic Bandolazaro Member. The middle part of the unit is formed by alternating bioclastic and nodular limestone beds with Archeocyats, and fenestral black limestones with shallowing strata made up of oolitic limestones with erosive bases passing into algal limestones with flat stromatolites at the base and curved towards the top, sometimes with dessecation cracks. At the top are alternating black dolomitized limestones, algal laminated limestones, and calc-lutites. These are interpreted as belonging to a peritidal carbonate plattform with little developed reef patches, separated by trans-reef channels and of protected low-energy environment, very shallow or periodically emerged. According to the recent faunal studies, the age of this unit is late upper Ovetian (lower Cambrian, zones VI-Vii of PEREJON 1984).

In the NE limb of the anticlinorium, these limestones crop out at the Los Navalucillos village, with



Comparation between Precambrian and Lower Cambrian synthetic stratigraphic sections in the two sectors of Hesperian Massif (Central Iberian zone, south portion and Central Ossa-Morena zone, NE. portion), which are visited, respectively, the 8th and 9th of September, 1.986.

8th September, 1.986

Stops included in the itinerary.

I) Precambrian and Lower Cambrian stops:

2a- Los Navalucillos limestones.

2b- Azorejo sandstones.

2c- Pusa shales.

2d- Cambrian-Ordovician unconformity.

3 - Alcudiense superior (Upper Alcudian). Campillo-Aldeanueva road.

4 - Fuentes level.

5 - Alcudiense superior (Upper Alcudian). Arroyo Pedroso.

6 - Alcudiense superior (Upper Alcudian). Tajo river.

7 - Limestones in Alcudiense superior (Upper Alcudian). Moya Hostal.

8*- Alcudiense superior (low Upper Alcudian). Casas de Miravete.

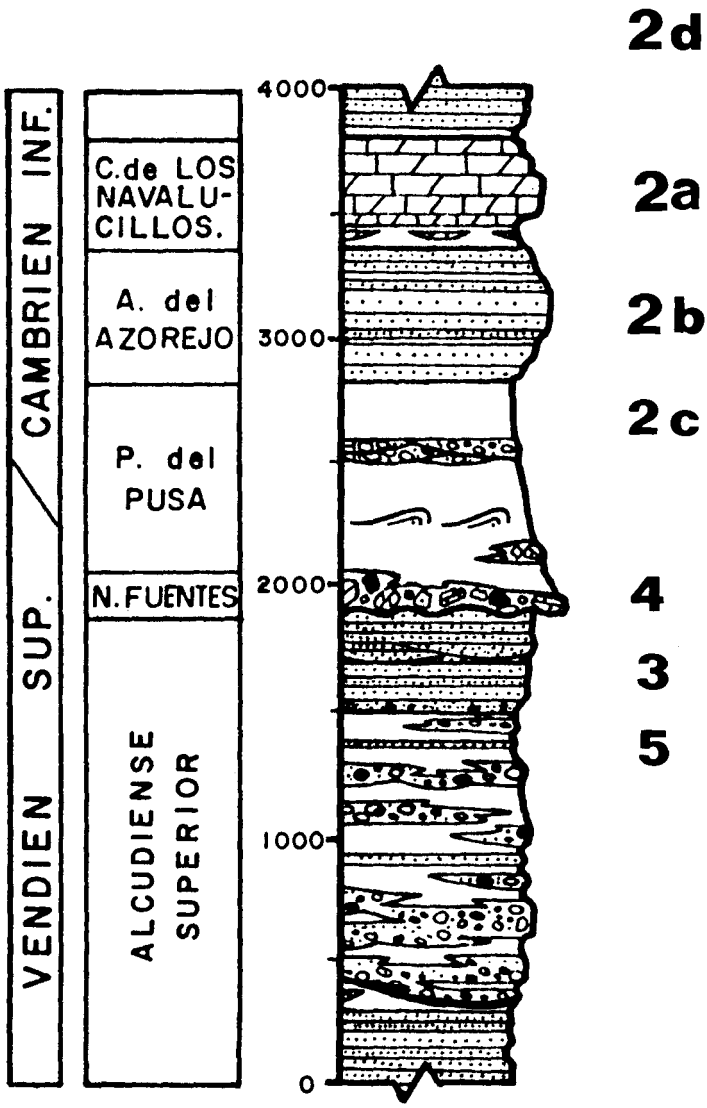
10- Alcudiense inferior (Lower Alcudian). Tozo river.

II) Other stops:

1 - Toledo migmatites (unknown age).

9*- Regional view and "Armoricain quartzites".

Fig. 4



Location of the stops planned for Sept. 8th 1.986 morning, on the partial stratigraphic NW Valdelacasa Anticline section (Toledo migmatites. N° 1 is not included).

Fig. 5

alternating sandstones and lutites with carbonate lenses up to the Ordovician unconformity above.

2b) km. 3.700 to km. 3.900. "Azorejo Sandstones", clastic inter- and sub-tidal lower Cambrian facies. At the same structure already described, in the SW limb, limited by a fault. 150 m of the Azorejo Sandstones are studied, made up of an upper unit with predominant alternating thin sandstones, siltstones or lutites with oscillation, current, and interference ripples, sometimes burrowed, over 100 m thick, and a lower unit, 50 m thick with 0.30-0.60 m strata of brown quartzite in alternating groups. They bear pyrite crystals, feeding tracks, burrows, etc.. The lower limit is faulted against the Pusa shales. The age is lower Cambrian according to the trace fossils.

2c) Km. 5.500. El Mazo Bridge on the Pusa River. Distal plattform and talus facies of the "Pusa Shales". Antiform core with decametric NW-SE folds. In the river bed, the gray predominant lutites can be seen with parallel lamination of siltstones or fine sandstones, some with graded-bedding slump-scars, and cross-lamination. Precambrian-Cambrian age.

2d) Km.8.000 to 8.600. "Azorejo Sandstones" and pre-Ordovician unconformity with basal conglomerates and detrital beds of the "Estena sandstones and quartzites" (lower Ordovician). SW limb of the anticlinorium, with the unconformable Ordovician cutting across the underlying sequences with dissapearance a few km away of the Los Navalucillos limestones and the Bandolazaro Member, while in the NE limb, rocks younger than the limesteones are represented. 150 m of the Azorejo Sandstones are here studies, with alternating rithmic units of flaser bedding, current marks and burrowing, and thick cross-laminated (planar, furrow or megaripples) quartzitic strata. Arthropod marks (Monomorphichnus), feeding tracks and burrows are common (Skolithos, Monocraterion, Diplocraterion, etc.). The whole is interpreted as a coastal inter- to sub-tidal complex of bars , channels, mud and sandy flats complex. A conglomerate succession 12.30 m thick with a 110N strike and 80S dip is unconformably overlying the Azorejo Sandstones with 140N strike and 85N dip, with paleorelief visible at the scale of the outcrop. These conglomerates have a brown sandy to silty matrix, and interbedded silty sandstone beds with shale pebbles and abundant holes probably due to weathering away of carbonate pebbles. On top are 4.7 m of sandstones and sandy siltstones with sparse conglomerate lenses and overlying microconglomerates and quartzite conglomerates, well bedded with alternanting siltstones and purple shales. . They are interpreted as fluvial sequences, passing towards the top to fluvio-tidal of proximal character. On top follow alternating microconglomerates, sandstones, and purple lutites of intertaudal character, and at the top are thick quartzite strata with large barrier-island oblique laminations, all of it within a prograding clastic linear coastal complex. The trace fossil study indicates a

Cordubian=Ovetian age (lower Cambrian) for the Azorejo Sandstones, and an upper Tremadoc-Arenig age (lower Ordovician) for the unconformable conglomerates, sandstones and quartzites.

STOP 1-3
Road C.401 from Toledo to Guadalupe, K.122. Roadcut in the abandonned Talavera de la Reina-Villanueva de la Serena Railroad crossing.

NE limb of the Northern end of the Valdelacasa Anticlinorium, showing Precambrian (upper Alcudian), Precambrian-Cambrian (Fuentes Member and Pusa Shales), and Cambrian (Azorejo sandstones and Los Navalucillos limestones) rocks unconformably overlain by the Ordovician sequence. 100 m of upper Alcudian typical sequence are studied, comprising the upper part of the Villar del Pedroso conglomerates and shales, and the lower of the Rio Uso rhythmic unit. From the abandonned rail-road viaduc, spectacular isoclinal folds with a Northern vergence are seen, with axial plane schistosity, in a graywacke, siltstone and shale sequence forming channelized sequences with clay pebbles or rounded quartz fragments at the erosive base. Towards the lower part becomes a mud flow or "mixtite" with disperse pebbles. Below it are shales and alternanting graywackes. The abundant trace fossils found here, together with the achrytarchs are indicative of an upper Vendian age (upper Ediacarian).

STOP 1-4
Fuentes (Toledo). Quarry and outcrops below the water supply and near the waste dumpings in the outskirts of the village.

Central Northern area of the Valdelacasa Anticlinorium. The "Fuentes Member" is studied in its type locality, where 50 to 70 m of heterometric megabreccia crops out, made up of two units with intercalated lutites. The lower one is composed of 30-40 m of angular to subrounded dolomite and gray or brown dolomitic limestone blocks , with other of graywacke, sandstone, conglomerate or limestone breccia, 0.3 to 1 m in diameter embedded in a calcilutitic matrix, with occasional blocks and pebbles of ferruginous dolomites crossed by quartz dikes. Above this megabreccia, are 6-10 m of gray siltstones and lutites with parallel lamination, oscillation, current, and interference ripples, slumps and hydroplastic deformations at the contact with the upper megabreccia unit. Isolated blocks and pebbles occassionally appear in this bed, together with large Planolites trace fossils. On top of the lutite intercalation are with a sharp contact, 20 m of calcareous and dolomitic conglomerates, will usually well rounded pebbles, 0.30 to 1 m in diameter decreasing towards the top, and lutite matrix more abundant than in the lower unit. The contact with the overlying Pusa shales shows some slumping and diffuse conglomeratic lenses. The lithologies present in the block of the Fuentes Member have been identified as belonging to the upper Alcudian.

STOP 1-5

Km. 6-7 of the road from Villar del Pedroso to Puente del Arzobispo towards Arroyo Pedroso. Roadcuts.

Central Northern Area of the Valdelacasa Anticlinorium. Discontinuous outcrops are studied along 1 km of the new local road from Villar del Pedroso to Puente del Arzobispo, from the Valdelacas road crossing to the bridge over the Arroyo Pedroso (Pedroso Creek). These outcrops belong to the "Villar del Pedroso conglomerates and shales (upper Alcudian), or "transitional series" of LOTZE (1956) or Valdelacasa Series (LLOPIS 6 SANCHEZ DE LA TORRE 1962,1965), or "Upper conglomeratic series" of BOUYX (1970), that have succesively been considered as of fluvio-glacial, fluvio-marine, and turbiditic. They are composed of alternating lutites and graywackes o decimetric to metric scale, with predominant positive graded-bedding and lamination due to graded-bedded fine sand and lutite alternances, together with channelized massive or graded-bedded sandstone strata. Massive coarse-grained graywackes and grain-supported conglomerates with pebbles of quartz, quartzite, sandstones, graywacke, lchert, acid and basic volcanics, and limestones, are also intercalated in this sequence. Some metamorphic rock fragments with a previous schistosity have also been occasionally found. This sequence is affected by isoclinal folds with Northern vergence. On top of the precedding succesion, descending towards the Arroyo Pedroso, and with erosive contact are 1.5 m of limestone breccia, 2 m of gray lutites with parallel lamination, and again 1.5 m of finer sized breccia topped by monotone lutites which are the local equivalents of the "Fuentes Member" and the basal part of the Pusa shales (Pusa Group of SAN JOSE 1983).

STOP 1-6
Road N-V, North of the bridge on the Tagus River. Roadcut in the abndonned road.

Northwestern end of a Hercynian syncline with 135 direction with Paleozoic sediments in the core more to the SE. 50 m of upper Alcudian are studied here in the "Unit AS.6". They are made up of fine to coarse-grained graywackes, locally microconglomeratic, and gray and green lutites, massive or with paralle lamination. They are interpreted as a channelized system in the shallow part of a siliciclastic low-energy plattform prograding on it (Unit AS.5).

STOP 1-7
Road N-V, Hostal Moya. Outcrop Southeast of the road.

NE limb of a the Santa Lucia Syncline, of Precambrian rocks with Paleozoic appearing anconformable on top at the fold core more to the Southeast. 200 m of "Unit AS.4" or "carbonate unit" are studied in a point with maximum

thickness. Three members are separated in this unit:

1.- Lower carbonate member, made up of massive or laminated dolomites with alternating organic and tractive laminae.

2.- Middle terrigenous member, of massive or laminated gray lutites and intercalated coarse-grained to microconglomeratic graywackes at the base.

3.- Upper carbonate-terrigenous member with organic dolomites at the base (flat stromatolites), and sandy dolomites, overlain by alternating massive dark gray lutites and gray dolomites with parallel lamination {flat stromatolites, locally eroded by sandy dolomites).

The basal member is interpreted as a mound structure of barrier type devloped in inter- tu sub-tidal environment. The middle member as deposited in a tidal flat with tidal channels in intertidal to subtidal environment, and the upper member as stromatolitic growth in a quiet subtidal environment with local high-energy episodes.

STOP 1-8
Road N-V. Casas de Miravete Junction. Roadcut.

Vertical beds in the core of a small Hercynian anticline of NW-SE direction, with unconformable lower Ordovician sediments in the core. 20 m of the upper Alcudian are studied here in the "unit AS.2", 400 m thick in this locality (maximum thickness). It is composed of massive or laminated lutites with decimetric intercalations of massive fine- to medium grained graywackes, and conglomerates not grain-supported with quartzite, graywacke, and lutite clasts. They are interpreted as talus deposits.

STOP 1-9
Miravete Pass (Caceres). Panoramic view.

Towards the North, it can be seen from the background to the foreground:

a) The mountain front of the Gredos and Calvitero Sierras, made up of metamorphic rocks, with elevations over 2,000 m that have been affected by Quaternary glaciarism. They belong to the Sistema Central (Central Mountain System) and are separated by the Jerte fault-valley excavated along the Plasencia Fault. This is a late-Hercynian strike-slip fault reactivated during the opening of the Atlantic Ocean in the Jurassic. Their Southern limit is a complex reverse fault system thrusted over the Tertiary sediments of the "Campo Arañuelo Basin". Towards the West, the Sierra de Gata and the Serra da Estrela, the last one in Portugal, are seen as the last elevations of the Sistema Central.

b) The Tertiary plain of the "Campo Arañuelo", drained by the Tietar River in its Northern edge, near the fault-line in the mountain front. Elevation of this plain progressively increases towards the South, where the Tagus River is entrenched in the Precambrian and Paleozoic rocks

due to superimposition.

c) The "appalachian" type morphology of the basement, rising as island-mountains over the plain, with "hanged" synclines near the Miravete Pass made up of lower Ordovician quartzites, while in the depressed anticlinal cores, the Precambrian rocks are found.

Towards the South, the morphology is quite different, with successive peneplains cut in the slates covered by discontinuous recent bahada-type sediments or "rañas" and residual Tertiary sediments, occassionally separated by quartzitic ridges or post-kynematic granites with metamorphic aureoles.

STOP 1-10
Road N-V, bridge on the Tozo River. River bed and roadcut outcrops.

Core of a Hercynian anticlinorium with NW-SE direction, where Precambrian deformations are seen discordant with the Hercynian structural directions. In the river bed, mesoscopic folds with subvertical hinges are crossed by the first Hercynian schistosity in a lower Alcudian succession, more than 7,000 m thick made up of alternating shales and graywackes in thin beds that could be od distal turbiditic character.

In the roadcut, more than 100 m of a typical lower Alcudian sequence are observed, also affected by folds with subvertical hinges. They are thick alternating medium ti coarse grained graywackes with shales and conglomerates not grain-supported. This succession is interpreted as deposited in a submarine fan.

DAY 2 (HERRANZ, P., SAN JOSE, M.A. de, PEREJON, A., PIEREN, A.P. & GARCIA-HIDALGO, J.F., Instituto de Geologia Economica, C.S.I. C.,Universidad Complutense de Madrid, 28040 MADRID,Spain

ITINERARY

Trujillo - Herguijuela - Conquista - Zorita - Madrigalejo - Acedera - Orellana - Orellana Reservoir (STOP 2-1) - Orellana Dam - Valdivia - Villanueva de la Serena - La Haba (cimetery)(STOP 2-2) - La Haba - La Guarda - Quintana de la Serena - (STOP 2-3) - Zalamea - Peraleda de Zaucejo (STOP 2-4) - Zalamea - Higuera de la Serena - Retamal - Puente de Arroyo Herrumbral (STOP 2-5) - Valle de la Serena - Cortijo de los Meregiles (STOP 1-6) - Puebla de la Reina - Palomas (STOP 1-7) - Palomas (STOP 1-8) - Alange (STOP 1-9) - Alange Dam (under construction) (STOP 1-10) - Pajares del Encinar (STOP 1-11) - MERIDA. Overnigh MERIDA.