ANGOLA PROFESSOR MEETING

DIAPIRIC EXAMPLES IN THE LUSITANIAN BASIN

FIELD TRIP GUIDE
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INTRODUCTION

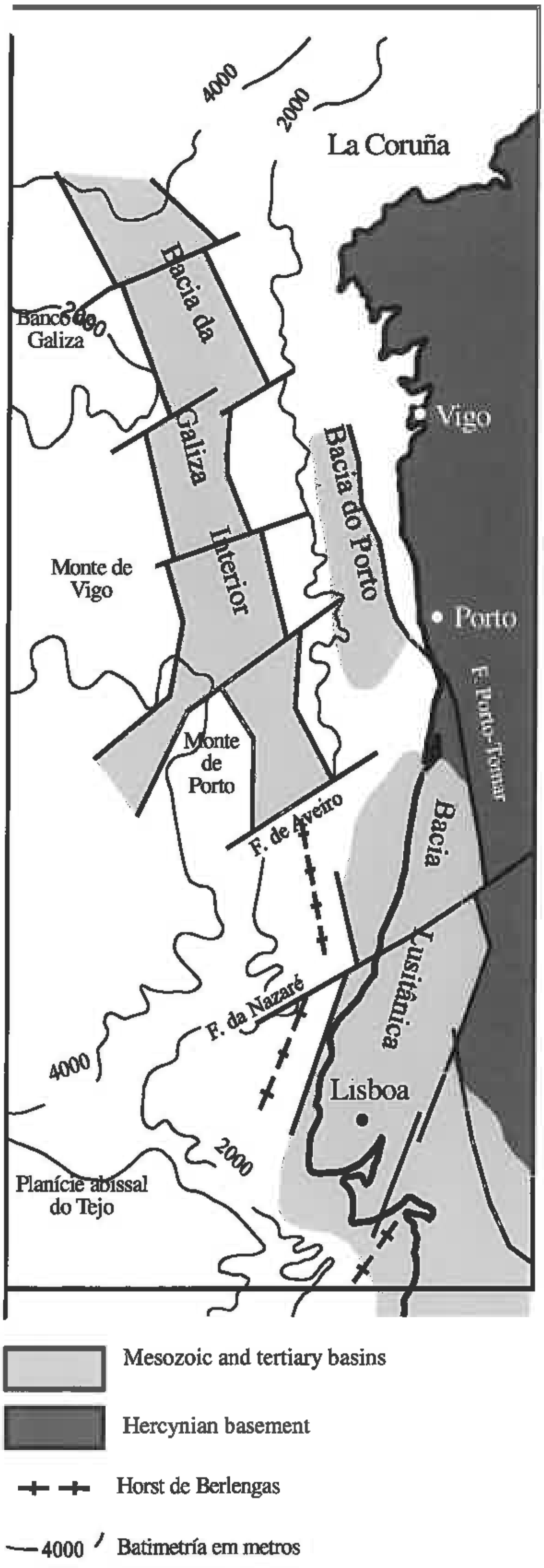

Fig. 1 - Mesozoic basins on the Iberia West border, showing the position of the Lusitanian Basin

The Lusitanian Basin was initiated during a late Triassic rifting phase and belongs to a family of periatlantic basins (e.g. Jeanne d'Arc Basin, Scotian Basin). It is located on the western border of the Iberian plate (Fig. 1) and extends some 250 km in a NNE-SSW trend and up to 100 km East-West. The axis of maximum subsidence follows a general NNE-SSW structural orientation.

The basin is located between hercynian basement rocks, namely, in the east the Iberian Meseta and to the west a marginal horst system (the Berlenga and Farilhões islands are emerged parts of this system).
In the Mesozoic sedimentary record of the Lusitanian Basin five great stages of infill are identified. They are represented by the following sequences, limited by unconformities: UBS1) upper Triassic - Callovian; UBS2) Oxfordian - Berriasian; UBS3) Valanginian - lower Aptian; UBS4) upper Aptian - lower Capanian; UBS5) upper Campanian - Maastrichtian. During the Mesozoic and part of the Cenozoic the structures with a NE-SW and NNE-SSW direction had a distensive behaviour. But after the end of the Cretaceous and mainly during the Betic orogeny, the western rim of the Iberian Plate suffered a compressive deformation that led to a progressive inversion of the central axis of the basin, uplifting and bringing to the surface the thick layers of the Mesozoic.
The geodynamic evolution includes two major rifting episodes, a passive margin interval and an inversion process.

The first rifting episode in Late Triassic
The first rifting episode that began during late Triassic (Figs. 2, 3) led to the definition of a system of submeridian grabens and half-grabens, bounded westwards by the Galice bank-Berlengas trend. The sedimentary record includes coarse alluvial fan and fluvial deposits followed by lacustrine and coastal sandstones covered distally by evaporites.
A transgressive dolomitic limestone unit marks the beginning of a thick sag phase, composed of ramp marls and marly limestones, lower and middle Jurassic in age.

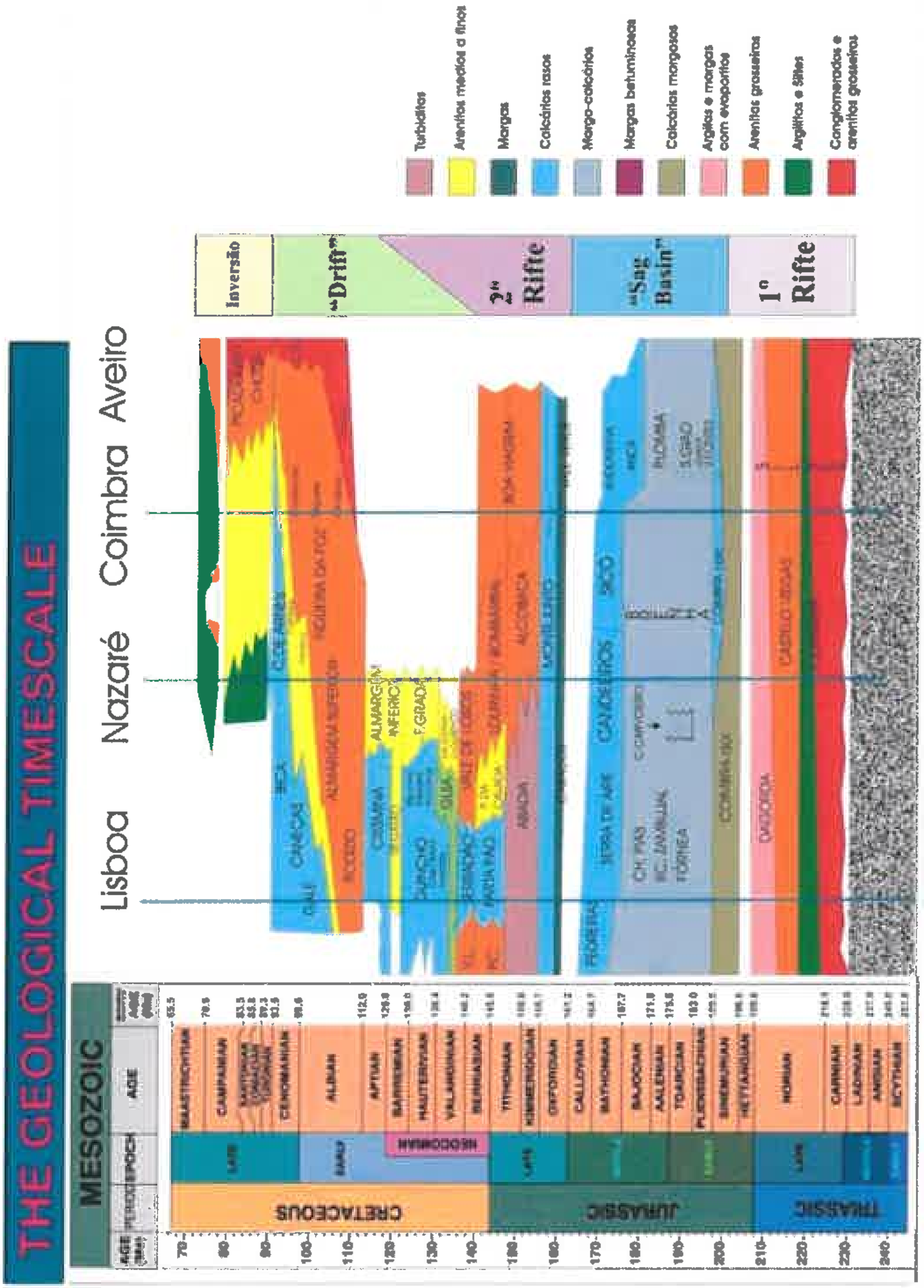

Fig. 2 - Stratigraphic chart of the Lusitanian Basin

The second rifting episode in Late Jurassic-Early Cretaceous

From the middle Oxfordian to the early Aptian a second rifting phase occurred. This can be separated into three main episodes: Late Jurassic-Berriasian and two Early Cretaceous steps.

The extensional episode activated hercynian faults coupled with moderate halokinesis and also caused intrusive igneous activity towards the south of the Lousã fault.

The Late Jurassic-Berriasian evolution of the Lusitanian Basin is divisible into three tectonic phases. The initial phase (Stage I) was the onset of rifting which resulted in widespread carbonate deposition. Extensional climax was reached during Stage II. This created highly subsident sub-basins and a significant siliciclastic influx. Stage III was a period of thermal subsidence overprinted by sea-level changes of presumed eustatic nature, which resulted in progradation of siliciclastic systems, overall shallowing and infill of the basin.

Geological framework:

The region belongs to the Estremadura trench, a cortical structure that was formed in the extensional phase of late Jurassic, with a general orientation NNE-SSW. The Caldas da Rainha salt dome is an asymmetric structure in a transversal cross section (with a low tilt in the west flank and a more abrupt tilt in the east) that establishes the pit domains: Peniche's block to the west (where S. Martinho is situated) is characterized by a moderate subsidence and another domain to the East (Bombarral and Ota blocks), where the subsidence is more intense.

***STOP 1* – S. MARTINHO DO PORTO**

Fig. 3 - Googleearth view of Caldas da Rainha diapir, with S.Marinho location. The grey area corresponds to the observation point (round) and the observed cliff of figure 4 (square).

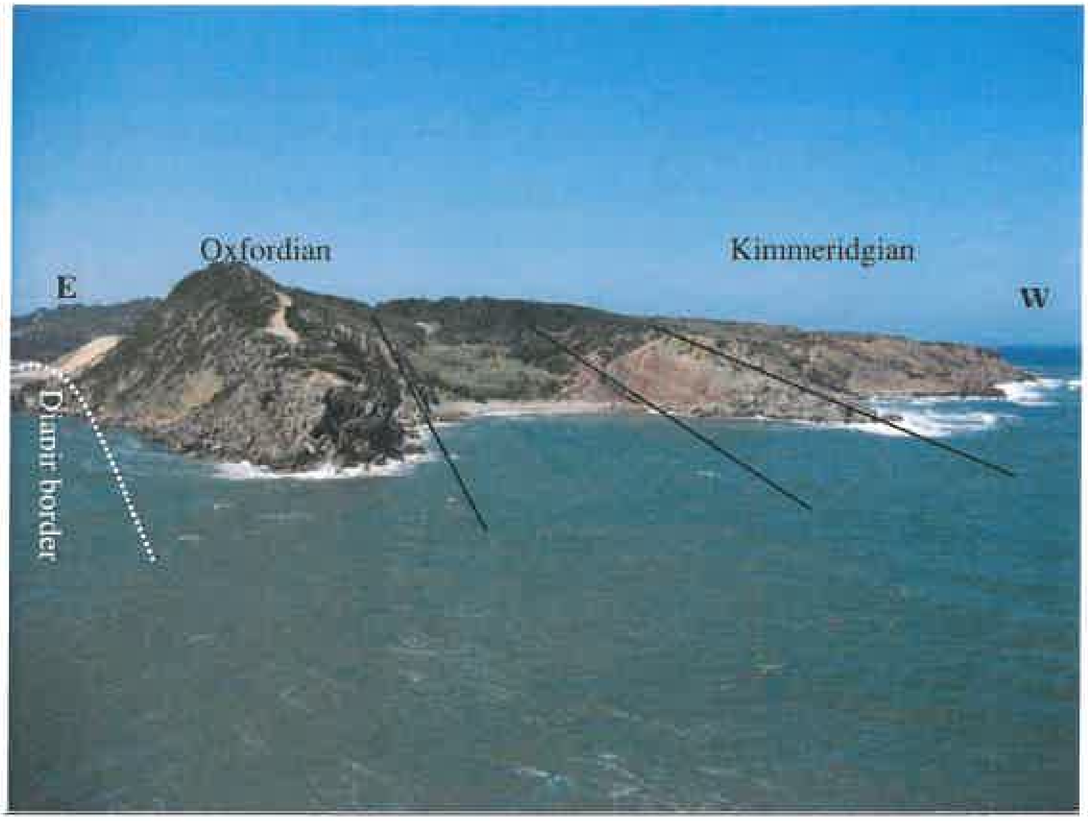

Fig. 4 - Stratigraphy of late Jurassic deposits in S. Martinho region (Oxfordian and Kimmeridgian), close the western border of Caldas da Rainha diapir. See figure3 for location.

Observations
The S. Martinho area allows scenic and detailed observations of the western border of Caldas da Rainha diapir. The Late Jurassic sediments dip westwards and suggest a gradually decreasing angle. The lower sediments include shallow limestones and coastal bay clayey materials overlain by a new limestone package. These sediments are followed by a thick Kimmeridgian deltaic succession shown in figure 3(small photo). This package is limited by a major transgressive surface overlain by a thick oncolitic bar, considered Tithonian in age.
Close to the harbour, it is possible to observe an inverse fault bounding the Hetangian evaporitic marls of the Dagorda Formation and the Oxfordian limestones (Cabaços Formation).

STOP 2 – VALE FURADO

Vale Furado is a coastal cliff area located 10 km North of Nazaré beach. (39° 41'N; 09° 03'W).

Observations
This outcrop shows a coastal cliff oriented North-South. It includes a evaporate diapir oriented NE-SW that enters in the sea (between red dots in figure 5). It is bounded to the North by a sandstone package of Pliocene sediments dipping to the North. The southern border of the diapir is composed of four main Cretaceous units spanning from Aptian to Maastrichtian. This units are from the base: Figueira da Foz Formation (the top is the yellow line in figure 5) a fluvial sandy and conglomerate succession; the Carbonate Formation (Cenomanian shallow limestones limited by the blue line in figure 5) overlying the former one with an angular unconformity, The Grés Superiores Formation, made of fluvial sands and conglomerates overlying the carbonate breccia and finally, the Taveiro Formation (Maastrichtian, beginning over the green line in figure 5) , composed of red sands and clays, recording a sinuous fluvial system. The contact with the underlying carbonates is an angular unconformity with a SW thickening carbonate breccia.
The southern border of the diapir shows a growth geometry, as indicated in figure 5.
It is possible the observation of large volumes of highly disturbed clays and dolomites with gypsum, in the diapiric body. The border sandstones and conglomerates show a persistent hydrocarbon impregnation.

Figure 5 – Googlearth representation of the Vale Furado area with the limits of the diapir (red) and the southern border cretaceous units. The white rectangle corresponds to the image of figure 6.

Fig 6 – Air photo of the cliff indicated in figure 5

Fig. 7 – Detail of the unconformity overlying the limestone breccia.