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Exploring in structurally complex thrust belt: Southwest Albania Case

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Introduction

Fold and thrust belts are characterised by complex trap geometry; a complex burial and thermal history; a narrow time line between the onset of petroleum generation, migration, and trap development; and a complex history of fill and spill. Most of the time, the available data support several "non-unique solutions". These different solutions may imply radically different geological models that have different geological risks.

To unravel the complex structural setting of the Vlora-Corfu sector of the Albanides thrust belt (Southwest Onshore Albania) we have adopted a workflow based on a multidisciplinary approach. The proposed geological model is based on fieldwork regional reconstruction, satellite images, MT data, Grav&Mag data and seismic acquisition methodology and parameters were continuously improved to optimise reflectivity response. The resulting structural model has been further validated using geometrical modelling (3D visualization and cross section balancing techniques), 2D gravity modelling, and the kinematics analysis of the structure using the HCA numerical modelling (Salvini et al., 2002).

The results represented here are part of the ongoing Southern Albanian program. Exploration in Albania has been limited in the past to the valleys where access and costs were lower than this renewed effort over rougher, higher altitude terrain (Fig. 1). OMV Albanien and Hellenic Petroleum are thanked for permission to present data from their recent efforts.

Overall Paleogeographic and Structural setting

The overall structural setting of the SW Albania is dominated by the Vlora Elbasan Accommodation Zone and the buttressing effect of the thick and rigid Apulian Platform colliding against the thin and relatively brittle Ionian sequence.

- **Vlora Elbasan Accommodation Zone (VEAZ)** - This outstanding NNE-SSW tectonic feature is accommodating the change in the tectonic setting between the northern and southern areas (Roure et al., 1995, Bakiaj et al. 1992). The northern area, west of the Kruja platform, is characterized by no thrusting of the carbonate sequence while in the southern zone the carbonate are heavily overthrusted, up to tens of kilometres per thrust (Velaj et al., 1999, Moorkens et al., 1994). This accommodation zone consists of several lateral ramps, more or less connected to form an apparent strike slip zone. This lineation may reflect a paleogeograhic change such as the edge of the thick Triassic evaporitic basin, and/or a pre-existing deeply rooted basement fault (Roure et al., 2000).

- **Apulian Platform Buttress** – The effect of the Apulian platform buttress can be seen in the western sector of the onshore Albania, south of the VEAZ (Gambini et al., 1996). There, the structural setting of the Ionian sequence reflects the shape of the Apulian platform margin. In this area the paleogeographic reconstruction shows three different sectors of the platform edge. Offshore Albania it runs more or less E-W, turning NNW-SSE from the Sazan Island to the Himara Town and finally it connects to a NW-SE oriented intra-platform basin (Himara Basin). The main platform edge and the connected Himara intra-platform basin form a sort of platform embayment where the Corfu thrust could develop relatively undisturbed. These three different sectors of the Apulian Platform edge caused three different structural areas.
- North and West of Sazan Island (north of VEAZ) the Apulian Platform and Ionian basin are relatively undisturbed simply forming the substratum of the Tertiary foredeep (Peri Adriatic depression).
- Between the Sazan Island and the Himara town the Apulian Platform collided heavily with the Ionian Sequence. In this sector the thick Apulian Platform stopped the foreland forward thrusting sequence of the Ionian sediments, promoting out-of-sequence thrusting (Tragjasi Unit).
- In the southern sector, in the Himara basin the Ionian thrust units are not constrained by the Apulian Platform and they could develop relatively undisturbed.

The structural complexity of the area and lack of a detailed tectono-stratigraphic study prevent detailed reconstruction of the kinematics evolution of the area. However, based on the regional knowledge, two main phases of thrusting can be recognized:

1. The first phase (Miocene in age) mainly involved the Ionian basinal sediments. It was characterized by a foreland forward thrusting sequence, with structural trends oriented NNW-SSE.
2. The second phase (Pliocene in age) involved the Ionian and the Apulian Platform. During this phase the Apulian Platform acted as a rigid buttress promoting out-of -sequence thrusting. The main axis of the structural trends produced during this phase are oriented NW-SE.

Most of the structures in the studied area have been affected by both phases. The outcropping Tragjasi Structure shows a multiphase evolution, the northern part of it still shows the older NNW-SSE orientation, while the southern part has been refolded and shows mainly the younger NW-SE trend. The two structural trends are accommodated along the Lapardha zone, a deeply eroded valley oriented NE-SW.

The structural setting generated during the first phase is well illustrated by the Fterra-Nemercka regional seismic line (Fig. 2). This line has been acquired on the highly deformed Ionian Basinal sediment, but in front of the Corfu' Apulian Platform Embayment (Himara intra-platform basin), in a zone only marginally affected by the Apulian Platform buttress. This line shows few well-developed fault-bend folds with few tens of kilometres of displacement along each thrust fault.

The buttressing effect and the development of the major out-of-sequence thrusting is well illustrated south of Vlora town along the Llogora-Golimbasi regional line (Fig. 3). The western portion of this line illustrates the rigid Apulian Platform acting as buttress, the fault bend folds generated during the previous phase and the development of the Tragjasi out-of-sequence thrust disconnecting this unit from the more internal Golimbasi trend.

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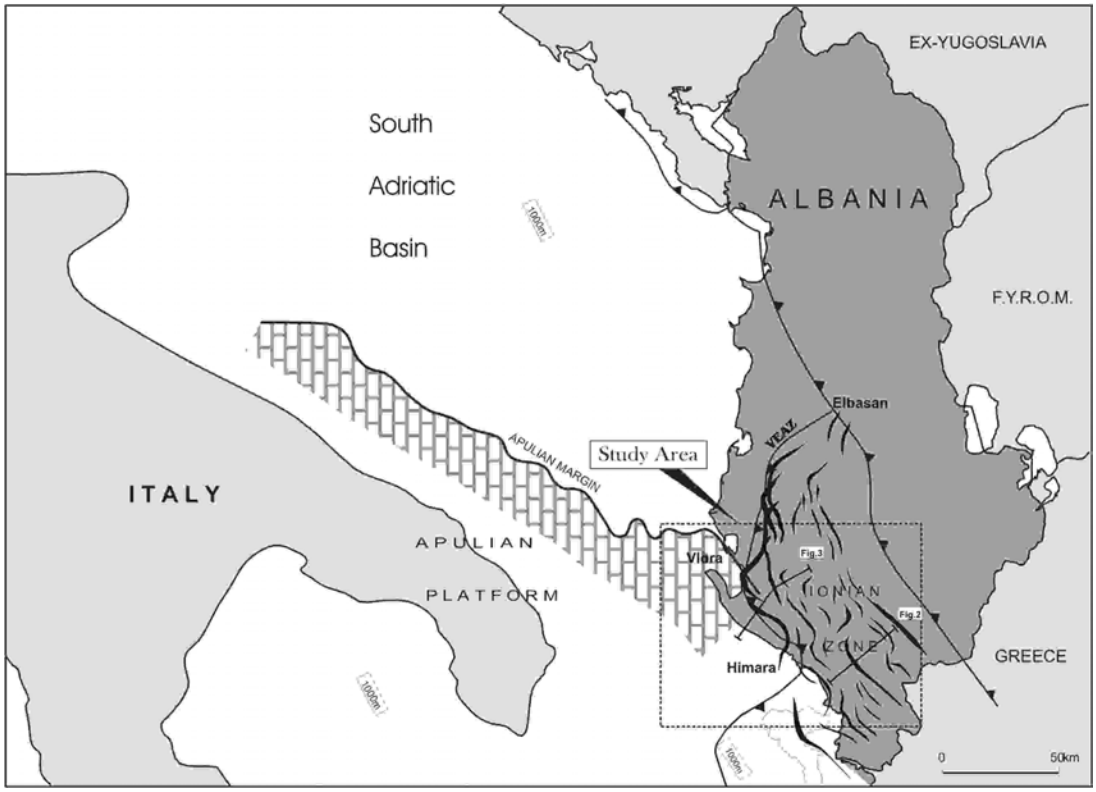

Fig. 1, Main Structural Elements, SW. Albania

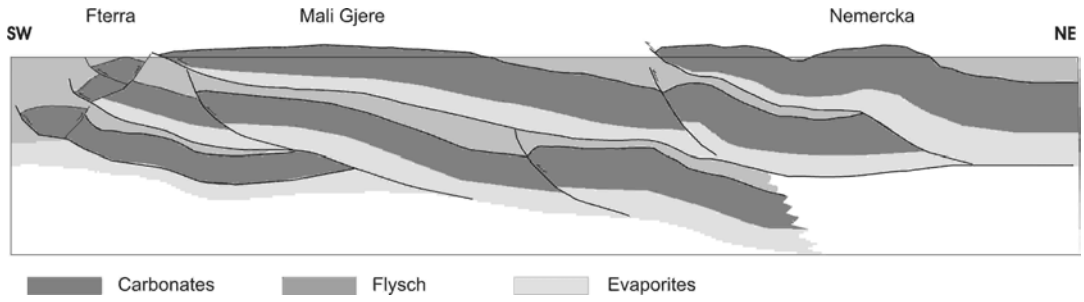

Fig. 2: Simplified Geological Cross Section Across Fterra-Nemercka Area, Based on Seismic Lines, S. Albania.

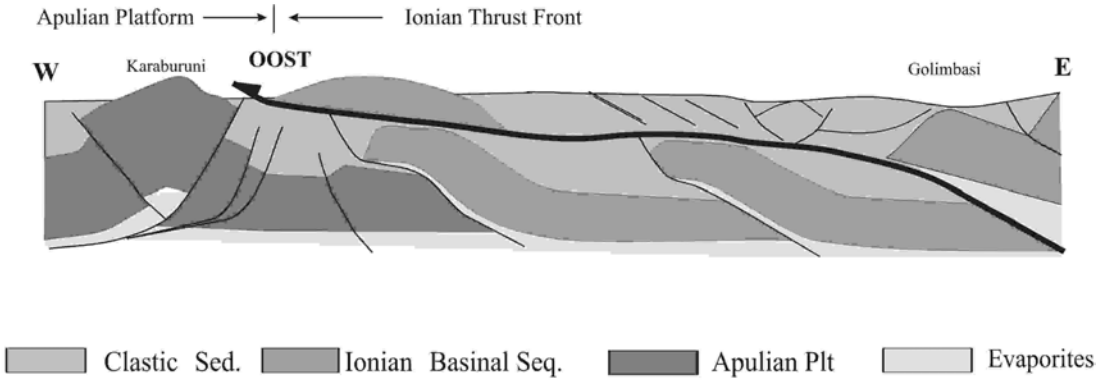

Fig. 3: Simplified Geological Cross Section Across Llogora-Golimbasi Area, Based on Seismic Lines, SW Albania.