RESIDUAL OIL AND GAS POTENTIAL OF THRUST BELTS REGIONS

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ABSTRACT

- The Cretaceous-Paleogene limestone sequence sealed by the Oligocene flysch is the main oil and gascondensate target, which has been and is still in focus of exploration along Albanides thrust belts. The later represent a segment of Alpine folding chain, situated between Dinarides and Hellenides.

- Enormous geological-geophysical data and integrated syntheses performed so far have brought about discovering of some oil and gascondensate fields, as well as depiction of many prospects. On the other hand, many wells drilled on some surface flysch folds or only on poor seismic events have resulted dry. What's happened? Why even many foreign oil companies have failed in Albania? The best response comes out from reconsideration of the exploration philosophy, as well as techniques in the course of acquisition, processing and interpretation of the all gained complex data.

INTRODUCTION

- Geological survey has been in the leading role of the all oil and gas exploratory methods in Albania thrust belt over the past sixty years. So, based chiefly on surface geology data is realized the discovery of the Gorisht field, etc. Meanwhile, 2D seismic survey has been the second progress resulted in some other discoveries as Finiq-Krane, Cakran and Amonica fields. Anyhow, the seismic survey method, frequently have faced serious restrictions and consequently, since the project of the wildcat of the last field discovered there is huge time gap of dry exploration in Albania.
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INTRODUCTION

- Presumably, the negative results have come from improper methodology in the course of acquisition, integration, evaluation balance and interpretation of the all geological geophysical data. That's the challenge of further preparations of many prospects already partly depicted in the Albanides thrust belts and presumably along their homologues worldwide. So, a study on the possibility of reflection of flysch folds at the Cretaceous-Eocene carbonate sequence must make out their lithologic and tectonic features, spatial relationship with known anticlines, as well as timing between folding and hydrocarbon migration phases. Also, in focus must be experimental seismic lines to find out the most appropriate acquisition and processing parameters before starting the whole survey works volume.

MAIN RESULTS AND PROBLEMS OF OIL EXPLORATIN IN ALBANIA THRUST BELTS

- Detailed geological surveys, as well as stratigraphic studies have been in the leading role of doing oil and gas exploration in Albania over the past sixty years. So, based on surface geology and few drilled wells data are realized interesting discoveries, as the Gorisht oil field *(Plaku K. et al, 1962),* Delvina condensate one *(Prenjasi E. et al. 1980), etc.*
- Caring out 2D seismic surveys starting from the year 1955 was the second important step in Albania. So, based on few seismic lines additionally to surface geology were discovered several other fields as Finiq-Krane, Cakran, Amonica, etc. Nevertheless, since the projection of the wildcat, which stroke gas condensate in the very complicated geological setting of the Delvina field, there are some 24 years of dry exploration. What's happened? Why even many big foreign oil companies have not been successful in Albania and other thrust belts regions worldwide?

MAIN RESULTS AND PROBLEMS OF OIL EXPLORATIN IN ALBANIA THRUST BELTS

- Most likely the negative results have come from implementation of impropriate exploration methodology in three main aspects:

- 1. Carrying out insufficient surface geological mapping or former maps revisions, especially by foreign oil companies, which have focused chiefly on new seismic works during their oil exploration in Albania.
- 2. Improper orientation of seismic lines for recording carbonates prospects' structural features.
- 3. Ignoring the leading role of geological data, especially by foreign oil companies, which has worked in Albania during the last 18 years.
- 4. Doing wrong evaluation of the reliability of the all exploratory methods data, as well as their coherence during making up comprehensive integrated syntheses to detect possible oil and gas prospects.

MAIN RESULTS AND PROBLEMS OF OIL EXPLORATIN IN ALBANIA THRUST BELTS

- The four abovementioned issues should be solved successfully through tackling carefully the followings:
- 1. Detailed revision of geological mapping and all drilled wells data focusing on lithological, structural and tectonic features of flysch deposits, which indicate whether an anticline flysch fold may be reflected at the limestone sequence or not? *(Fig. 2, 4, 8, 9)*
- 2. Timing between tectonic and secondary oil migration phases.
- 3. Tracing field location of seismic lines, as well as selecting the acquisition and processing parameters that can provide obvious record of the undulations of the top carbonate sequence everywhere, despite the geological setting complications. For example the Delvina 2D seismic profiles *(Fig. 6, 7)* have provided reliable records, while working on outcrops of the Oligocene flysch and the Burdigalian premolasses deposits, whereas they have got nothing on the outcrops of carbonate and evaporitic deposits of the Upper Triassic.
- 4. Coherence among the all oil exploratory methods data.

DETECTING OF CARBONATE PROSPECTS SEALED BY THE OLIGOCENE FLYSCH

- In response of the negative results and their casual questions from numerous complex exploratory field works and data syntheses have come out some invaluable practical experiences:

- 1. Possibility of the reflection of the Oligocene flysch folds at the Cretaceous-Paleogene limestone sequence in question depends on their spatial position in the course of tectonic development of the whole region that could bring about their birth and growing. In general, the anticline flysch folds, overlain transgressively by premolasse deposits of the Burdigalian to Serravallian (*Fig. 1, 3)* have a considerable reflection at the Cretaceous–Eocene limestone sequence *(Bakia H., et al, 1987, Prenjasi E., 1992)*.

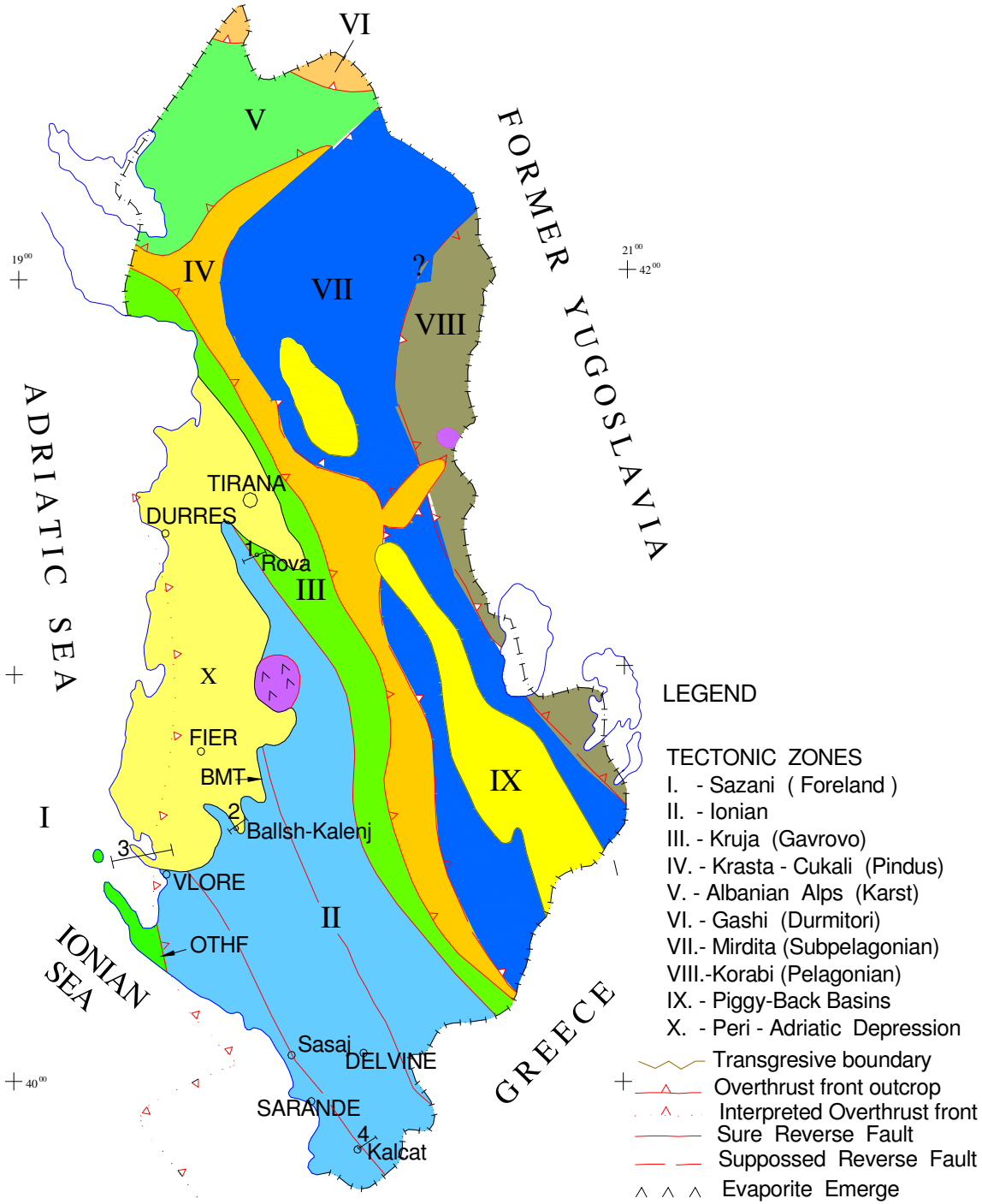

Fig. 1: Tectonic sketch of the Albanides thrust belts

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DETECTING OF CARBONATE PROSPECTS SEALED BY THE OLIGOCENE FLYSCH

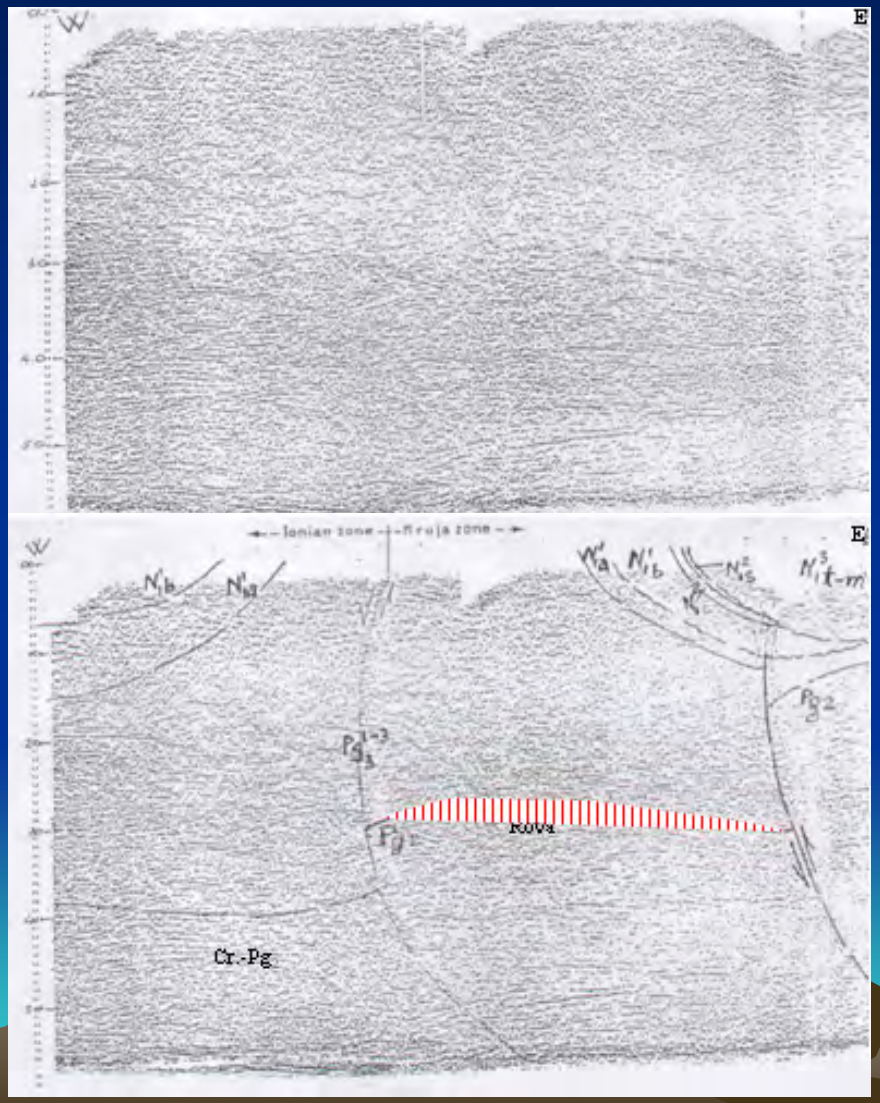


Fig. 2: Geoseismic profile of the Rova potential prospect.

Cr-Pg_2 Cretaceous-Eocene limestone target, Pg_3^{1-3} Oligocene flysch, $N_1^1{}_a$ Aquitanian, $N_1^1{}_b$ Burdigalian, $N_1^1{}_l$ Langhian, $N_1^2{}_s$ Serravallian, $N_1^3{}_t$ Tortonian.

DETECTING OF CARBONATE PROSPECTS SEALED BY THE OLIGOCENE FLYSCH

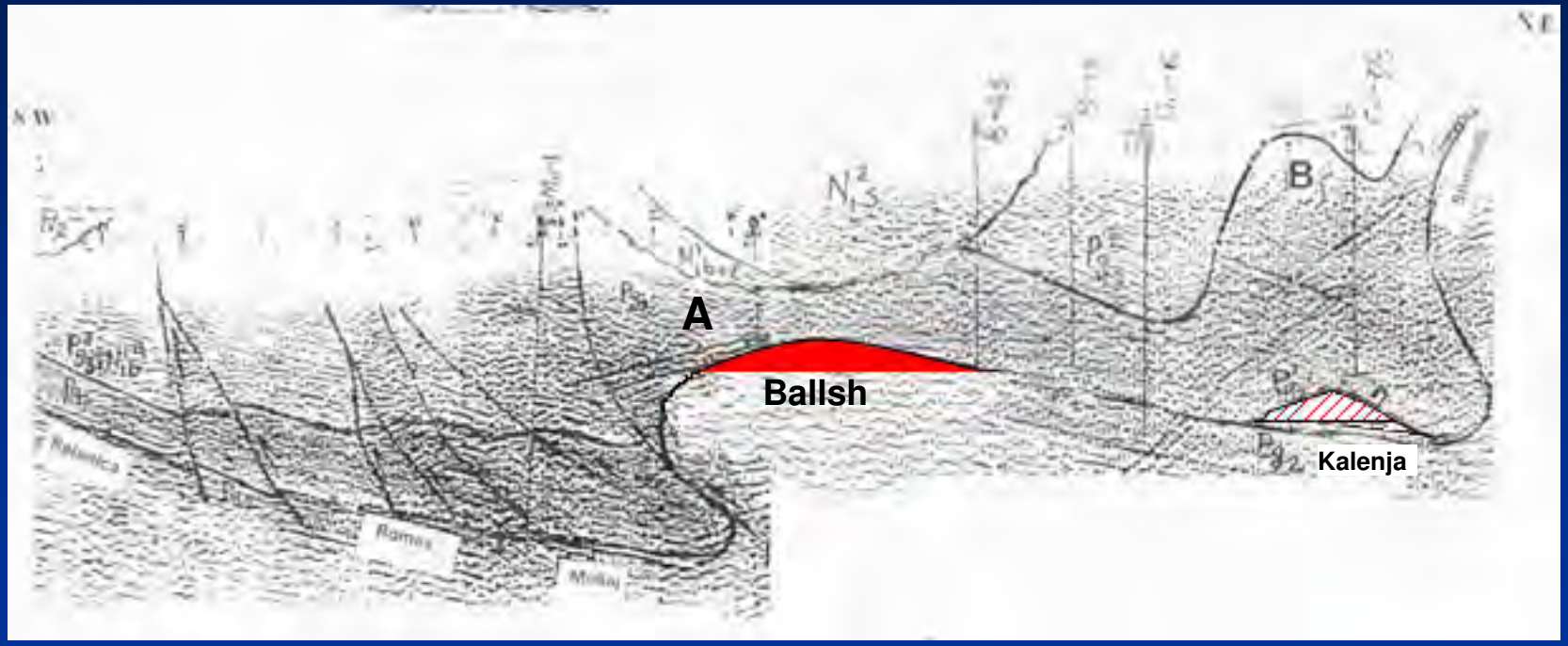


Fig. 3: Geoseismic profile of the anticline of the Ballsh oil field (A) and Kalenja prospect (B)
Cr-Pg_2 Cretaceous-Eocene limestone target, Pg_3^{1-3} Oligocene flysch, $N_1^1{}_b$ Burdigalian, $N_1^1{}_l$ Langhian, $N_1^2{}_s$ Serravallian, N_2 Pliocene, B-45 Drilled well.

DETECTING OF CARBONATE PROSPECTS SEALED BY THE OLIGOCENE FLYSCH

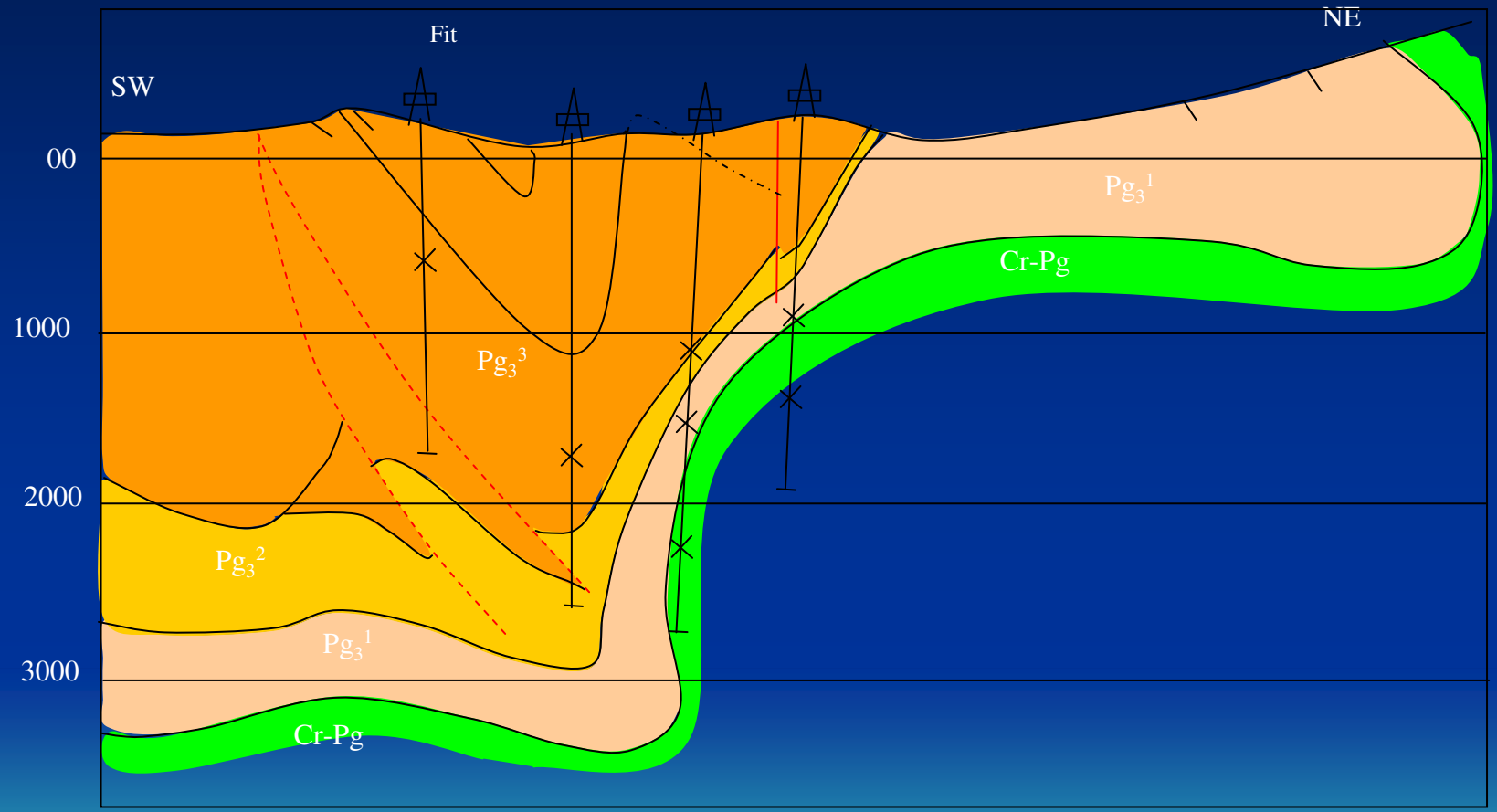


Fig. 4: Geoseismic profile of the flysch folds of the Kalcat region formed along the western steep flank of a big anticline structure.
Cr-Pg_2 Cretaceous-Eocene, Pg^3_{1-3} Oligocene flysch, K-1 Drilled well.

DETECTING OF CARBONATE PROSPECTS SEALED BY THE OLIGOCENE FLYSCH

2. A complete depiction of the structural and tectonic relationships between a flysch fold and the nearest eroded carbonate anticlines is also very necessary. So, relatively big flysch anticlines, located in continuation of the eroded carbonate structures, can result in considerable reflection at limestone level *(Fig. 2, 3 (A), 6, 8).* Whereas, small flysch folds encountered along the steep flanks of the big carbonate structures have a very disputed or lack of reflection at the limestone sequence *(Fig. 3(B), 4)*. In other wards, if geological survey mapping makes out a closed flysch fold, the latter may or may not has expression at limestone sequence. But, if the flysch fold does not exist it is not possible to have anticline structure at the carbonate sequence.

DETECTING OF CARBONATE PROSPECTS SEALED BY THE OLIGOCENE FLYSCH

- 3. Some drilled wells have proved that prevalence of the clay component in a flysch section brings about clay diapirism phenomenon and consequently the diminishing chances of reflection of the flysch fold at the limestone sequence *(Fig. 3(B), 4, Prenjasi E., 1992, 1997).*

DETECTING OF CARBONATE PROSPECTS SEALED BY THE OLIGOCENE FLYSCH

4. Possible direct contact between the Albania thrust belt limestone and the pre-Apulia platform ones, along the thrust plane may have destroyed former traps. Presumably, aggressive movement of the underground waters from platform high porosity carbonates into the thrust belt ones is a potential threat to hinder formation or destroy possible hydrocarbon traps along the frontal part of the latter. So, low chloride waters of 7 to 10 gr. / litre are obtained from two wells penetration into the Eocene limestone of the eastern flank of the Vlora prospect, at relevant depths of about 4500 and 4800 m *(Fig. 5).*

DETECTING OF CARBONATE PROSPECTS SEALED BY THE OLIGOCENE FLYSCH

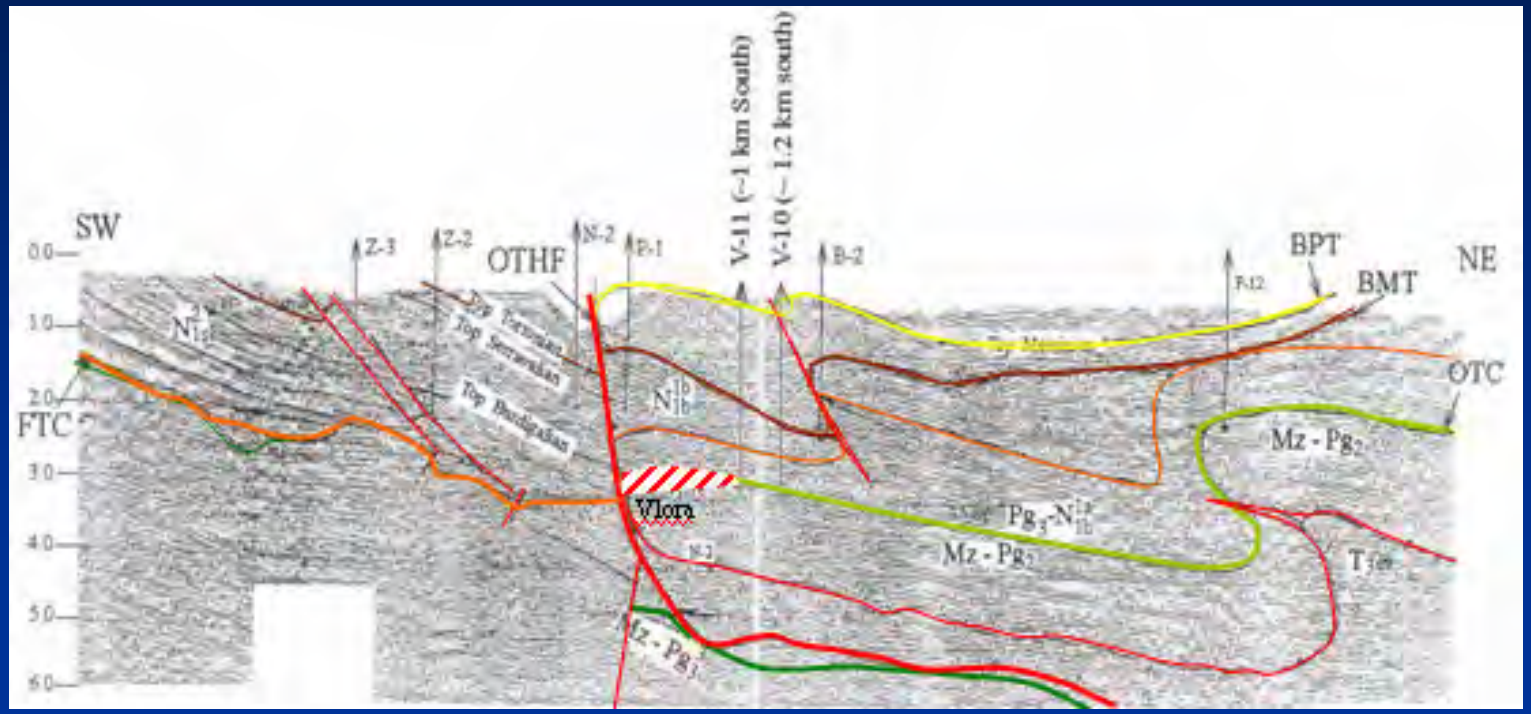
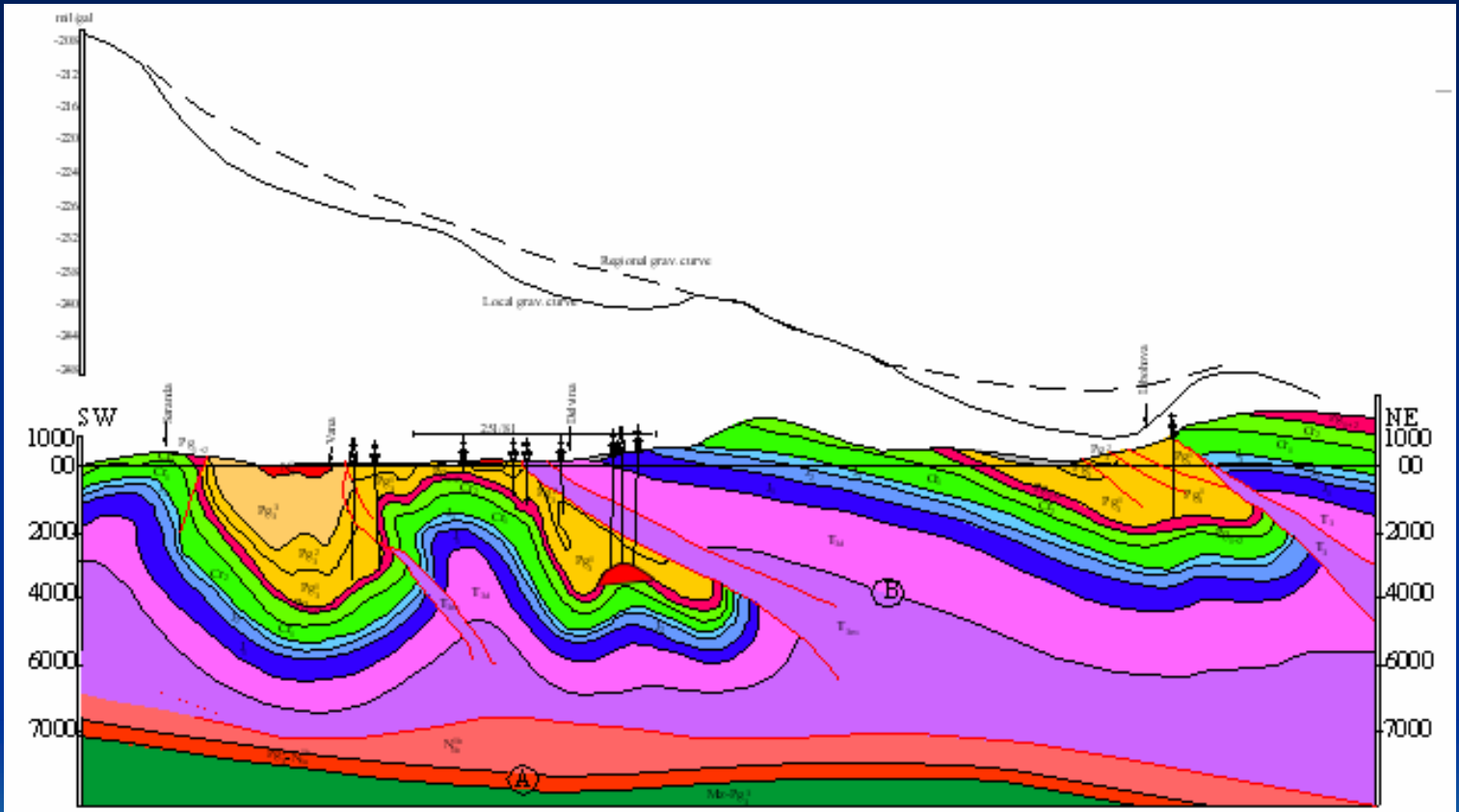


Fig. 5: Geoseismic profile of the Vlora prospect, located at the very edge of the Albanides thrust belts overthrusted onto the pre-Apulia platform.
BPT- base of Pliocene transgression, BMT- base of Messinian transgression, OTC orogenic top carbonates, OTHF - Thrust belt front, FTC- pre-Apulia platform top carbonates, Mz-Pg_2 Mesozoic-Eocene, Mz-Pg_3 Mesozoic-Oligocene, Pg_3-$N_1{}^1{}_b{}^a$ Oligocene to lower Burdigalian, $N_1{}^1{}_b{}^b$ Upper Burdigalian, $N_1{}^1$l Langhian, $N_1{}^2$s Serravallian, $N_1{}^3$t Tortonian, $N_1{}^3$m Messinian, P-1 Drilled well.

DETECTING OF CARBONATE PROSPECTS SEALED BY THE OLIGOCENE FLYSCH

- The practical experiences considered above, etc, reveal that detailed geological survey is the leading method of oil exploration in thrust belt regions. Whereas the 2D seismic survey has faced serious restrictions owing to the existence of intensive flysch folding frequently complicated by different faults, steep flanks and closers, as well as small wideness of the oil prospects, which sometime are masked by eroded and thrusted anticline structures *(Fig. 6)*. On the other hand considering enormous compelled geological geophysical data and syntheses carried out so far have revealed a great similarity between the Alban ides and Hellenides geological setting *(Fig. 10, 11)*.

DETECTING OF CARBONATE PROSPECTS SEALED BY THE OLIGOCENE FLYSCH



- Fig. 6 Geoseismic profile of the anticline structural trap of the Delvina gas-condensate field below the thrusted anticline of Mali Gjere and seismic detection of the Apulia Foreland (A), below the Albania thrust belts (B), about 30 km east of the overthrust front *(Prenjasi E, et al, 1993)*

CONCLUSIONS

- Faced problems and negative exploration results in Albania thrust belts and elsewhere worldwide do not imply poor hydrocarbon perspective. On the contrary, many oil and gas condensate prospects exist, but they need more accurate acquisition, processing, reprocessing, integration and interpretation of the all exploratory methods data.
- Surely, geological survey must be in the leading role of the oil exploratory works in the thrust belt regions. This has been the main way of doing oil explorations be the Albanian experts, whereas foreign companies working in Albania after the year 1990 use to focus only on the seismic works disregarding their orientation according to the geological setting nature of the partly prepared prospects.
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CONCLUSIONS

- Seismic and all the other geophysical and geochemical exploratory methods must increase their solution capability carrying out methodical tests before shooting the all works volume.
- Failures of the Albanian and foreign oil companies happened mainly due to overestimating the seismic or geological poor data. Subsequently, a critical evaluation of the reliability of the all geological-geophysical data is a permanent must.
- Learning from past successes and failures and making up necessary improvements in oil exploration methodology will lead to new discoveries in thrust belts regions worldwide. Specifically, it is very fruitful to undertake a joint Greek-Albanian project on oil and gas exploration in both countries.

THANK YOU FOR YOUR ATTENTION !