

# Location of the Gasfields in the Periadriatic Foredeep and Some of Their Characteristics

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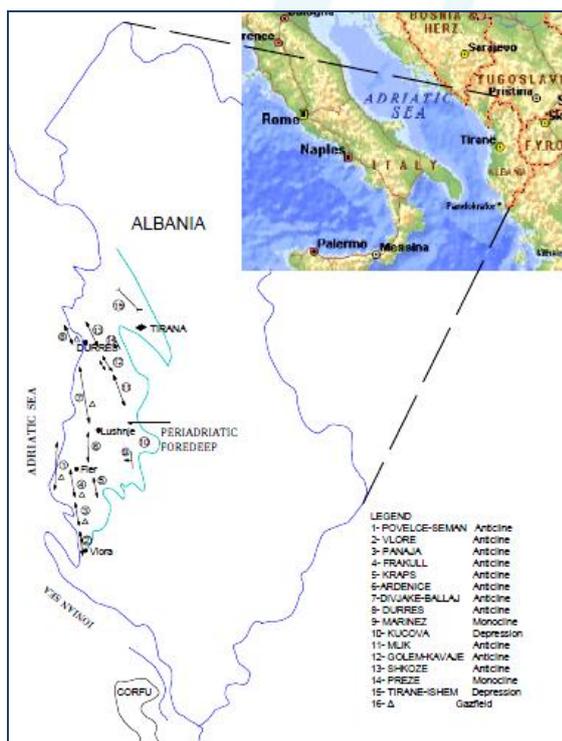
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**Abstract:** *In this paper we have deal briefly with the geological – tectonically position of the Periadriatic Foredeep as an integral part of the Adriatic Basin. This foredeep is stratigraphically represented by the terrigenous deposits of the Serravallian – Pleistocene age. These deposits are folded in the western part forming some anticlines and synclines structures placed linearly. Some main characteristics are also treated such as stratigraphy, tectonics, gas bearing, etc., of the gas fields discovered up to now in some of the anticline structures of this Foredeep.*

**Keywords:** Anticline, Correlation, Gas field, Periadriatic Foredeep, Reserves, LithoStratigraphic column

## 1. Geological setting of the Periadriatic Foredeep

The Periadriatic Foredeep (P.F.) is located in the western part of Albania (Figure 1) and is geologically represented by the uppermost part deposits of the Adriatic Basin which is included in the central Mediterranean Basins group.



**Figure 1:** Location of study zone

This Foredeep is stratigraphically represented by deposits of Neogene age (Serravallian stage to Pleistocene included) which are placed with stratigraphic and angular unconformity in the lateral parts of the basin. The total thickness of the P.F. deposits is more than 5000m [1]. This is based on the drilled wells and seismic data. The thickness increases from the lateral parts of the basin towards its centre.

The P.F. deposits are lithologically represented by clay, siltstone, sandstone, conglomerate, and evaporate. Based on the drilled wells data is noticed that, passing from the lateral parts towards the basin centre, the facies change from coarse-grain facies to fine-grain ones i.e. from shallow facies to deep ones [3], [4], [5], [6]. Vertically from the bottom to the top of this section, is noticed a facies change to pass from fine-grain facies to coarse-grain ones which indicates shall owing direction of the basin.

As for the western part of P.F. the tectonic view indicates the presence of some anticline and synclinal structures, which are mainly placed in linear way forming some structural ranges with South South-East – North North-West axis direction. From east to west, the below mentioned anticline ranges, are distinguished:

- Mlik-Kavaje-Shkoze range.
- Kraps-Ardenice-Divjake-Durres range.
- Vlore-Panaja-Frakull range.
- Povelça-Seman range.

The anticline structures are complicated with over thruster tectonic fault in their western flanks. In some cases they are complicated in the eastern flanks as well [1].

The eastern part of P.F. is not very folded but there are distinguished some depressions and monoclines (Figure 1).

In some of the anticlines structures like Frakull, Divjake, Povelçe, Durres and Panaja were discovered gas fields [1].

The general characteristic of these discovered gas fields is the presence of the gas bearing pools in sandstone layers and sandstone beds packets located in the uppermost part of the structures. Reservoir in the gas fields of PeriAdriatic Depression is related to molasses sandstones of Late Miocene of Tortonian-Messinian in age or in turpitude sandstones of Pliocene age, with porosities ranging between 12-30% and low permeabilities with values up to 45mD [12].

The gas reserves for each of gas bearing pools are estimated to be from 0.5 Million Nm<sup>3</sup> to 40 Million Nm<sup>3</sup> [3]-[9].

The thickness of the gas bearing section varies from 200 m to 1500 m, in the different gas fields. The depth of the gas bearing sandstone beds varies also from 300m to 3000m.

## 2. Some Characteristics of the Gasfields

### 2.1 Divjaka gasfield (Tortonian)

The Divjaka gasfield is located in north-west of Lushnja town, near Adriatic Sea (Figure 1).

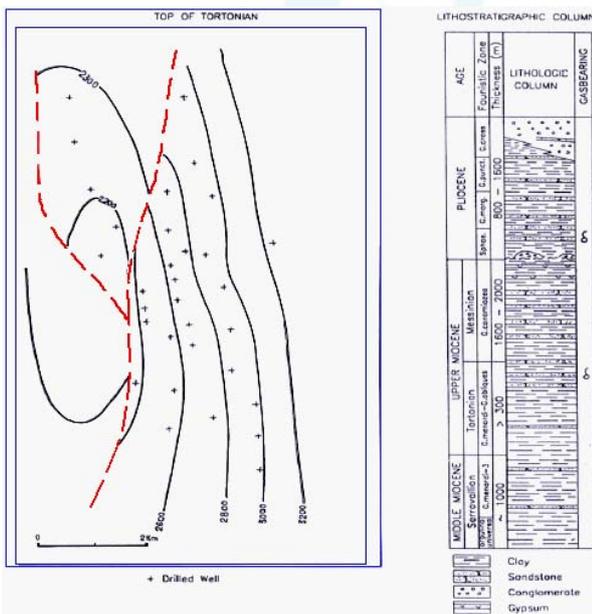
Gas bearing section of this gas field belongs to the uppermost part of the Tortonian deposits. This gas bearing thickness is named as "Divjaka suite" and its top coincides with the top of Tortonian stage (Figure 2).

Based on the drilled wells data it results the generalised stratigraphic section as follows.

- Pliocene deposits 800-1600m thick.
- Messinian deposits 1600-2000m thick.
- Tortonian deposits 200-300m thick (upper part only).

"Divjaka suite" is lithologically represented by the intercalations of sandstone and clay layers. In this suite are distinguished 18 sandstone beds with a thickness ranging from 2m to 20m [3], [4].

The form of Tortonian top shows an anclinal structure complicated with a tectonic fault in the western flank (Figure 2).



**Figure 2:** Correlation of data taken from the drilled wells of Divjaka Tortonian suite

The interpretation of the depositional environment for "Divjaka suite" is based on the geometrical forms of sandstone beds and paleobathymetric data of fauna encountered in these beds. A deltaic facies is indicated by these data. Gas reserves of this gas field are evaluated to be about 2 Milliard Nm<sup>3</sup>.

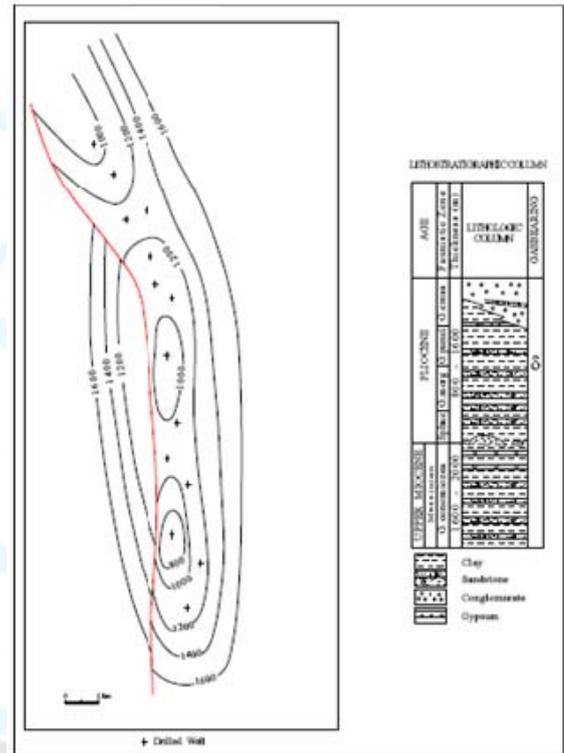
### 2.2 Divjaka-Ballaj gasfield (Pliocene)

The Divjaka-Ballaj gas field is located in north-west of Lushnja town, too (Figure 1).

The proven gas-bearing formation thickness ranges from 450 to 800 m [3].

The lower part of the Pliocene deposits (named "Helmasi suite") is lithologically represented by intercalations of massive clays and rare sandstone beds with e thickness of 0.5m to 30m, while the upper part (named as " Rrogozhina suite") is represented by intercalations of sandstones, conglomerates and clays (Figure 3) [3], [9].

The base of Pliocene deposits reflects the presence of an anticline structure complicated with a tectonic fault in its western flank. The axis of this structure plunges towards the north with a small angle (Figure 3).



**Figure 3:** Correlation for the Pliocene deposits

The fauna bathymetric data and the correlations of the sandstone beds indicate the presence of a deep depositional environment in the lower part of the Pliocene deposits.

A near shore and deltaic facies is encountered in the upper part "Rrogozhina suite".

Reserves of gas of this gas field are evaluated to be about 0.5-0.6 Milliard Nm<sup>3</sup> [3].

### 2.3 Frakulla gasfield

The Frakulla gas field is located in the south of the Fieri town (Figure 1). Gas bearing section of this gas field, belong to the upper part of Messinian deposits and its thickness is about 1500m.

Messinian deposits in this gas field are lithologically represented by a clay package with rare intercalations of siltstone and sandstone beds in the lower part. The section continues with another sandstone-clay package which is gas

bearing. The thickness of these sandstone beds is about 1-20m. In the uppermost part of the section is a gypsum-clay package with rare intercalation of sandstone beds.

- Pliocene deposits 1500-1800m thick.
- Messinian deposits 300-400m thick.
- Tortonian deposits 800-1000m thick [6].

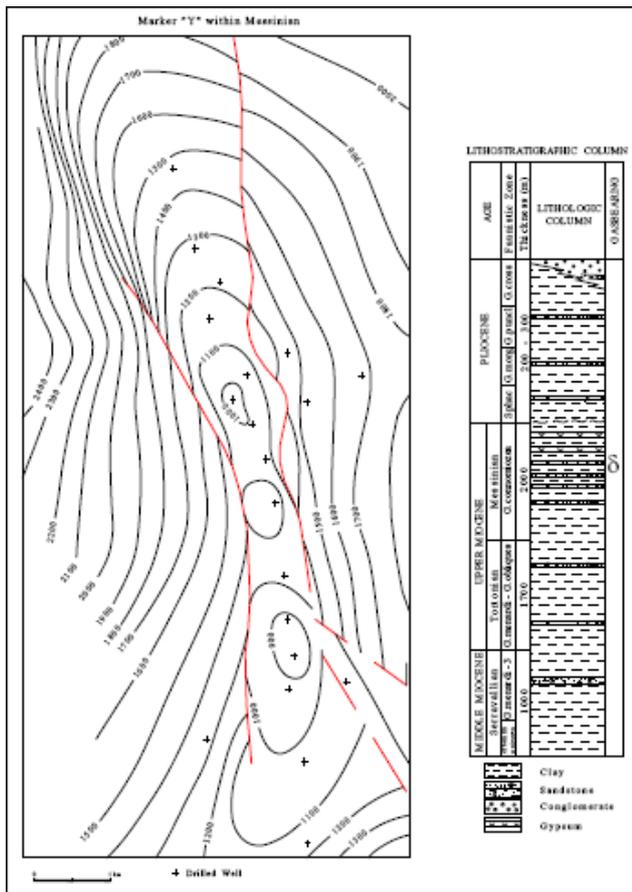


Figure 4: Correlation of data taken from the drilled wells in Frakulla gas field.

Messinian deposits are covered by a thickness of 200-400m of Pliocene deposits placed transgressively. The mapping of the marker "Y" (within Messinian deposits) represents obviously the structural form of the Messinian deposits. An anticlinal structure complicated with tectonic faults in both flanks is shown in (Figure 4).

Clay package in the lower part of Messinian deposits belongs to a deep-sea depositional environment; while the overlain clay-sandstone package is deposited in a shallow environment of deltaic type. Gypsum-clay package is deposited in a closed shallow environment of lagoon type. Gas reserves of this gas field are evaluated to be about 0.25-0.30 Milliard Nm<sup>3</sup> [7].

#### 2.4 Povelça gas field

The Povelça gas field is located in the west of the Fieri town, near the Adriatic Sea (Figure 1).

Gas bearing section of this gas field belongs to upper Tortonian and Messinian deposits with a thickness of 500-700m (Figure 5).

Stratigraphic section based on the drilled wells data is as following.

Tortonian deposits are lithologically represented by clay facies with intercalations of sandstone and siltstone layers in the lower part, while in the upper part there is a sandstone-clay facies. Messinian deposits are lithologically represented by a sandstone-clay facies.

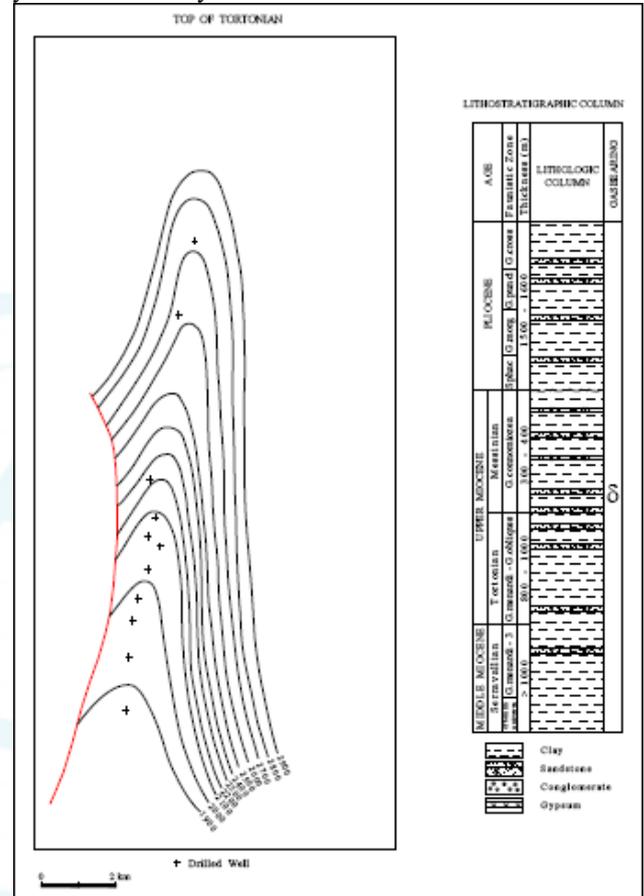


Figure 5: Correlation for the Povelça gas field.

The thickness of the sandstone beds within the gas bearing section ranges from 2m to 25m.

The structural map of the Tortonian top (Figure 5) indicates an anticlinal structure complicated with a tectonic fault in the western flank. The axis of this structure plunges towards the north with a small angle (5° – 10°).

The main characteristics of the Tortonian-Messinian deposits indicate the presence of a deep-sea depositional environment. Gas reserves of Povelça gas field are evaluated to be about 0.25-0.30 Milliard Nm<sup>3</sup>.

#### 2.5 Durres gas field

The Durres gasfield is located in the north-west of the Durres town. Most of the gas is produced in the Durres Basin and only one gas field (Delvina) is located in the Ionian zone. By contrast, most of the oilfields produce from reservoirs in the Ionian zone, and only two have been found in the Durres Basin [10].

Gas bearing section of this gas field belongs to the lower part of Tortonian deposits. Up to now there are three wells drilled in this gas field with this stratigraphic section.

- Messinian deposits 500 - 600m thick.
- Tortonian deposits 900 - 1100m thick.
- Serravallian deposits 200 - 300m thick (upper part only).

Tortonian-Messinian deposits are lithologically represented by a clay facies with rare intercalations of sandstone beds (Figure 6).

Durres structure is an anticline complicated with tectonic faults in both flanks. The deposit of this structure belongs to a relatively deep-sea environment.

Based on San Leone strong seismic indications while the stratigraphic equivalent of the reservoir target has been penetrated by the A3-1X well (drilled in 1994) encountered a 55% sand/shale ratio in the pre-evaporitic Upper Miocene section. Here have been identified six source rock intervals with several potential oil reservoirs expected in Mesozoic carbonates and flysch as well as numerous gas reservoirs in the shallower Tertiary clastic deposits [13]. The gas discovery in Messinian sandstones was a condensate and biogenic gas.

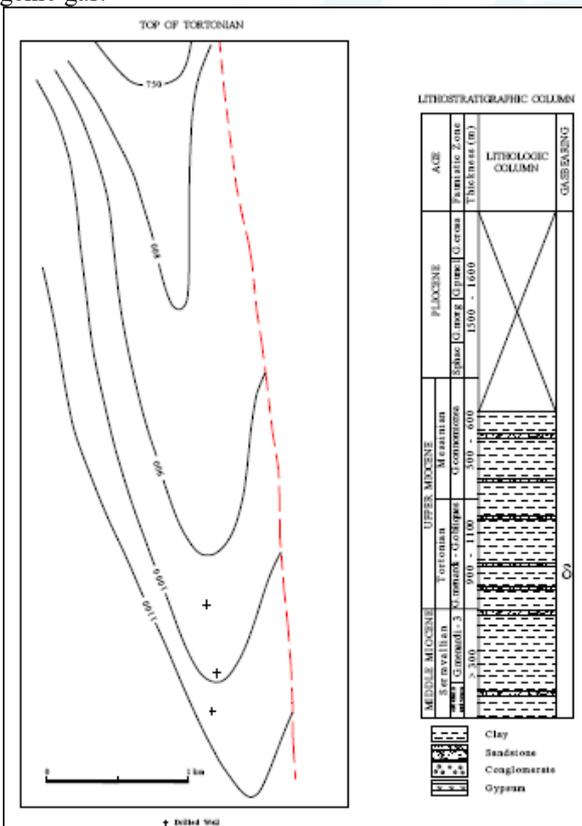


Figure 6: Correlation of data taken from the drilled wells

### 2.6 Panaja gas field

The Panaja gas field is located in the north of the Vlora town near the Panaja village (Figure 1). This gas field is discovered in 1987 and the reservoir depth is 2500m. The gas bearing bed is discovered in Serravallian deposits (Figure 7). The geological feature is very complicated nevertheless there is an anticlinal structure which plunges towards the north.

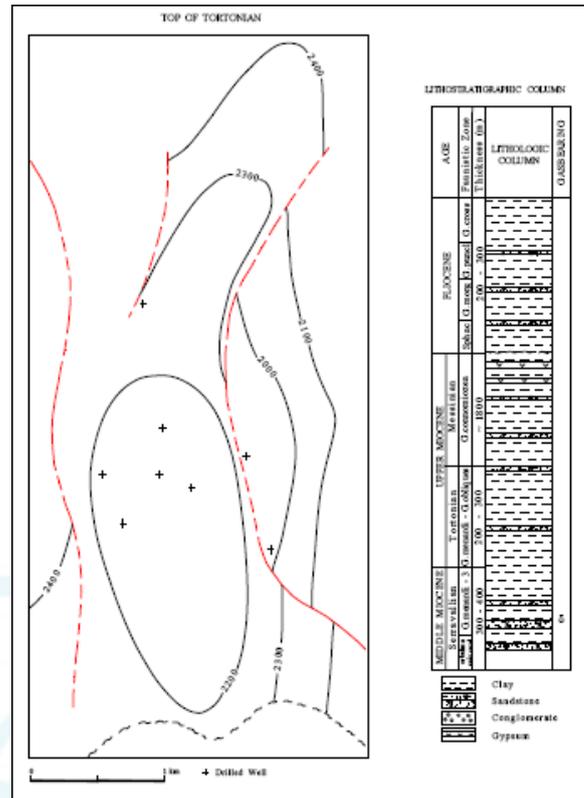


Figure 7: Correlation of data taken from the drilled wells in Panaja gas field

### 3. Characteristics of Hydrocarbon Gasses

The majority of the gas data have been derived from Tortonian and Pliocene sands of the Divjake dry gas field [3], [4], [9]. They have been combined with a number of samples from other dry gas fields, and with associated gas samples from the oil fields.

Based on methane stable carbon isotope values a range of gas origins can be established. Almost all Divjake and Frakulla samples, together with Panaja gas, Vurgu gas and Ardenica gas shows, appear to have a biogenic origin. The remainder of the Divjake and Frakulla samples, and the Durres and Povelce gas are of mixed thermal and biogenic accumulation, together with some of the Cakran, Mollaj and Hekal gas samples. Although the two Divjake samples falling in this category have both been derived from below 2800 m, from Tortonian reservoirs, other deep samples from the same level fall in the purely biogenic range. The associated gasses sampled in the oil fields like Ballsh, Visoka and Marinza, have been derived from oil and wet gas generation.

### References

- [1] N. Rakipi, S. Guri, "Analizes of basen for molassis deposits in F.D. throu secuencial stratigraphy", ING Fier 1991 (technical report style, in Albanian).
- [2] Sky Petroleum Inc. "Exploration Blocks in Albania", Full Report, 27 September, 2010.
- [3] A.Mesonjesi, K.Buli, "Studim gjeologo-kanterial mbi perhapjen e shtresave gazmbajtese ne vendburimin Divjake-Ballaj", Fondi ING Fier 1993 (technical report style, in Albanian).

- [4] Koci T, Mesonjesi A. “Kushtet e formimit e te ruajtjes se shratimeve ne Pliocenin Divjake-Ballaj”, ING Fier 1988 (In Albanian, ne publicat).
- [5] V. Janopulli, Sh. Nazaj, “Pergjithesimi gjeologo-gjeofizik i rajonit te Durrësit”, Fondi ING Fier 1990 (technical report style, in Albanian).
- [6] N.Rakipi, T.Sota, “Pergjithesimi gjeologo-gjeofizik i rajonit Povelç-Seman”. Fondi ING Fier 1994 (technical report style, in Albanian).
- [7] T.Sota, R.Koçi, “Pergjithesimi kompleks i vendburimit Frakull”, Fondi ING Fier 1993 (technical report style, in Albanian).
- [8] T. Sola, R. Koçi, “Pergjithesimi gjeologo-gjeofizik i rajonit Panaja”, Fondi ING Fier 1993 (technical report style, in Albanian).
- [9] Z.Xhafa, Sh.Kurti, “Pergjithesimi gjeologo-gjeofizik i rajonit Divjake per depozitet e Tortonian-Messinianit”, Fondi ING Fier 1993 (technical report style, in Albanian).
- [10] Maxim Kotenev: “The Hydrocarbon Potential of Albania”, Search and Discovery Article #10710 (2015)
- [11] AKBN, “Geological Overview” [www.akbn.gov.al/images/pdf/hidrokarburet/Geological-Overview.pdf](http://www.akbn.gov.al/images/pdf/hidrokarburet/Geological-Overview.pdf)
- [12] Nadège Vilasi: “Study of reservoir analogues in foreland fold-and-thrust belts: sedimentology, diagenesis, deformation and fracturing of the upper cretaceous-eocene carbonate systems of the ionian zone (Southern Albania)”, PhD Thesis 2009.
- [13] SLR “Independent Resource Assessment on Adriatic Oil Plc Assets Offshore Ireland, Offshore UK, Offshore Albania and Offshore Italy” Adriatic Oil, 2013 (technical report).

## Author Profile



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