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A STUDY ON THE GEOLOGY OF THE ȚAGA REGION (CLUJ DISTRICT)[1]

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ABSTRACT. The geological formations from Țaga area (Cluj District) are Sarmatian in age (in outcrops) and Badenian (under surface). Lithologically, they are represented mainly by sands and sometimes fine sediments (clays, marls), interbedded with volcanic tuffs a low fossil content. The Badenian is the host of gas accumulations, concentrated in dome structures.

Key words: stratigraphy, petrology, tectonics, Țaga

Localization: the rural community of Țaga is located East of Cluj District, at the border with Bistrița - Năsăud District.

Relief and hydrography: this region with large hilly areas belongs to the transition zone from the "Transylvania Plain" (S) towards the Someşan Plateau (N). The highest hills are between 400 to 500 m (the Bocor Hill is over 500 m high). The cuesta relief that corresponds to the unconformable valley slopes is well represented. The main hydrographic collector is the Fizeş Valley (from SE to NW) together with its numerous tributaries; within the frame of this valley and its affluents there are extensive marsh lands and lakes formed from a mixed origin (due to natural – earth slipping- and anthropogenous factors). This natural phenomenon originates in tectonic consequences, the rise of the confluence zone of the Fizeş Valley, due to diapirism. The most well known lakes are those from Țaga, Geaca, Cătina, and Sântejude. Maxim (1935) examined the evolution of this region's valleys, while Săndulache (1970) covered a study of the lakes.

A review of geological research studies:

- Koch (1900) – in the Țaga area the "Plain Strata" (Stratele de Câmpie) are developed (Middle Miocene).
- Wein (1941 – 1942) – focus on the stratigraphy of the Buza-Năsal perimeter, as related to a nondenominated tuff level, and notes the lack of fossils (mentions a few *Ervilia* examples).
- Mârza (1960, 1962) – identifies the Ghiriş Tuff in the region and follows it through to Ocna Mureş (Uioara), proves its continuity, identifies the geological formations as belonging to the Sarmatian, and discovers more fossil occurrences (*Ervilia* and *Abra*), including the fossil level located under the Ghiriş Tuff.
- Sabău (1984)[3] – his thesis on the Țaga gas structure focus on the lithology of the formations and their paleonthologic content (micro and macro fauna).

[1] Abstract of "Geologia perimetrului comunei Țaga"- by I. Mârza (from "Monografia comunei Țaga"; in press)

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[3] Sabău E. (1984). Analiza datelor şi informațiilor obținute prin lucrări de prospecțiune, explorare şi exploatare efectuate pe structura Țaga, jud Cluj. Lucrare de diplomă. Univ. Babeş-Bolyai, Cluj-Napoca, Biblioteca de Geologie.

- Vântu et al (1998)[4] – presents a geology report on the gas structures (Ţaga, Strugureni etc), with some data concerning the drillings and surface geology.
- Other brief on geology data belongs to Vancea (1929, 1938, 1960), Pătruţ (1948-1949), Răileanu (1952), Ciocârdel (1952), Maxim (1960), Mârza and Mészáros (1991), Mârza et al. (1991).

Stratigraphic remarks:

- Late Badenian – exclusively identified by the geologist team from Gas Metan Mediaş in boreholes based on microfauna (Vântu et al., 1998)[4]. It develops above the salt horizon along a 800 m wide strip. Lithologically it is represented by sands with slim bands of clayey marls; the Badenian formations are the host rocks of the natural gas.

- **Sarmatian** - all geological formations that appear on the surface, including those 200 to 300 m deep from the lowest relief which corresponds to the valleys, belong to the Sarmatian. They mainly develop on a lithologic column of approximately 500 to 600 m wide.

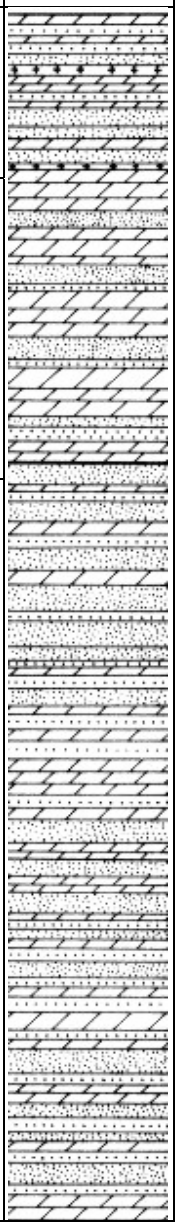
Lithologically, the Sarmatian formations are mainly formed out of sands with slim bands of clayey marls; they vary in dimension, from bands that are fractions of inches wide to chocks or benches of about 10 m. From place to place, the sands are slightly cemented, with rare instances of strong cementation (taupy sandstone). Within the sands there are several types of sandstone concretions: spheric - frequent occurrences, disc- like, rare occurrences, cylindrical, plan-convexical, entwined and incorporated in newer concretions, incidental occurrences. The Volcanic Tuff horizons (the Hădăreni Tuff and the Ghiriş Tuff) complete the lithology of the Sarmatian deposits (Fig. 1).

Fauna – a close examination of the stratification plans within the clayey - marl pellites, yields few examples of macrofauna represented by casts of *Ervilia* and *Abra*. There are some compact rock areas where these forms occur frequently (1-2 examples in an 20cm square area, eg. Râpa Dracului from Ghiolţ/Ţaga, a fossiliferous occurrence identified in 1957 by Mârza.

The **fossiliferous level** located below the Ghiriş Tuff (Mârza, 1960) represents a particular case. It is characterized by frequent occurrences of lamellibranchiate specimens, but the genus types are scarce (fig. 1). Especially common occurrences are the *Ervilia* and the small size gasteropodes (*Mohrensternia*). The microfauna is abundant at this fossiliferous level where other fragments of fish can also be found, such as *otolithes*, and very rarely small sized teeth.

The **volcanic tuffs in this area** are levels of volcanic tuffs of extrabasinal origin. From the bottom part of the geological formations in the outcrop, towards the top, the following intrasarmatian levels are present within outcrops:

[4] Vântu C., Alexandru F., Frâncu P., Negoescu G., Cişmaru A., Olteanu M., Gheorghi L., Gliga Mihaela, Farkas Monica, Barbu I. (1989). Evaluarea resurselor geologice şi a perimetrelor în exploatare a zăcământului comercial Ţaga, la data de 1.01.1989. M. I. Romgaz R. A. Gaz Metan Mediaş (Raport geologoic).

Geochronological units		Lithology	Thickness (m)	Facies	Guide fossil (animal association)
Lower Sarmatian	Lower Volhinian (the upper part)		200	Ghiriş Tuff Hădăreni Tuff	Ammonia beccari (Linné) Elphidium aculeatum (d'Orb) Abra reflexa Eichw. Ervilia dissita Eichw
	Lower Volhinian, basal		300	Prevalent pelitic facies	Ammonia beccari (Linné) Elphidium macellum (Fichtel de Moll) Cibicidea dutemplei (d'Orb) Anomalinoides badenensis (d'Orb)
Upper Badenian			250	Prevalent pssamite facies	Spiratella subtarchanemsis (Zhizh) Bulimina elongata (d'Orb)
			550	Prevalent pelitic facies	***Biofacies with agglutinate foraminifera:*** Bathysiphon carapitanus (Hedb) Hiperammina elongata (Brody) Dendophya latissima (Grb) ***Spiratella associations:*** Spiratella subtarchanensis (Zhizh) Spiratella nucleata (Zhizh) Globigerina praebulloides (Blow) Globigerina concinna (Reuss) Globigerina opertura (Brady) Globigerina scitula (Brady) Globigerina bulloides (d'Orb) Globigerina bolii (Cita-Premolisilbva)

1 2 3

Fig.1. *Synoptic lithostratigraphic column of the geological formations from the Țaga structure; accordingly the Mediaş Gas Enterprise, Sabău (1984)[3], with annotations and supplementary data.* ***Legend****: 1-Cemented sands and sandstones; 2- Clayey marl pellites; 3-Volcanic tuffs*

- The **Hădăreni Tuff** (dacite)– mentioned in this area for the first time, it appears in the Sântejude area, Sântejude Vale, and Husuierului Valley; it measures 4 – 4.5 m in width (fig.3).

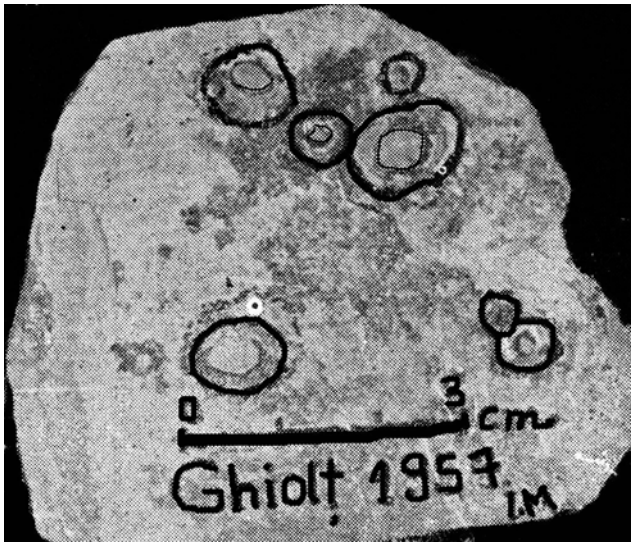


Fig. 2 *The frequency of macrofossils (**Ervilia**) in the fossilliferous level under the GhirişTuff*

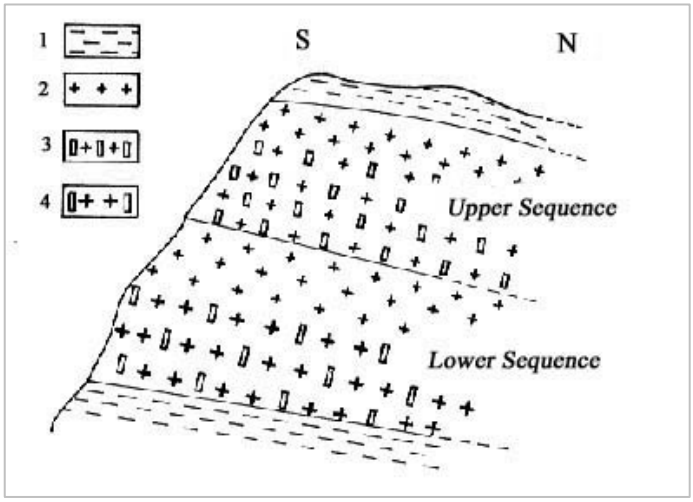


Fig. 3 *Lithological column through the Hădăreni Tuff (the left slope of the Codomarc Valley).* ***Legend****: 1 – marls; 2 – vitroclastic tuff; 3 – crystalloclastic tuff; 4 – vitrocrystalloclastic tuff; Upper Sequence (1.80 m); Lower Sequence (2.30 m)*

- The **Codomarc Tuff** (named and identified by Marza, 2000) runs about 50 m above the Hădăreni Tuff and measures 10 cm width (the clayey marl pellites within which this tuff is situated, often contain well preserved specimens of *Ervilia).*
- The **Ghiriş Tuff** (andesitic) – outcrops without interruption on the right slope of the Fizeş Valley; it is mapped from the Lacu village (S), to the right slope of the Sărmătin Valley, along aprox. 15 km; the 1.35 to 1.40 cm tuff horizon maintains this consistent width. On the left slope of the Fizeş Valley, the Ghiriş Tuff occurs in the Sucutard and Țaga areas, to the South, while to the North, due to tectonic consequences, its occurrence in outcrops is problematic.
- The **Vulturul Fizeş Tuff** - identified by Mârza în 1957 - is situated in the Vulturul Fizeş Hill (outside of the Țaga perimeter), and measures around 50 cm in width; it is the last level of Sarmatian tuff in the region.

The **Țaga gas structure** lies to the NW of the Transylvania Depression; it has been underlined through field studies and drillings (1965 – 1975) by the team of geologists from the Mediaş Gas Enterprise. It is part of a larger gas field, developed on a dome structure (Fig.4).

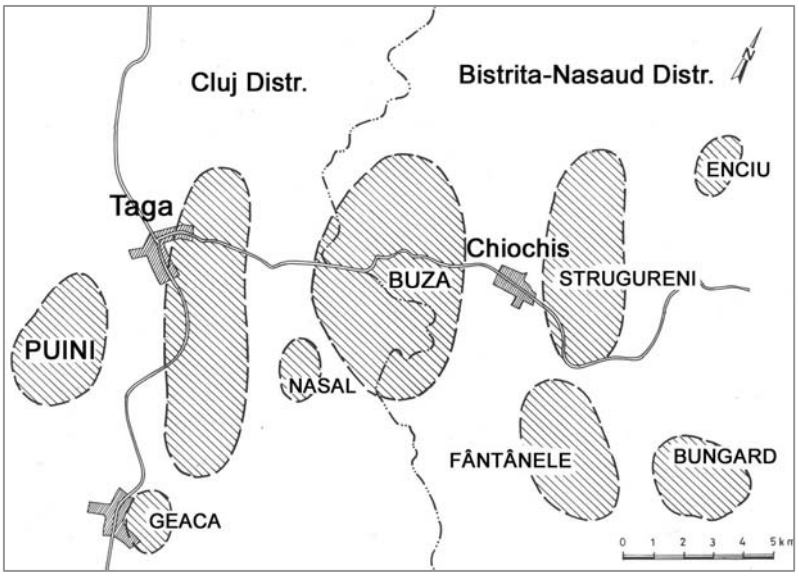
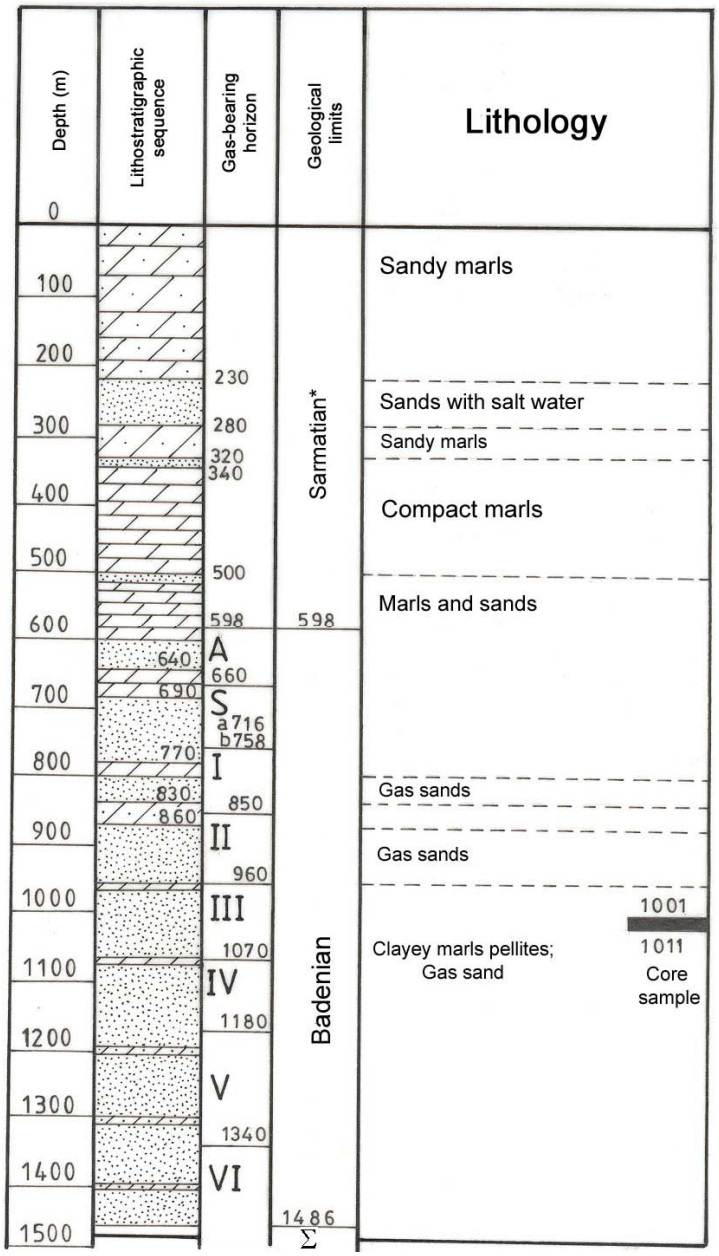


Fig. 4. *The Țaga gas structure from the dome gas fields in NW Transylvania; after the "EXPROGAS S.A. Tg. Mureş" data.*

The gas accumulations are amassed in Badenian, they are grouped in thirteen complexes and they belong to the **structural, lithological and mixed traps** (Fig. 5; 3 column). Noteworthy in the chemical composition of the gases is the high methane purity, 97,85 – 99,33%.



** Buglovian according to "EXPROGAZ" S.A. - Tg- Mureş data*

Fig. 5. *The localization of the gas horizons in the Ţaga structure (Badenian); after the "EXPROGAZ S.A. Tg. Mureş" data.*

Tectonics – from a tectonic point of view the Țaga region is marked by the following types of structures:

- **Disjunctive tectonics** – expressed through faults in the northwestern part of the region (Sântejude, Sântejude Vale, Sântioana)
- **Diapirism Effects** – in the northwestern part, they are recognized through the presence of salt-water springs (Sântioana); also in the gas dome structures.

Economic resources:

The area is poor in subsurface resources. Among the few we will mention:

- **Raw materials**: sands, sometimes sandstone, and volcanic tuffs may also be rarely used (eg. Hădăreni Tuff from the Sântejude Vale area); the clayey marl deposits are used locally for bricks production.
- **Natural Gas** - methane gas, introduced in the national economic circuit in 1982, and at a later date, locally in Țaga, is the most important exploited geological resource in the region.
- A **salt-water spring** (Sântioana)- known and minimally fitted out by the locals, used to treat rheumatism.

Conclusion: a hilly relief with valleys marked by extensive marsh lands characterizes the Țaga region. The geological formations, poor in fossils – sands with pellitic, clayey marl bands – have been identified in boreholes, and outcrops. The formations belong to the Badenian and Sarmatian. The Badenian hosts natural gas, which are exploited and used nation wide.

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