

Stratigraphy, Facies and Sedimentary Environments of Pliocene Deposits in the North of Tabriz, Iran

Rahim Mahari*, Somaieh Sadigh Janbahan

Department of Geology, Tabriz branch, Islamic Azad University, Tabriz, Iran

ABSTRACT

In the north of Tabriz, Pliocene deposits have outcrops along the North Tabriz Fault, which is a dextral strike-slip fault[7]. Three sections from these deposits in the Baghmisheh, Sparan and Marzdaran areas were studied during this present study in order to determine their stratigraphy, facieses, and sedimentary environments. The results of studies show that rock units in the sedimentary sequence of these deposits begins, from bottom to top, with lahars and agglomerates of Sahand Volcano, south of Tabriz, with white fine grained sandstones of lamination and cross-bedding, and continues with marl, sandstone and sand-lignite-marls with the fresh water gastropoda fossils, and reaches to tuff deposits, diatomite dish-beds and conglomerates of Baghmisheh and Marzdaran formations at the top of sequence. The achieved information from the present studies also revealed that the sedimentary environment of these Pliocene deposits was a fresh-water lake with the periods of succulence and water shortage. Using all these results made it possible the reconstruction of ancient geography of the region.

KEYWORDS: Pliocene, fish-beds, Tabriz fault, Baghmisheh Formation, Diatomite, Lignite.

1. INTRODUCTION

Pliocene deposits have considerable outcrops along the trend of North Tabriz. These deposits generally are distinguished from the clastic deposits of Upper Red Formation. The main distribution of these deposits are seen between longitudes 46°.15'.00"E and 46°.22'.30"E and latitudes 38°.07'.30"N and 38°.15'.00"N. Parts of studied outcrops located in the northeast of Tabriz and the residential area of Baghmisheh township, and the other parts in the northwest of Tabriz near the Dash-Sparan village. Distribution of younger units of Pliocene deposits is seen in the east of Tabriz, around the international exhibition.

In the Geological map of Tabriz with the scale of 1:100000 (Asadian, 1993), the Pliocene deposits have been shown at a limited area and with clastic and pyroclastic lithology. Pedrami (1993) attributes the lacustrine beds with fish fossils of this area to the age of Apshehon[1]. Rahimzadeh (1994) considers that the fresh water sediments in Tabriz area to be the equivalent of fresh water clays of Share-Rey, which includes conglomerate, evaporates, stracoda bearing marls, pyroclastic, gypsiferous ciltic clay and interlayers of gypsiferous limestone[2]. Khodabandeh et al., (2009) have studied the epiclastic layers and fish beds of around Tabriz mainly in the south, southwest, and southeastern parts of Tabriz[4].

Hag Farshi (2009) studied the lower Pliocene sediments of North East of Tabriz in Sari Dagh area and introduced two main members with angular unconformity, and he used lithological and paleontological evidences to introduce them as being the sediments of small-scale fresh water lake[6]. Richen Bakher, et al., (2011) also studied the fish and lignite bearing layers of Tabriz basin and indicated them as being Upper Miocene deposits[5]. Mohajjal et al., (2007) believe that the sedimentation of pyroclastic and clastic sediments with volcanic fragments of Sahand Volcano have occurred during the time of tension tectonic events and the formation of Tabriz fault[7].

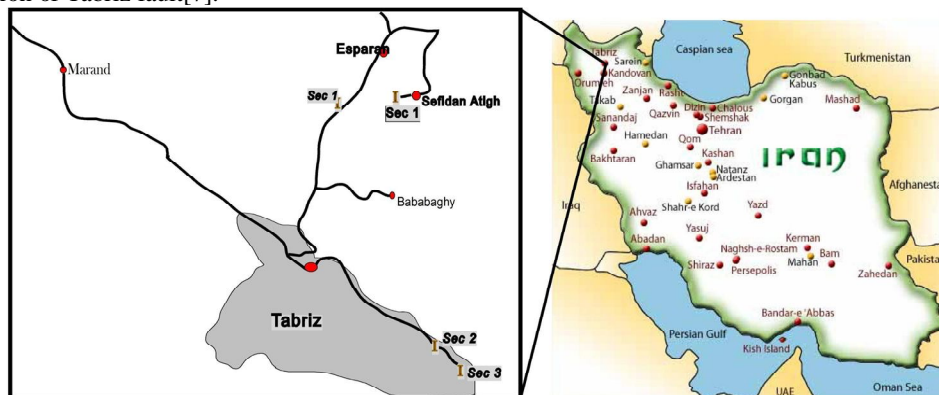


Fig1: Access ways to the studied sections.

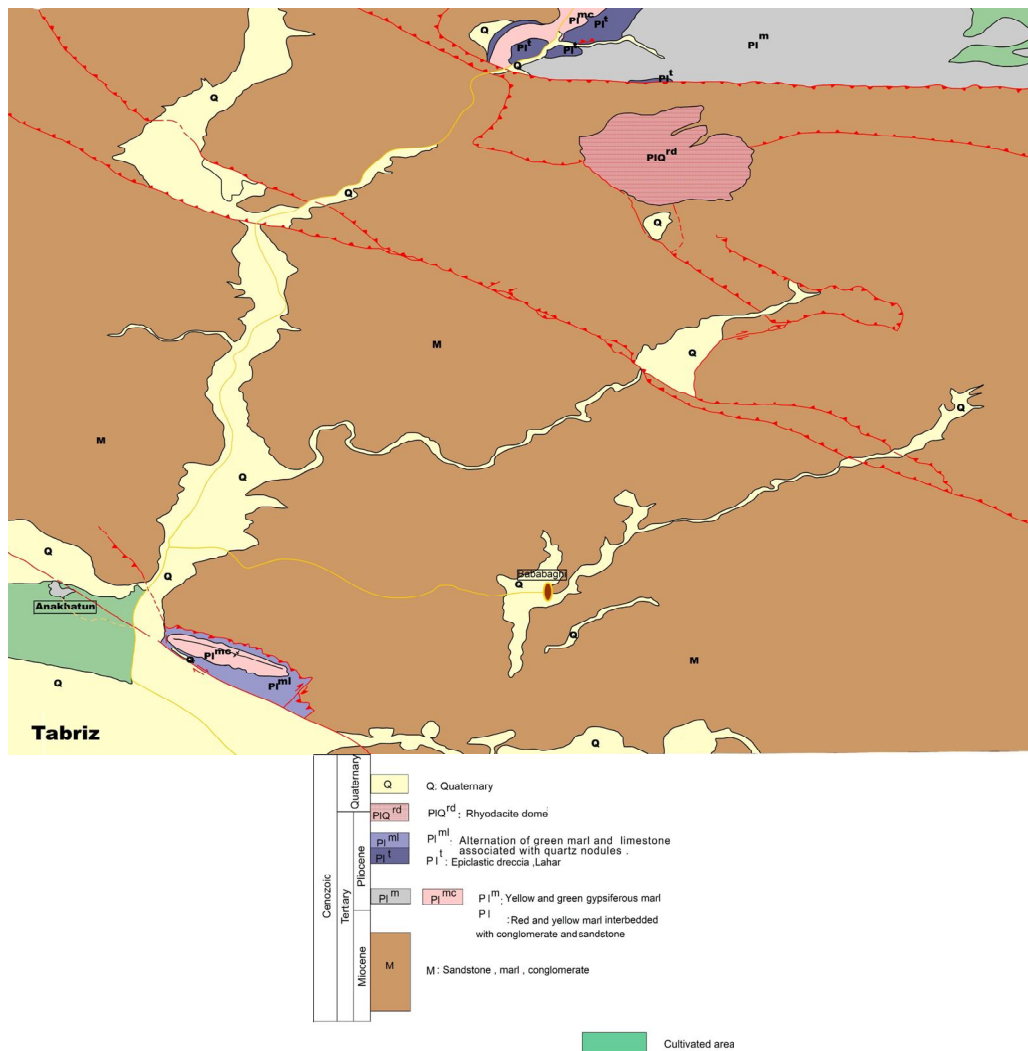


Fig2. The geological map of Pliocene layers in northern parts of Tabriz, (after: Ana Khatun Map, Iranian Geological Organization, at a scale of 1:25000).

DISCUSSION

A. Lithological Units :

In the Sparan area the sediments of Lower limit of Pliocene are seen with a rough morphology. The variation of flow style during the formation of these sediments as well as the later sediments resulted in the formation of lahar and agglomerate. In the western side of area the lahar unit, and in the southern side of area the agglomerate unit are seen. In the northern parts of Sparan village and in the light colored hills which have generally covered by the sediments of quaternary time, some out crops of white Pliocene sandstone also are seen. In the Sefidan junction there are flysch layers of Cretaceous which are considered as the lower limit of Pliocene sediments.

Unit 1: Lahar (or massive para-conglomerate without layering) is seen as a mass without any layering which contains 90 percent igneous fragments and sometimes sedimentary and sandstone fragments. Variation in the size of fragments is high and the size of some particles reaches to 2.5 meters, indicating the existence of a dense flow in the area. Their white color is due to the existence of tuff and sporadic sandstones fragments.

Unit 2: Mass agglomerate with joints and fractures, and tuffaceous matrix with amphibole phenocrysts with flow texture orientation, and weathered plagioclase, and rarely quartz with external or internal volcanic fragments are seen with a maximum size of 50 cms. The rocks of this unit are without layering but the orientation of layers is possible to be identified.

Unit 3: White fine-grained sandstones (laminated calcareous sublitharinate with weak texture maturity, and with completely angular grains, medium sorting and relatively more matrix), with granular structure and

alternating thin and thick layers, and upward reduction of thin layers. The graining sequence of fining upwards and coarsening upwards are both seen as alternatingly layers of low thickness. The general trend of the layers is west-east, and their inclination is southward. The sedimentary structures are considerably widespread, so that the sand-lenses, cross-beddings and laminations are frequently observed. Most of the layers are fast-eroding and have caused a latency of most of the thickness of Pliocene deposits between the two outcrops of volcanic rocks. Secondary iron and magnesium dendrites created in Quaternary are sporadically observed.

In the Baghmisheh area, other Pliocene deposits are seen as follows:

The first layer is a thin bedded mud-sandstone, the next layer is coarse-grained sandstone, and the upper layer is sandstone with cross-lamination, and upward coarsening graining, and then massive sandstone with a small layer of fossil-fragments, and magnesium dendrites and finally sandstone with siliceous nodules, sylvite and chert.

Unit 4: Alternation of thin-bedded, fine-grained sandstone with marl, with lamination and alternation of yellow and gray colors are seen. According to the Petit John classification, these rocks are Feldspathic and Kilitic bearing, and in the Folk's classification they are lithic bearing.

Unit 5: Alternation of soft marly sandstone with sandy marl, yellow to very light brown, laminated, fine grained, lower lime content, some gray and sometimes limonitic interlayers, and frequent gypsic fillings of secondary fractures, some gray, original chalk interlayers, some fossiliferous layers (fish, gastropoda and etc.), and secondary iron and magnesium dendrites are observed. In microscopic sections, sands contain evaporite mineral pseudomorphs and pellets. The quick transformation of the facieses and the low thickness of the layers and the existence of ripple marks with high ripple index are the major features of these layers.

Unit 6: is Lignitic sandy marl, alternation of sandstone and marl, and mudstone with coal inlayers in mudstone and green marl. Discontinuous nature of coals indicates the lacustrine origin of the layers.

In the Marzadaran area of Tabriz, the following layers were seen:

Unit 7: Fish fossil containing diatomites with light colored tuff inlayers and three white, yellow and orange layers with fresh water fish fossils. In Marzadaran district of Tabriz, layers were observed as follows: At first layers resembling the marl and diatomite layers of Baghmisheh are seen, that gradually are transformed into muddy sandstone and later to fine grained sandstone with thin layering.

Unit 8: The rocks of this unit contains soft alluvial conglomerate with bigger pebbles. The existence of filled alluvial channels and lenses and the intermittent layers of sandstone and conglomerate can be seen in this unit.

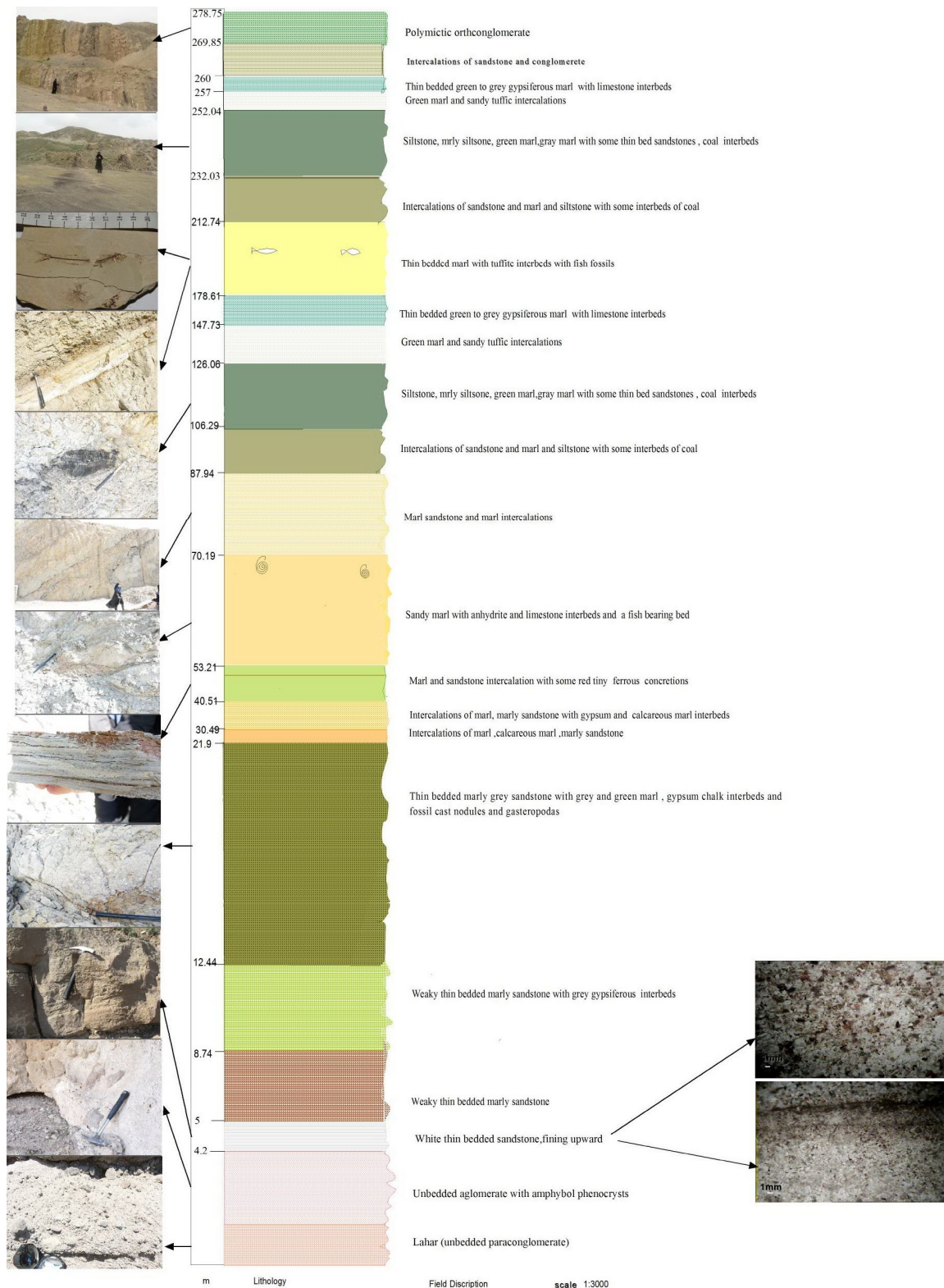


Fig 3: Section of Pliocene of north of Tabriz .

B. Facieses :

1. Lahar facies: The filled channels indicate that lahar process has occurred on land.
2. Aglomera facies.
3. Laminated sandstone facies : is equivalent of SI in Mial classification.
4. Sandstone facies with oblique trough cross-bedding: equivalent of St in Mial classification.
- 5- Marl Facies Group:

- 5.1. Massive marl.
- 5.2. Sandy marl.
- 5.3. marly sandstone.
- 5.4. laminated marl.
- 5.5. Gypsiferous marl.
6. Lignite Facies
7. Tuff and sandy tuff facieses.
8. Fish-containing diatomite facies.
9. Sandstone facies with graded graining and lamination.
10. Conglomerate facies: including polymictic ortho-conglomerates, weak sorting and sand matrix.

C. Interpretation of Sedimentary Environment:

According to all achieved results it can be concluded that the Pliocene deposits of Tabriz have been formed mainly in a fresh water lake environment, which due to uplifting gradually have been transformed into river alluvial. The cross-bedding trough is the indicative of low energy channel environment and its thickness is the indicative of canal depth. Presence of Gilbert delta cross-bedding is the confirmation of lake sediments. The presence of many canal fillings with fine graining upwards is the confirmation of the existence of alluvial environment.

The annual shore varves and the alternation of sandstones, some with fine graining upwards, indicating flooding, and some with coarse graining upwards, indicating progradation, confirm the existence of lake. Lignite lenses indicate the inter-distributary basins in the river banks.

It seemed that the rate of sedimentation was generous such as the Caspian sea's rate[9] .



Fig 4: The big Gilbert type crossbedding in the Pliocene deposits north of Tabriz.

Conclusion

- The outcrops of Pliocene sediments are seen in Sparan, Baghmisheh and Marzadaran areas.
- Pliocene sediments consist of 8 units including lahars, aglomera, fine-grained, white sandstone, marly sandstone, lignite bearing sandy marl, tuff, fish-bearing diatomites, and conglomerate.
- Lamination sedimentary structures, shore varves, iron concretions, sand lenses, ripple marks of higher ripple index, cross-bedding, iron and magnesium dendrites, fracture filled by gypsum are clearly seen in Pliocene rock units.
- Fresh water fish fossils, gastropods, stracodas, and lignite traces are found within these sediments.
- According to the results of studies, structure and texture of Pliocene sediments show fresh water lake conditions with intermittent periods of water shortage and affluence and similar to another deltas such as Niger delta it has an alternation of sandstone and shale[8].

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