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Review Article

PHYSICAL PROPERTIES OF ROCKS AND CRUSTAL STRUCTURE OF THE BASIN OF THE ZERAVSHAN

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ABSTRACT
The article deals with the petrophysical properties of rocks of the earth's crust within the zone of articulation of the Turan platform with the orogenic structures of the Tien Shan. It also deals with the results of geoplatnostic modeling on the profile of Beshagach – Samarkand – Navoi – Dul-Dul.

Keywords: *Model, structure, profile, crust, fracture, density, electrical resistance, magnetic susceptibility, elasticity*

INTRODUCTION
Petrophysical properties of the Riphean-Vendian and Paleozoic complexes of rocks Kuramina Fergana median of the array are nearly identical and differ significantly from the underlying early Proterozoic. Sedimentary-metamorphic rocks are weakly magnetic; most of them have magnetic susceptibility (χ) within tens x 10-6 CGS, and the average value in the region is (20 - 30) x 10-6 CGS. Even a smaller quantity is characterized by remanence. As an exception, there are some metamorphic rocks (shales with magnetite mineralization), as well as formations in the zone of active contact with igneous rocks (scarred, cornified, etc.), or mineralized, enriched with ferromagnets. The magnetic susceptibility of these rocks can reach tens of thousands x 10-6 CGS.
Magnetic properties of igneous rocks depend on their composition: magnetization increases with increasing basicity. Effusive acid composition usually weakly: more basic (diabase, spilite, basalts, etc.) can be attributed to magnetic - χ of up to 1200 x 10-6 CGS and more. However, among the main effusions, along with magnetic differences, there are non-magnetic ones.
Intrusive rocks of basic and ultrabasic composition (pyroxenites, serpentinites, gabbro) are magnetic and highly magnetic: up to 15000 x 10-6 CGS. The granitoids usually weakly magnetic granites, alaskite, some varieties granodiorites. Other petrophysical difference relate to magnetic. In some cases, the magnetic and acidic differences: χ leucocratic granites Angren is 800 x 10-6 CGS. In Mogoltau most of the granodiorites are strongly magnetic-χ is 2300 x 10-6 CGS, but along with them there is a group of almost non-magnetic granodiorites, geologically different from the first and is 22% of the studied. The reason for such a sharp divergence of properties, according to N. B.Dortman is a tectonic regime in the period of their formation; in P.G. Akhmatova's opinion, it is an earlier (Caledonian) age of non-magnetic intrusions.
Most of the Riphean-Paleozoic formations have a bulk density of 2.60 to 2.70 g / cm^3 and an average of 2.67 g / cm^3. The average values are characterized by shales, sandstones, siltstones, conglomerates; elevated - carbonate (limestone, dolomite) and mineralized formations. Effusive rocks of medium and basic composition: excess density of these rocks (σ_{iz}) from 0.03 to 0.05 g/ cm^3. Low density – the number of effusive acid and their derivatives (σ_{iz} from 0.15 g/ cm^3). In Intrusive and effusive rocks there is also a distinct dependence of density on basicity. Minimum density rocks have acidic range (granite, alaskite, quartz porphyry, acidic volcanites, (σ =2,58-2,60 g/ cm^3); this group includes the syenites (σ =2,61 g/ cm^3). To Intrusive rocks with an average density are granodiorites (σ =2,64-2,66 g/ cm^3); high density have syenite diorites,

diorites, effusive medium and basic composition (σ =2,70-2,75 g / cm^3). The most dense rocks are the main and ultrabasic composition: gabbro, peridotites, pyroxenites (σ =2.80-3.10 g/ cm^3).
The geoelectric section of the region is insufficiently studied. In General, pre-Mesozoic formations are characterized by relatively high values of resistance which are compared with the meso-Cenozoic may be considered almost infinite. The electrical resistance of pre-Mesozoic rocks are determined mainly by the lithological composition: actively affects them, the degree of metamorphism. The highest resistances (RC) are carbonate rocks - limestones RK from 500 to 15,000 OMM, Dolomites - 3000 - 2000), less high - crystalline schists (600-2000 ohms.m) and rocks of different composition (300 + 2000 ohms.m.) The average position is occupied by sand-shale and volcanic strata (150 - 700 Ohm). The lowest co-resistance (100 Ohmm) are shales; with the increase in arenaceous material resistance increases and the highest values it has reached the sand-conglomeratic thick. Effusions of different composition have an average of about 500 ohms, effusive-sedimentary thickness - from 100 to 1000 ohms.
One of the main factors determining the velocity properties of the pre-Mesozoic rocks is their lithological composition. The greatest speed (5800 - 6000 m/s and more) have carbonate rocks, as well as amphibolites and igneous rocks of the main series. Sand and shale formations in the carbonate column reduce its speed; Dolomites, on the contrary, lead to an increase. The complex, represented by magmatic, metamorphic and sedimentary rocks, is characterized by velocity values from 5000 to 6000 m/s. In the sand and shale strata, as well as in acidic granitoids, this indicator tends to the lower limit and rarely exceeds 5000 m/s.the upper Paleozoic volcanic rocks are very heterogeneous thickness, characterized by a wide range of speeds-from 3500 to 6000 m/s. the Lowest speed in tuffs, the highest in andesite - dacite porphyry from the lower akchin Suite. In General, effusive can be considered as medium-speed at a speed of 5250 m/s.
On the elastic properties of rocks is significantly affected by the fracture, leading to a sharp decrease in velocity, which is usually in fractured rock is not above 4500 m/s. therefore, the minimum values of velocity are characterized by a zone of faulting (3500-4500 m/s).
Mesocainozoic rocks lying on the blurred surface of the Paleozoic and represented by Cretaceous, Paleogene, Neogene, Quaternary deposits, composed of clays, sandstones-siltstones, gravelites, have a density σ =1,8-2,3 g / cm^3, (usr= 2,2 g / cm^3), virtually non-magnetic, VR=2800-3500 m/sec, RK=50-300 Ohm. The total capacity of these deposits is from 0 to 1000 m and more.
Within the southern Tien Shan of lower Paleozoic geosynclinal deposits are represented by rhythmically alternating shales, sandstones, and siltstones with interlayers of separate gravelites and conglomerates, limestones, siliceous rocks, porphyries, basic composition, quartz albitophyre and their tuffs are usually weakly magnetic (χ average 0 - 30 x 10-6 SI units), they have a high apparent resistance (RK = 500 ohms.m) and boundary velocity (V gr = 5300 - 5400 m/s), average density (σsr = 2.68 g/ cm^3).
The middle Paleozoic formations are represented mainly by limestones and Dolomites, in Karatyube - marl and limestone, marble limestone llandloveri and venloka and siltstone, with siliceous inclusions. This section is characterized by a slightly increased density σ_{av} = 2,69 g / cm^3, speed Vgr = 5600 m / s, average resistance $\rho_к$ = 800 ohms.m, is practically non-magnetic khsr = 20x10-6 SI units. Carbonate formations of the upper Silurian-lower Devonian age are widespread. In Kuldzhuktau (Dzhangeldin Suite, Borgustan Suite, Turkmen Suite, they are composed of limestones, dolomite, marble limestones with rare interbeds of siltstone and siliceous rocks (σ_{av} = 2.72 g/ cm^3, χ_{av} - 0 - 20 x 10-6 SI units, V_{gr} = 5700 m/s, $\rho_{к\ av}$ to 1000 ohms.m) and include the full age interval. Visible power up to 2000 m.

On average, petrophysical characteristics of the sediments of upper Paleozoic age are greatly influenced by the presence of a breakdown of the carbonates, the average density of 2.68 g/cm3, non-magnetic - χ=0 and 20 x 10-6 SI units, a sufficiently high speed V g -5600 m/s, have a large apparent resistance with $\rho_к$ =300 ohms.m (reaching 1000 Ohm).

The upper Paleozoic complex of the lower Permian formations is closed. They consist mainly of clay shale, arkose sandstones, coarse-grained and gravel conglomerates. These deposits are characterized by low (for pre - Mesozoic formations) petrophysical parameters-σsr=2.65 g/ cm^3, XSR 20 x 10-6 u SI, V $_{gr}$ 5200 m/s , with $\rho_{к\ av}$ = 100 ohms.M. Apparent resistance directly depends on the content of the clay fraction and at its large quantities can drop to 30 ohms.mmm.

Intrusive rocks play an important role in the structure of the upper crust. Their study involved a number of researchers. The results of the work are summarized in the monograph "Petrography of Uzbekistan", which is taken as a basis in this description. In addition, the materials used are R. N. Abdullayev, M. A. Akhmedzhanova, A. A. Bakirova, V. Knyazev, V. A. Khokhlova and others.[1]

On the territory of the South Tien Shan geosynclinal stands out a number of different age Intrusive complexes. The most ancient - refasten - Intrusive formations are individual xenoliths in granitoids kittenishly the court Zirabulak-Zaitzevsky mountains (σ_{av} = 2.85 g/ cm^3, $\chi_{\ av}$ = 1000 x 10-6 SI units, V g = 5700 m/s, RC = 1500 ω.m) and gabbroids (σ_{av} = 2.8 g/ cm^3, $\chi_{\ av}$ to 700 x 10-6 u SI, V gr = 5500 m/s, $\rho_к$ = up to 1000 ohms.m), installed in Kuldzhuktau and Zirabulak mountains.

In General, it can be noted that a number of regularities have been established for the petrophysical characteristics of Intrusive rocks. Thus, the density increases with increasing basicity of rocks. Magnetic susceptibility also depends on the composition of rocks - increases from acidic (almost non-magnetic) to ultrabasic (strongly magnetic). However, in some cases, this regularity is disturbed, as granites and granodiorites exposed to the South Kuldzhuktau have χ_{av} to 1000 x 10-6 SI units, at the same time of the main species, sometimes meet non-magnetic difference. The boundary velocity and apparent resistance also generally increase with increasing basicity.

The analysis of these materials showed that petrophysical characteristics of Intrusive rocks of the boundary massif and geosynclinal system are similar in many respects. The exception is magnetic properties, in particular, magnetic susceptibility. Its value is much greater in those Intrusive formations that are located within the boundary array. All of the above information on the geological structure and petrophysical characteristics of pre-Mesozoic formations of the region lay in the future, the basis for all future builds:

According to petrophysical characteristics, the following anomalous objects are distinguished:

Density properties.

1. The most consistent boundaries in the pre-Mesozoic section are:

а) the surface of the crystalline basement $\Delta\sigma_{\ av}$ = 0,18 g/cm^3;

б) surface of pre-Mesozoic formations (relative to meso-Cenozoic strata) $\Delta\sigma_{\ av}$ = 0,32 g/cm3.

2. Inside the Riphean-Paleozoic formations the followings stand out:

а) carbonate complex ($\Delta\sigma_{\ av}$ = 0,03-0,05 g/ cm^3);

б) volcanogenic and volcanogenic-terrigenous complexes with effusions of medium and basic composition ($\Delta\sigma_{\ av}$ = 0,02- 0,06 g/ cm^3);

в) upper Paleozoic molasse strata ($\Delta\ \sigma_{\ av}$ = 0,05 -0,07 g/ cm^3);

г) the Intrusive formation of ultrabasic, basic and intermediate composition ($\Delta\sigma_{\ av}$ = 0,15 - 0,2 g/ cm^3, $\sigma_{\ av}$ = 0,1 – 0,18 g/ cm^3, σ_{av} =0,07 g/ cm^3 respectively);

д) Intrusive and effusive formations of acid composition ($\sigma_{\ av}$ = 0,05 - 0,12 g/ cm^3).

Magnetism.

1. The most magnetic are the Intrusive rocks of the foundations of the tion, of ultramafic composition and effusive rocks of the main composition (χ_{av} to 1500 x 10-6 SI units).
2. Metamorphic rocks of the crystal base (amphibo-litas, amphibolite shales, etc.) χ_{av} = up to 200x 10-6 u SI - for the boundary massif; χ_{av}= 150 x 10-6 u SI-geosynclinal-folded system.

Speed performance.

High and high boundary speeds have:

1. Metamorphic rocks of crystal base V gr = 6200 m/s.
2. Carbonate formations, V gr = 5800-6000 m/s.
3. Basic and ultrabasic Intrusive rocks. V g = 5600 - 6000 m/s.

The reduced boundary velocities are marked:

1. Upper Paleozoic (Permian) terrigenous formations (V gr = 5200 - 5400 m/s).
2. The zone of faulting. V g = 3800 - 4800 m/s.

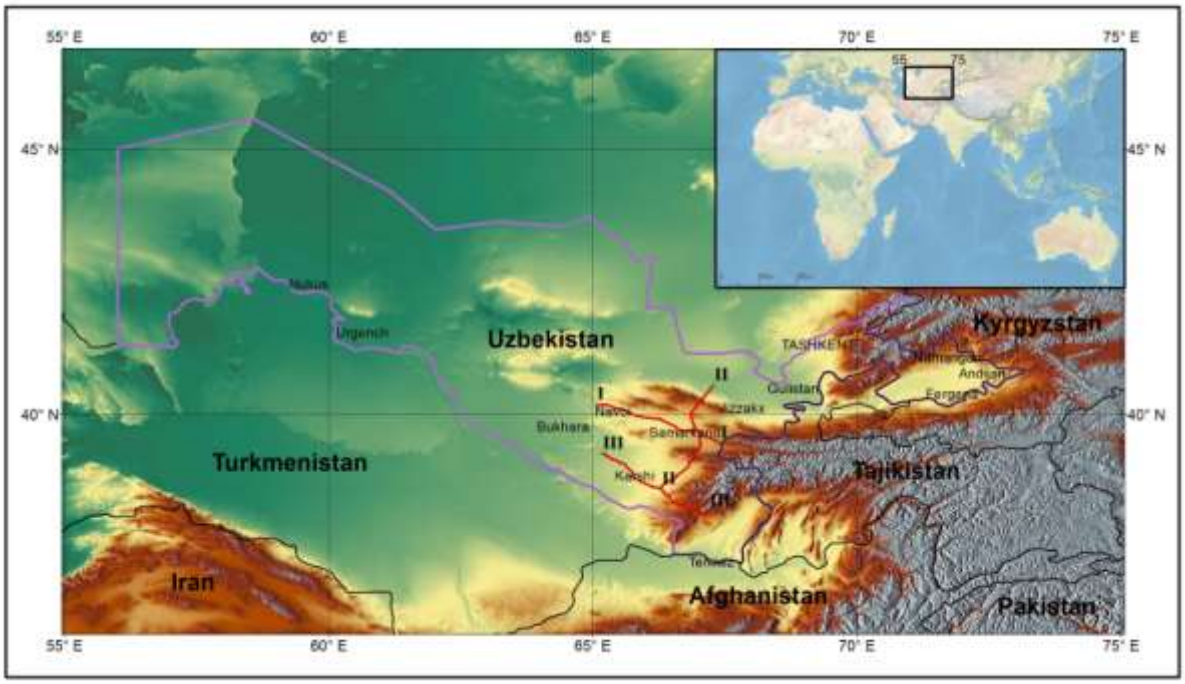


Figure 1. Scheme of profiles.

To study the deep structure of the study area profiles of EULEX was built geo-density model. The basis of these models of the first approximation was made by seismogeological sections according to NHS, kmpv, movz, features of the top part of a section were proved by results of geological surveys, drilling, and also available materials of the geological and geophysical researches executed in the previous years Fig-1.

The structure of the earth's crust on the profile I-I

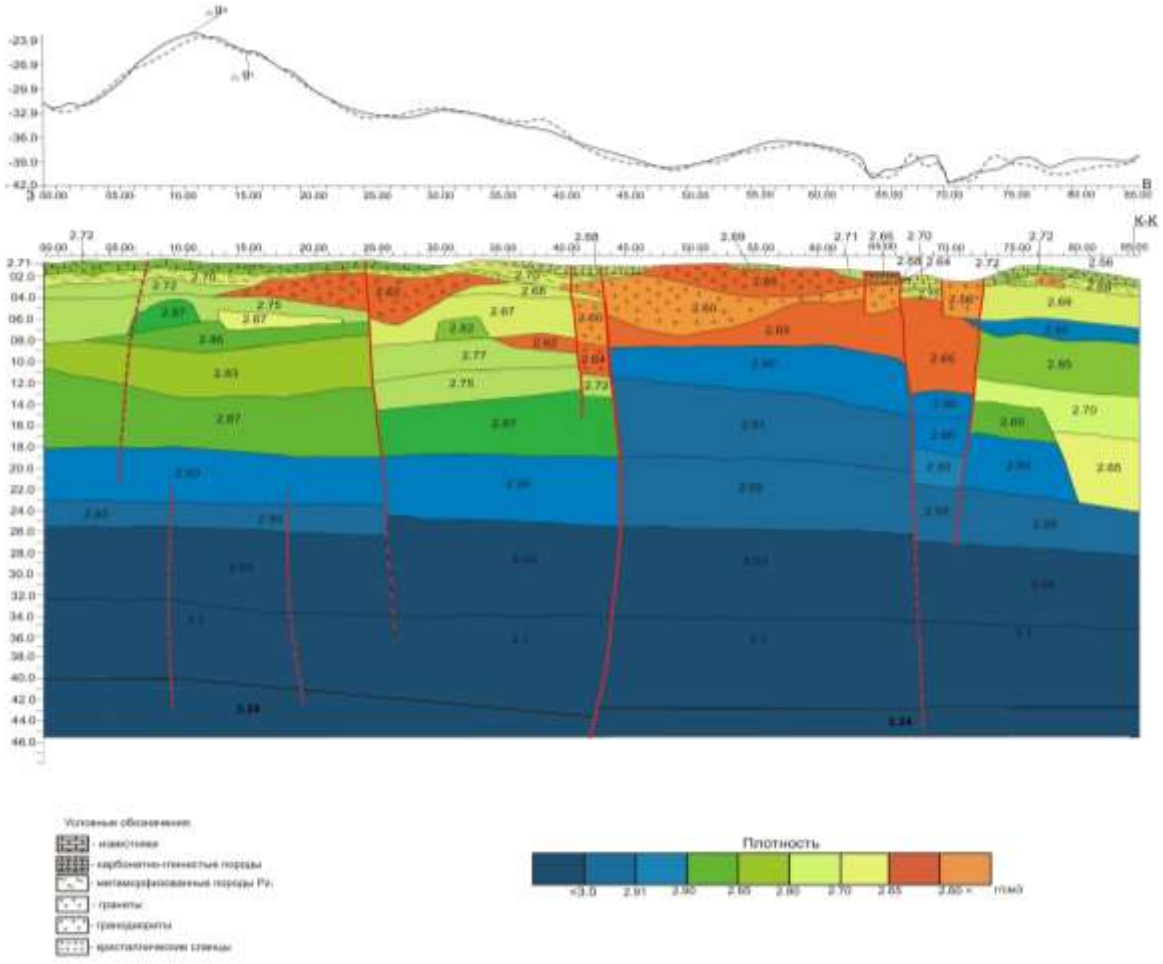
(Beshagach-Samarkand-Navoi-Dul-Dul)

Profile I-I corresponds to geotravers Samarkand – Serikzhan. The General nature of the structure of the geo-density of the slit – layered-block; conditionally, in the first approximation, the surface of the Moho plunges to the East from 40 to 43km. We are allocating a transition zone, the Moho (σ_{ef}=3,10 g/ cm^3), the capacity of which is also increasing in an easterly direction from 3.5 to 5.0 km. overall rather heterogeneous structure of the upper crust (deeper than the roof of

the crystalline basement), where the mapped geoblock with a completely different horizontal sizes (10÷50 km) and effective density (σ_{ef}=2,62-2,90 g/ cm^3). For this part of the section the rule of the General increase of density with depth is not maintained. On the contrary, we note some alternation of blocks with different densities, when objects with low density are adjacent to dense and abnormally dense (for the depths under consideration).
Special attention should be paid to the Eastern part of the profile, where sharply decompressed bodies (σ_{ef}=2.65-2.70 g/ cm^3) stand out at depths not peculiar to them – 10-25 km, at the same time, abnormally dense and sufficiently long blocks are fixed at 4-6 km, which is also not typical for them.

Geo-density model on the profile I-I

The established density distribution in the section is indirectly confirmed by the materials on the profile of GSS Karabekaul-koytash, where within this territory at comparable depths the



waveguide is mapped, characterized by sharply reduced values of the reservoir velocity and effective density (Babajanov *et al.*, 2001; Mordvintsev *et al.*, 2003).
The lower crust is characterized by a more mature structure, and the total increase in density with a depth of 2.9 to 3.1 g/ cm^3 is recorded. The sizes of the allocated geoblocks are 50-90 km, with their power from 3 to 11 km.

The peculiar structure of the upper part of the section (above the surface of the crystalline basement) is fairly calm, you might say, monotonous occurrence of Paleozoic formations, are represented, on the basis of effective petrophysical parameters, mainly the carbonate, terrigenous-carbonate and metamorphic complexes (σ_{ef}=of 2.68-2.72 g/ cm^3) with an abundance of Intrusive bodies of acidic composition (granites σ_{ef}=2,56-2.6 g/ cm^3, granodiorites σ_{ef}=2,6-2,64 g/ cm^3). Intrusions, in some cases, do not reach the Paleozoic surface, located near the roof of the crystal base.

The power of Intrusive formations reaches 5.5-5.0 km, the horizontal dimensions up to 40 km. The bodies of increased basicity in the section are practically not mapped. The exception is a small object, presumably of medium composition (σ_{ef}=2.72 g / cm^3), with horizontal dimensions up to 6.0 km and a capacity of about a kilometer.

The absence of bodies of increased basicity is also indicated by the nature of the change in the magnetic field, which is negative on a significant part of the profile, and its maximum values do not exceed 25 gamma. By the way, there is practically no magnetic anomaly over the selected object, which makes it possible to assume that the object is strongly eroded.

Within the considered part of the geotraverse, several large discontinuous faults are distinguished, probably cutting off the entire earth's crust and serving as boundaries for geoblocks. In the Central part two parallel faults are fixed, which practically divide the profile into two parts: Western and Eastern. The peculiarity of this fault zone is that the area between them is decompressed and can serve as a favorable channel for the penetration of deep fluids.

From the point of view of oil and gas potential prospects and detection of other types of minerals, taking into account modern views (Babajanov *et al.,* 2009, 2005; Trofimov, 2006), the most favorable sections of the profile can be considered, where contacts of abnormally dense and decompressed geological bodies, regardless of their depth. These are, first of all, the Central and Eastern regions of the profile, where objects with σef=2.65-2.70 g/ cm^3 and σef=2.90-2.95 g/ cm^3 touch at different depths. This dependence is established for many regions of Uzbekistan (Babajanov *et al.*, 2005, Sidorova *et al.,* 2006).

This conclusion is also facilitated by the fact that the Paleozoic section above these sections of the profile is composed of limestones and carbonate-terrigenous rocks, which can have the necessary filtration-capacitive properties and structure for the formation of oil and gas traps. The presence of major disruptive faults within these territories is an additional favourable factor.

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