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ANALYSIS OF GEOPHYSICAL FIELDS OF MUD VOLCANOES SOUTHEAST ABSHERON (AZERBAIJAN)

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Mud volcanism is one of the interesting phenomena in nature. They are most developed in Azerbaijan, Turkmenistan, Georgia, Italy, Romania, Iran, China, Japan, Mexico, Venezuela and other countries throughout the mobile belts. In the Azerbaijan there are many active mud volcanoes. The Lokbatan mud volcano had been chosen because it is the very active not in Azerbaijan but all over the world. It erupted 21 times for 200-year history. The last eruption had been occurred on October 25, 2001. Together with gravimetric, geodetic temperature and radiometric studies conducted after this eruption.

In this paper the connection gravity, geotermal and radioactive fields with distributions of mud volcanoes in the southwest Absheron region is analyzed.

Gravity map in Bouguer reduction compiled with a value of density of intermediary slab is 2,67 g/cm^3. Normal value of gravity was calculated according to Gelmert formula 1909 accounting the corrections was -14 mGal. Topography (R=200 km) was taken into consideration when calculating Bouguer anomalies. For sea areas gravimetric map was compiled accounting the amendments for surrounding relief and topography of sea bottom.

The compiled map of Bouguer anomalies of Azerbaijan is not differed from the similar maps of other geosynclinal areas. There a vast areas of intensive minimums and maximums of gravitational field are distinguished (Figure 1).

On the map of gravitational anomalies of Azerbaijan in Bouguer reductions two main strips of negative anomalies linked with elevations of the Greater and Lesser Caucasus and separated by strip of positive and weak negative anomalies are distinguished. Through the lower zones of the Western Azerbaijan stretches Alazan - Middle Kura minimum. Alazan Middle-Kura minimum within Kura, Gabyrry and Alazan interfluve has the most width. On the map of gravitational anomalies of Azerbaijan in Bouguer reductions within the Absheron peninsula, Absheron threshold, Gobustan, Low-Kura area, Baku archipelago, sea continuation, Pri-Caspian-Gobustan area and Cheleken isle, are called Eastern-Azerbaijan. In plainer words the Eastern-Azerbaijan minimum covers the south Caspian and framing it offshore areas. The considered anomaly through the occupied area is considered to be one of the largest among gravitational anomalies of Azerbaijan. The northern border of Azerbaijan minimum coincides with Makhachkala - Krasnovodsk gravitational degree, separating he minimum from maximum of Middle Caspian (maximum of Derbent depression). From the west the area of Eastern-Azerbaijan minimum is limited by Azerbaijan maximum. Minimal value of anomalies is in the sea northward from Absheron peninsula. Value of anomaly here reaches to -125 mGal, is quite unusual for areas of the earth crust with not-high relief (Kadirov). Within the Lesser Caucasus there stretches a zone of strong negative anomalies (-160 mGal). Isolines describes the arc protuberant to the north and reiterative in outline the arc-shaped outlines of this fold-zone. But the axle of minimum doesn't coincide with a more elevated part of the ridge it passes southward the main elevations of the Lesser Caucasus. By intensity of anomalies the Lesser Caucasian minimum takes the first place. The axle zone of that minimum stretches in the direction of Caucasian over 30 km from Geicha lake. The north-eastern border of Lesser Caucasian minimum passes along the line of the most intensive on Caucasus Ardebil - Lachin Dilidjan gravitational step. Azerbaijan minimum with values of gravity varying from zero to 105 mGal, mainly linked with Talysh mountains. One of them stretches northward and connected woth Alazan zone and the other north-westward continuing through the Gyanja to Tbilisi and cover the narrow strip of lavations by the north-western margin of the Lesser Caucasus. Azerbaijan maximum is separated into various by its nature three parts delimited by narrow zones of relative minimums. The first of them Khodjavend-Tbilisi maximum stretching from Daghlyg Garabagh to the north-west through basins of right tributaries of Kura river to the Gori latitude. The second one - Talysh-Vandamian maximum located between the north-western spurs of Talysh mountains and area of Geichai river - Karamaryam. Talysh-Vandamian maximum. This anomaly stretching in the meridianal direction forms the bridge between two stretching relative maximums in the sublatitudinal direction located on the South slope of the

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Greater Caucasus and on the Northern slope of the Lesser Caucasus (Shamkir-Talysh maximum). The third one -Dyubrar-Sheki (Eastern-Caucasian) maximum territorially confined to the Eastern Caucasus, starting from the Caspian Sea to Sheki city. This maximum is stretched by narrow strip north-westward to VladiCaucasus. On the west and particularly on the east restrictions of Azerbaijan maximum are very rare. A bit westward the profile of Guba-Shamakhy-Salyan, Azerbaijan maximum is separated from the Eastern-Azerbaijan minimum almost by rectilinear zone. Area of positive anomalies (40 mGal and higher) corresponds to the Central-Caspian. Along the eastern margin of Azerbaijan maximum gravity varies on the 120 mGal in a distance of 30 km. Shamkir-Talysh maximum occupies the north-eastern part of the Lesser Caucasus and its northern-eastern slope including the Talysh mountainous area where positive anomalies reach 100 mGal and more. Areas around Azerbaijan mud volcanoes are reflected by minima of the Bouguer gravity field (from —120 to —40 mGal) (Kadirov, 2000).

Figure 1 shows mud volcanoes are distributed in a zone of the large minimum of a Bouguer gravity anomaly, where the thickness of the layer of sediments approximately 7-20 km. Detailed survey of gravity field show that in zones of mud volcano development (Lokbatan, Akhtarma-Puta, Gushkhana) there are local negative anomalies of -5, -3 and -2 mGal, respectively.

Temperature measurements have been made in the drill wells. Temperature measurements have been made using a mercury thermometer and a thermistor thermocouple with a balancing Wheatstone Bridge, with resistance calibrated to true temperature in the laboratory to a precision of ± 0.01 ºC using a High accuracy mercury thermometer. Similar temperature measurements, carried out earlier, have shown high temperature gradients in the mud volcano crater area (Mukhtarov and Adigezalov, 1997).

Heat flow density was determined using drill well temperature gradients and heat conductivity of core samples. The onshore heat flow density through the Caspian Sea bottom was determined with the marine thermal probe (Lubimova et al., 1974; Ashirov et al., 1976).

It is necessary to note mud volcanoes are distributed in a zone of the minimum of a thermal field (the thickness of the layer of sediments reaches to 20 km).

It turned out, that mud volcanoes are known by the high values of heat flow density. At the same time in districts of mud volcanism development regional values of heat flow density occurred below medium continental ones (table I).

Two days after the explosion of 25 October 2001, the γ-ray intensity in the crater was as high as 28 µR/hr before returning over a few days to around 10-15 µR/hr. Apart from the isolated high intensity point at the 1.5 km marker on figure 9 (likely due to either radioactive waste being deposited in an old well or due to an open fault bringing up radioactive material from depth; it is not known which), to be noted is the broad increase in total intensity in the neighborhood of the Lokbatan volcano, associated with the ejected mud that was transported from depth.

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Table 1

Field	Presence of mud volcanoes	Heat flow, mW/m^2	
		After Kashkay and Aliyev	After Sukharev et al.
Absheron region			
Kergez	yes		69.9
Lokbatan	- " -	41.9	65.1
Bibi-Eybat	- " -	29.3	72.2
Binagady	- " -	50.2	65.0
Balakhany-Sabunchi-Ramany	- " -	29.3	56.1
Surakhany	- " -	50.2	51.1
Garachukhur	- " -		60.5
Zykh	- " -		53.3
Buzovna-Mashtaga	no	16.7	41.3
Kurdakhany	- " -		37.7
Gala	- " -	46.1	44.4
Turkan	- " -	37.7	38.5
Howsan	- " -		39.3
Gum-deniz	- " -	25.2	43.2
Zirah	no	33.5	33.1
Pirallahy island	- " -	33.7	33.9
Gurgan-deniz	no		48.6
Neft Dashlari	- " -	39.8	46.3
Darvin bank	- " -		59.5
Pre-Kurian region			
Padar	no		23.0
Kalamaddyn	yes	16.8	
Big Harami	- " -	16.8	
Small Harami	- " -	16.8	
Mishovdagh	- " -	25.1	24.0
Kalmas	- " -	16.8	24.7
Bandovan	- " -	25.1	43.1
Pirsaat	- " -	29.3	
Kursangah	- " -	16.8	23.4
Kurovdagh	- " -	20.9	27.6
Garabaghly	no	20.9	27.6
Babazanan	yes		24.7
Khilly	- " -		24.7
Neftchala	- " -		33.6

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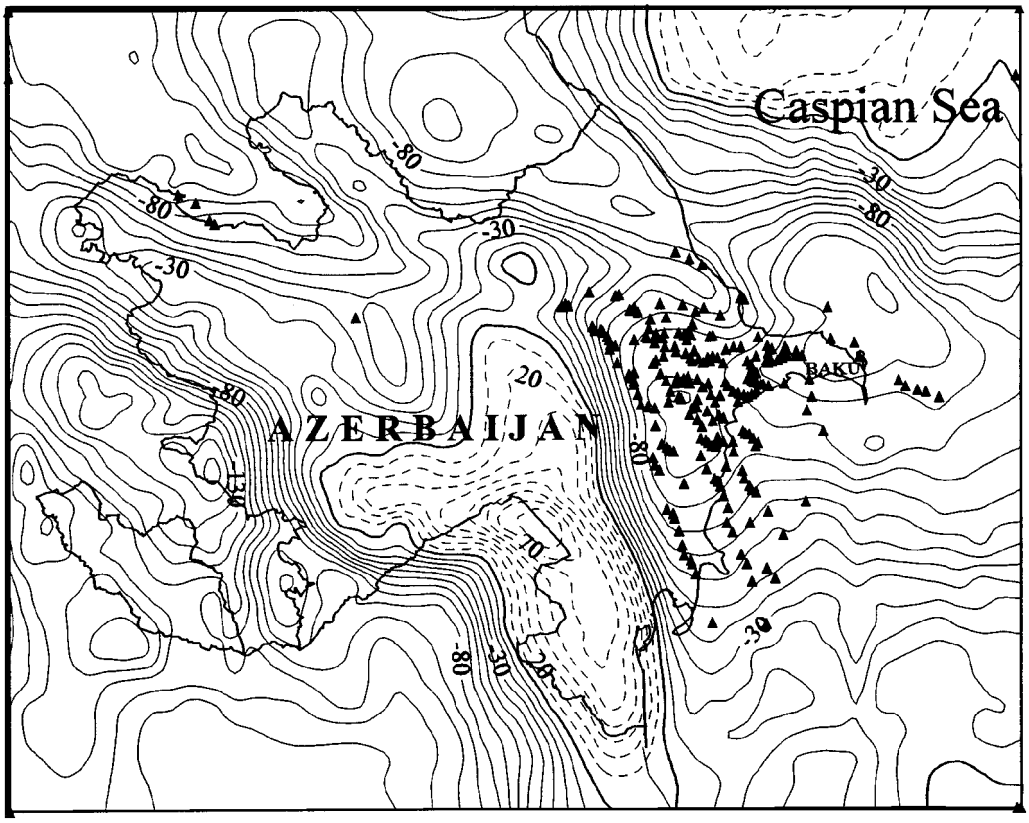

Figure1. Bouguer gravity map and distributions of mad volcanoes (Author F.A.Kadirov)