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Block Structure of the Nakhchivan Autonomous Republic and Seismicity of the Crust

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Abstract: The article provides depth divisions bordering the Araz megazon, which includes the Nakhchivan Autonomous Republic. The seismically active areas of the region are adapted to the large tectonic faults of Anatolia, the Caucasus and Iran, are more seismically active, and the hearth zones are located at the intersections of faults in the Caucasian and anti-Caucasian directions. The presence and seismicity, tension and deformation of the complex tectonic structure of the region, the movement of the mixed block structure to the north are regulated by the rigid Arabian plate, which enters the area intensively wedge-shaped. Seismological surveys are carried out in the territory of the autonomous republic on the basis of an observation network consisting of 4 satellite communication systems, digital telemetric seismic stations manufactured by “Kinemetrics” (USA). Earthquakes are processed using Apple's “Antelope 5.6” software. Local, near and far earthquakes, explosions, volcanoes, landslides are processed through the network of telemetry stations. The catalog of earthquakes is compiled on the basis of data from telemetry stations. This catalog defines the parameters of earthquake centers (T, φ, λ, h and ml). The territory of Nakhchivan AR is divided into Ordubad, Nakhchivan, Shahbuz, Sadarak blocks, which are seismically tectonically separated by pan-Caucasian and transverse faults, and earthquakes of magnitude ml ≥4 are observed at the borders of the blocks.

Key words: Earthquake, tectonic blocks, fractures, seismicity

1. Introduction

The Nakhchivan Autonomous Republic is located in the southern, south-eastern part of the Caucasus. Its territory is located between 38 °51' - 39 °47 'north latitude and 44 °46'- 46 °10' east longitude. Almost 66% of the area is above 1000 m above sea level. Daralayaz stretches in the north and Zangazur range in the east. The southern and south-western part of the area stretching along the Araz River is the plains of the third and fourth period sediments located at an altitude of 600-1400 m [1].

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The territory of the Nakhchivan Autonomous Republic is included in the Araz tectonic mega-zone and is bordered by Girratag in the north-east, Ashagi Araz (Palmyra-Absheron) in the southeast, North Tabriz in the south-west and Agridag in the north-west. Within the Nakhchivan Autonomous Republic, it is located as the central part of the mega-zone - the north-eastern flank is located in Armenia, the south-western flank in Iran, and partly in Turkey [2]. The seismically active areas of the region in question are adapted to the large tectonic faults of Anatolia, the Caucasus and Iran, are more seismically active, and the hearth zones are located at the intersections of faults in the Caucasian and anti-Caucasian directions. The main role in the formation of the modern relief of the area is played by uplift, which is associated with modern uplift processes and is an important factor in the formation of earthquakes. In the mega-zone with compression deformation, shrinkage of the crust, wrinkles and overlaps, inverse filings, bending and horizontal displacement of the uplift and subsidence-type blocks occurred. Studies show that the evolutionary history of the autonomous republic and the adjacent Anatolian and Iranian provinces corresponds to the scheme of plate tectonics. The alpine geology, volcanism, seismicity, tension and deformation of this region, the mixed block structure, the northward movement are regulated by the rigid Arabian plate, which enters the area intensively in the form of a wedge.

The geomorphology of the territory of Nakhchivan shows the complexity of its deep geological structure and blockade. According to the results of research, all-Caucasian fractures are considered to be Paleozoic, and anti-Caucasian fractures are considered to be Mesozoic [3].

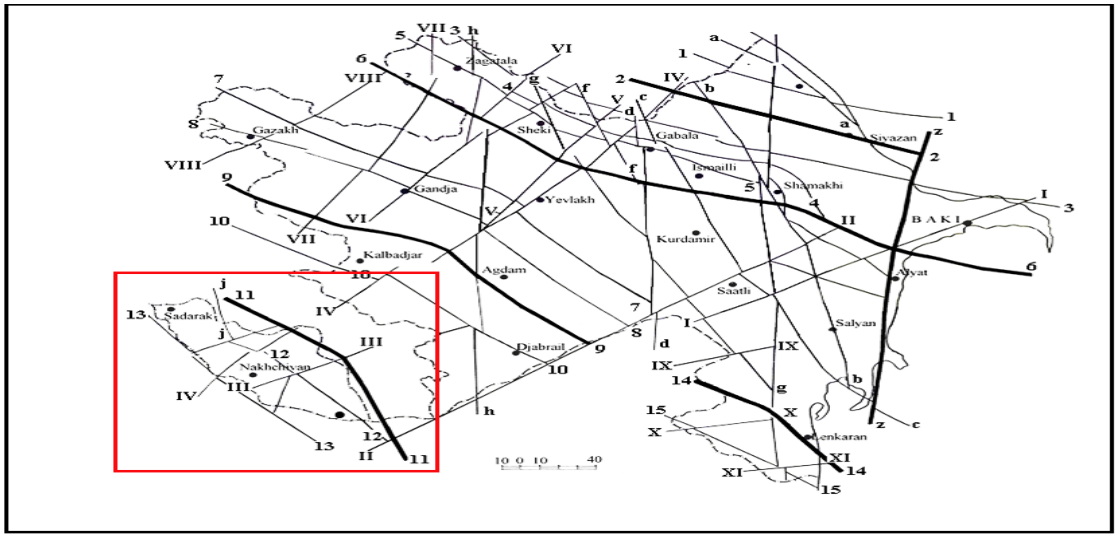

Figure1. Deep fractures of the pre-alpaca foundation of Azerbaijan (T. Kangarli)

Pan-Caucasian fractures

11-11 Zangazur

Transverse fractures

I-II Palmyra - Absheron

12-12 Sharur-Ordubad **III-III Nehram - Lakatag**

13-13 South-Araz **IV-IV Arpa – Samur**

Orthogonal fractures

J-J Sharur - Goycha

Time-spatial distribution of seismicity, determination of spatial conditions of strong earthquake foci, analysis of their manifestation and characteristics on the earth's surface are the main research areas of seismic hazard assessment of the area. After the separation of seismogenic zones in the Nakhchivan Autonomous Republic and adjacent border areas and the assessment of the probable maximum intensity of these zones, the importance of studying seismic activity arises, which is of particular importance for long-term seismology forecasting. From this point of view, it is very important to study the seismic regime from weak to strong shocks. During historical periods, strong earthquakes have occurred in the Nakhchivan Autonomous Republic and adjacent border areas. The Nakhchivan Autonomous Republic and adjacent border areas represent the boundaries of active faults and host strong earthquakes.

Seismological surveys are carried out in the territory of the Autonomous Republic on the basis of an observation network consisting of 4 satellite communication systems, digital telemetric seismic stations manufactured by Kinemetrics (USA). Earthquakes are processed using Apple's Antelope 5.6 software. Local, near and far earthquakes, explosions, volcanoes, landslides are processed through the network of telemetry stations. The catalog of earthquakes is compiled on the basis of data from telemetry stations. This catalog defines the parameters of earthquake centers (T, φ, λ, h and ml).

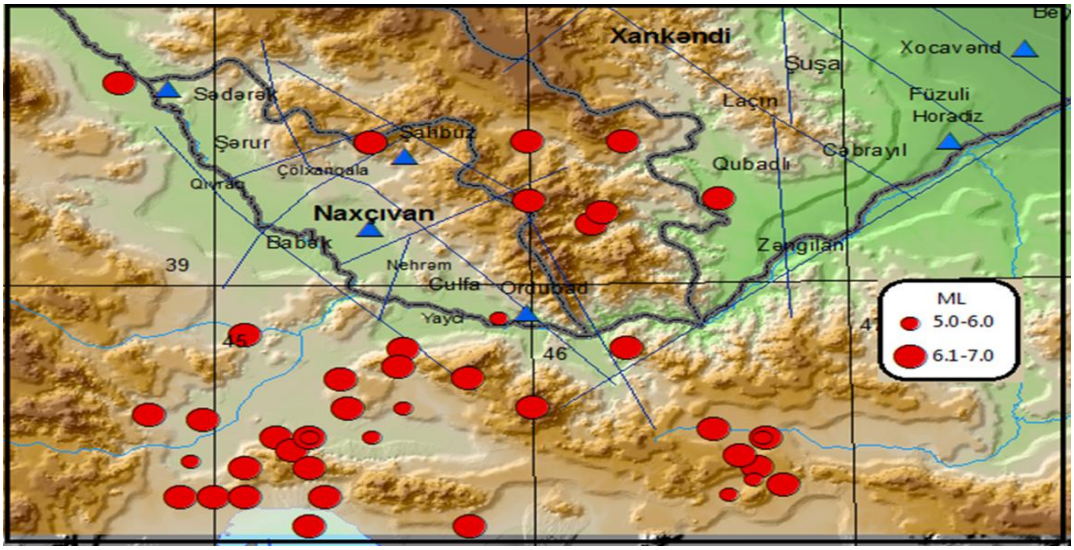

Figure 2. Epicenter map of earthquakes with magnitude ml≥ 5,0 in the Nakhchivan Autonomous Republic and border areas in 1905-2015

The territory of Nakhchivan AR is divided into Ordubad, Nakhchivan, Shahbuz, Sadarak blocks, which are seismotectonically separated by pan-Caucasian and transverse faults and differ in seismicity. Strong and medium-strong earthquakes are known in Nakhchivan, mainly within and near the Zangazur seismogenic sub-block, in the north-eastern segments of the Lower Araz fault line, south-east (Iran-Islamic Republic) and north-west (Turkey-Armenia) of the Sadarak seismotectonic block. observed in segments. The seismically active block is Ordubad seismotectonic block. Ordubad seismotectonic block Sharur - Ordubad is divided into Zangazur and Ordubad semi-blocks along the deep fault. The Shahbuz seismotectonic block combines the south-eastern wing of the Zangazur anticlinorium with the western tectonic elements of the Ordubad syncline. The block is separated from the north by Dabekli and from the south by Sharur-Ordubad. The Nakhchivan seismotectonic block was separated from the Shahbuz seismotectonic block by the Sharur-Ordubad extraneous deep fault, covering the Sharur-Julfa anticline and the Nakhchivan sedimentary mulch morphostructures. The Sadarak seismotectonic block is separated from the Nakhchivan and Shahbuz seismotectonic blocks by the Validagh-Qabagyal tectonic fault and covers the Sharur-Julfa and Daralagoz tectonic elements.

The intensity of earthquakes that occurred in different years in the territory of the Nakhchivan Autonomous Republic was investigated.

Figure3. Map of intensity of earthquakes in different years in the territory of Nakhchivan Autonomous Republic

Strong earthquakes IV.906 In the epicenter of the Sadarak seismotectonic block (8 points according to the CEC-64 schedule) there was a strong earthquake in the epicenter and adjacent areas and resulted in the loss of life. The Zangazur earthquake, which was felt in an area of 100,000 km, resulted in the loss of life in Armenia and the Nakhchivan Autonomous Republic, and about 100 villages were completely or partially destroyed and

severely damaged. Strong earthquakes also occurred in the Zangazur block in the following periods. Let's look at the strong earthquakes in that block. The following earthquakes are listed according to the CEC-64 schedule: on September 16, 1968, earthquakes with intensity I0 = 6 points, on November 9, 1968, earthquakes with intensity I0 = 7.5 points were observed. These earthquakes were mainly observed in the north-eastern and north-western segments of the Dabekli fault, which extends in a pan-Caucasian direction. In the Nakhchivan seismotectonic block in the north-eastern part of the Lower Araz fault line on 13.04.1851 I0 = 6 points, on 15.05.1888 I0 = 6 points, in the intensity, in the Sadarak seismotectonic block on 27.07.1840 and 17.05.1841 Earthquakes with intensity I0 = 7.5 points were recorded in No high-intensity earthquakes were observed in the Shahbuz seismotectonic block. Interestingly, few weak tremors were observed in the northern region of Nakhchivan, where no strong earthquakes were recorded. Thus, the analysis of the distribution of weak earthquakes shows that in the northern part of Nakhchivan AR there are a number of seismically active zones, and in some of them very strong earthquakes have occurred in the past. The operatively prepared macroseismic areas of earthquakes in Nakhchivan AR are mainly in the direction of elongation of regional and inter-block depth tectonic faults, are asymmetric in shape and Pleistocene areas (areas with disjunctive dislocations) usually cover small areas. As a result, it can be said that in the Ordubad and Sadarak seismotectonic blocks there are fracture and hearth zones that can generate strong earthquakes (M≥6.5), and potential hearth zones with maximum magnitude earthquakes to the territory of the republic according to MSK-64 schedule VIII-IX may be exposed.

2. Results

1.The Nakhchivan Autonomous Republic has a complex tectonic structure and consists of 4 tectonic blocks separated by pan-Caucasian and transverse faults.

2. The territory of the Nakhchivan Autonomous Republic is mainly affected by strong earthquakes in the border areas (Iran, Turkey, Armenia).

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