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Geophysics

Monitoring of the Influence of the Technical Effect upon the Mixar Fault by Geophysical and Geodetic Methods

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ABSTRACT. In order to control the possible activation of the fault (intersecting the water reservoir of "Tishrin" hydroscheme on the Euphrates) during the reservoir's filling geophysical and geodetic investigations were carried out. The influence of the filling process upon the surfacial part has been ascertained; in two years from starting the filling it is stabilized. © *2008 Bull. Georg. Natl. Acad. Sci.*

Key words: *Mixar fault, stress-strain state, water discharge.*

The Euphrates valley spreads out dozens of kilometers and includes the section of "Tishrin" hydroscheme location, where it follows the Mixar regional fault (further – fault №41) (Fig.2). The possibility of contemporary activity of this fault is very important for exploitation of the structure. If tectonic zone №41 is "alive", then changes of stress-strain state should be observed in this zone and its surrounding district. This, in its turn, should have an effect on the structure of the geophysical field, water expenditure and variation of displacement of surfacial parts of the fault in the mentioned section [1]. In this connection a series of investigations was carried out using the following methods:

Cross-Hole survey. At №41 fault section the method of seismic translucence was used: from both sides of the fault two boreholes (300 m) № 754 and № 755 were drilled. The distance between the boreholes is 95 m. They are disposed on the opposite sides of the fault on the left side of the water reservoir, along the dam (Figs.1, Fig.2). In each borehole, at various depths, six recording points consisting of two geophones were disposed. Elastic waves were generated by explosions from two points (Figs 1, 2).

Observations in boreholes. In periods of the dam's construction and filling the water reservoir, in order to study the hydrogeologic regime of the rocky massif surrounding the fault, water discharge was observed in borehole № 342, which was in the fault zone and the depth of which was 50 m. At the same time the regime of

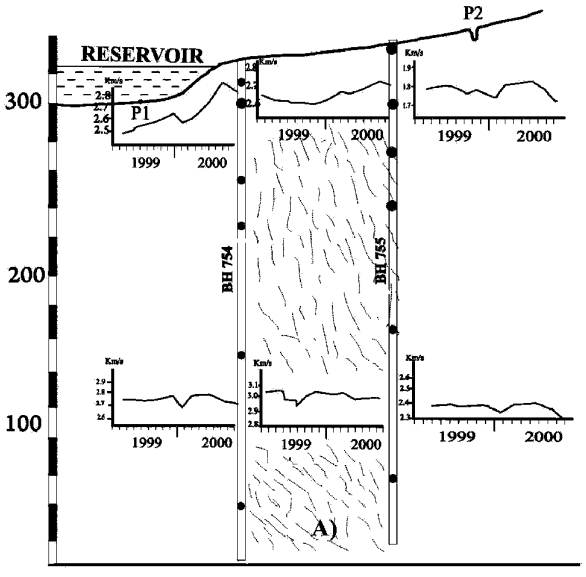

Fig. 1.

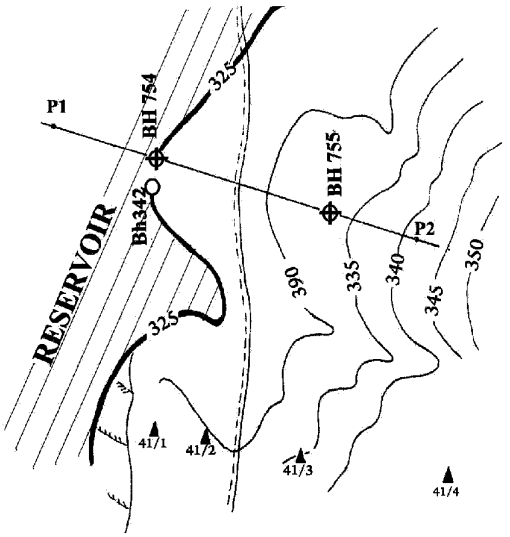

Fig. 2.

the level of underground waters was studied (Figs 3, 4).

Geodetic observations. In order to study the movement of blocks in the surfacial zone of the fault, cycles of regime geodetic observations upon vertical H and horizontal L movements of special benchmarks were carried out. Fig. 2 shows the disposition of 41/1, 41/2, 41/3 and 41/4 geodetic benchmarks.

For all types of observations the graphs of corresponding parameter variations are constructed according to cycles: velocities of longitudinal waves V_p (Fig. 3); water discharge and level of underground waters (Figs 3, 4); distances between benchmarks and their absolute markers (Fig. 4, a-g); all of them are considered in compliance with the regime of the water reservoir's filling (Fig.2). Analysis of these graphs gives us every reason to conclude the following:

1. At the beginning of the reservoir's filling, from 01.08.1999 to May 2000 mainly in the surfacial zone cracks and voids were saturated with water. Due to pressure of water on the foundation the stress-strain state of the massif is also changed. These two factors condition the increase of V_p velocities at the given section (Fig.1).

2. After November, 2000, in the surfacial zone stabilization of V_p velocities begins, which indicates the end of the process of water penetration into cracks and complete water saturation of this section of the massif.

3. The influence of the factor of the reservoir's filling upon values of V_p practically spreads from the surface to 50 m depth and decreases far from the water reservoir. This influence decreases at 100 m distance from the bank.

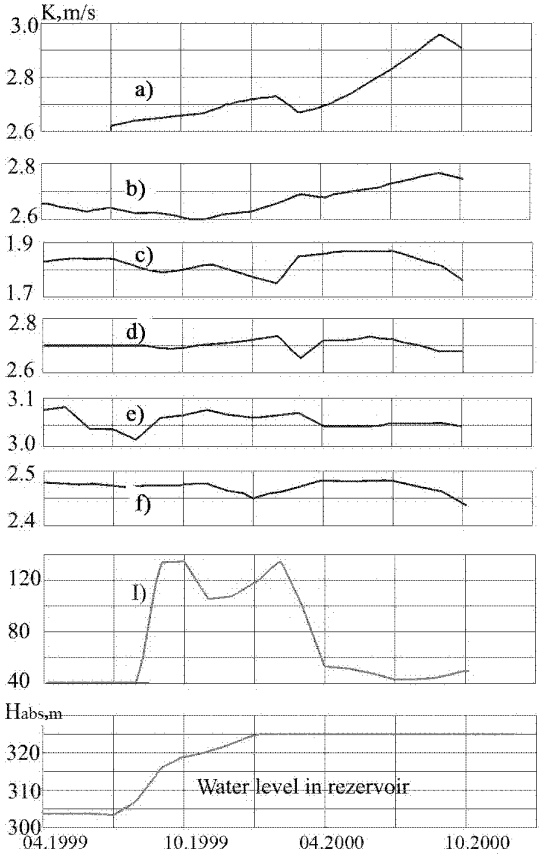

Fig. 3.

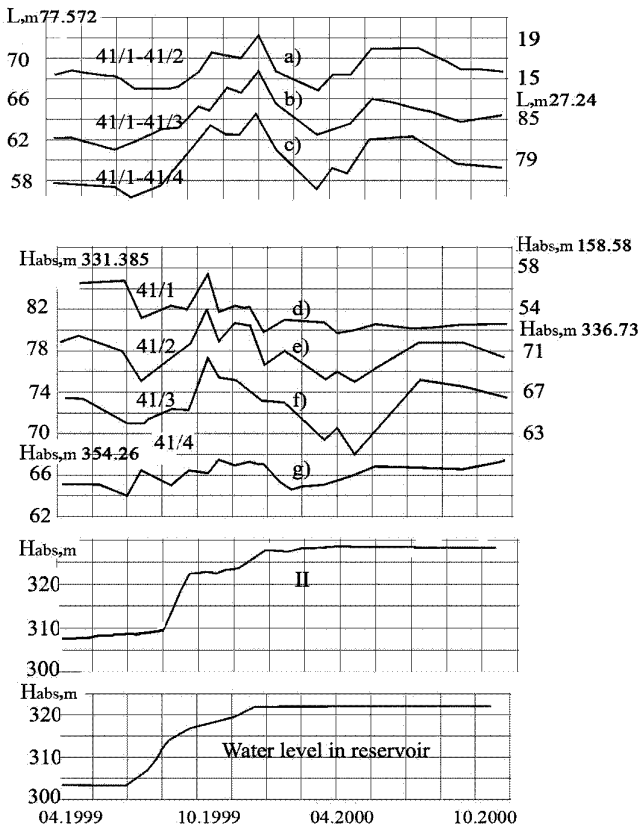

Fig. 4.

4. Good correlation between the level of underground water and regime of the reservoir's filling is due to strongly fractured cracked coastal part of the massif.

5. The coincidence of maximum intensity of water discharge in the borehole with water level increase can be explained by the same reason (Fig.3, I).

6. The discharge regime (Q l/min) in the borehole practically returned to the initial values (Fig. 3, I) and this indicates irreversible processes in the filtration properties of the massif and absence of new filtration flows.

7. Insignificant variability of H and L values before the reservoir is filled may be connected with large-scale changes of the stress-strain state of the region of "Tishrin" hydroscheme.

8. From 01.08.90 to May 2000 the influence of the reservoir's filling upon the coastal part of fault zone №41 is observed. At the same time, the displacement of benchmark 41/4 – most distant from the reservoir – undergoes minimum changes (Fig. 4, g). This means that the influence of the reservoir upon the massif is limited to 100 m coast line of its head part.

9. From April 2001 the tendency of H and L quantities to return to their average values indicates the stabilization of the state of the fault zone's massif on the coast line of the water reservoir (Fig.4, a-g).

10. After November 2000 the process of water penetration into cracks ends and hence development of pore pressure and process of swelling ends too. Stress-strain state of the test area №41 fault is stabilized.

გეოფიზიკა

მიქსარის რღვევაზე ტექტოგენური ზემოქმედების გავლენის მონიტორინგი გეოფიზიკური და გეოდეზიური მეთოდებით

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სირიის არაბთა რესპუბლიკაში მდინარე ევფრატზე "ტიშრინის" ჰიდროკვანძის წყალსაცავის შევსებასთან დაკავშირებით მისი გადამკვეთი მიქსარის რეგიონალური რღვევის შესაძლო გააქტიურების კონტროლის მიზნით ჩატარებულ იქნა რეჟიმული გეოფიზიკური და გეოდეზიური კვლევების სერია. დადგინდა, რომ წყალსაცავის შევსების მომენტიდან იწყება მისი ზემოქმედება რღვევის სანაპირო ზონის ზედაპირული ნაწილის ჰიდროგეოლოგიურ და დაძაბულ-დეფორმირებულ წონასწორობაზე, ხოლო ორ წელიწადში წყალსაცავის დონის საპროექტო ნიშნულამდე მიღწევის შემდეგ ეს პროცესი სტაბილურდება.

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