A strong earthquake destroying a number of populated areas and killing a considerable part of the population occurred in northwestern Armenia on December 7, 1988 at 11:41 a.m. local time. Maximum destruction was noted in the region of Spitak city, where the intensity of the earthquake is estimated to be 10. A zone of severe destruction extended from Leninakan to Kirovokan. In Leninakan the intensity of the tremors was estimated to be 9 and in Kirovokan, 8-9. On the seismic regionalization map in the building code SNiP II-7-81, the cities of Spitak and Kirovokan are assigned to an intensity 7 zone with a frequency of such earthquakes of once in 100 years, Leninakan is located in an intensity 8 zone with a frequency of once in 1000 years. The earthquake of December 7, 1988 in its intensity considerably exceeded the expected events. Therefore, the entire intensity 7 zone of the Spitak earthquake has presently been changed to an intensity 9 zone in accordance with SNiP 7-81.

The catastrophic character of the destruction related to the Spitak earthquake in many respects is due to the characteristics of the seismic process at the focal zone and extremely unfavorable surface ground conditions. According to the data of the network of regional seismic stations, the process of release of seismic energy at the focus was a multiple event and the shocks that followed with a small time delay and were imposed one upon another caused additional seismic loads. The epicenter of the main shock with a magnitude \( M = 6.8-7.0 \) was located 6 km north of Spitak. The main shock was accompanied after 4 min 23 sec by a strong aftershock with \( M = 5.8 \), the epicenter of which was located 5 km west of Spitak. After the principal aftershock, an active aftershock process began simultaneously on an area with a length of about 50 km and width of 12 km: during December 7-8, an additional 49 earthquakes occurred here of energy class \( K = 9-13 \). This process, gradually diminishing, lasted throughout December 1988 and January 1989, and individual shocks were noted also at later times.

The indicated region of aftershocks was confined to the valley between the Badum and Panlak ranges, to the zone of the sublatitudinal deep Sevan--Akera fault, characterized by a steep dip (to 80°) southward. The Spitak earthquake occurred as a result of upthrow along a plane having a strike close the strike of the Sevan--Akera fault, but dipping at an angle of about 60° northward. As a result of the movement, a fracture with a length of about 10-12 km formed on the surface, the northeastern wall of this fracture was uplifted 1.5 m above the southwestern wall, the horizontal separation reached 1 m. The region of active aftershock processes encompassed a depth from 5 to 40 km. The foci of the main shock and principal aftershock were located at depths of 10-20 km.

The isoseisms of the Spitak earthquake extend in a WNW direction, which coincides with the direction of the deep fault. The local seismic-geological and engineering-geological conditions of the region have a considerable effect on the configuration of the isoseisms and intensity of the seismic vibrations. According to the preliminary data of the engineering-seismometric stations located in Leninakan, the displacements recorded by the SVM instruments at four points in this city reached 12-18 mm. The maximum amplitude of the horizontal accelerations recorded by an accelerograph in Gukasyan (intensity 8 zone) reached 0.15g. The dominant periods for the accelerations correspond to 0.20-0.25 sec and 0.6 sec.

All hydropower installations in Armenia were to one extent or another subjected to the effect of the Spitak earthquake (Fig. 1). A special commission of the USSR Ministry of Power and Electrification (Minénergo) worked in Armenia to assess their state after the described earthquake. Some results of the inspections are given below. The hydropower installations of the Debet, Sevan--Razdan, and Vorotan cascades, as well as the Leninakan hydroelectric station, were examined.

Only the Leninakan hydростation on the Akhuryan River with a head of 116 m was located in the zone of rather strong seismic actions, the main structures of which located on Quaternary deposits experienced tremors with an intensity of 7-8, and the powerhouse located on basals in the canyon of the Akhuryan River was subjected to an intensity 6 earthquake. According to the data of Gidroproekt, the indicated structures were designed for intensity 6 seismic loads.
The station was not operating at the time of inspection. It was shut down after the Spitak earthquake due to damages on the intake works and other structures. Vertical through cracks with a width of 1.5-2.0 mm occurred on the retaining walls of the daily storage over their entire height (wall height 2.0-2.5 m). The water-intake building has 3rd-degree damage in the form of deep, and in some cases through, cracks in the walls (Fig. 2).

The powerhouse of the hydrostation does not have visible disturbances of the load-bearing structures. Hairline cracks are seen on the inside surfaces of the walls (in some places with collapse of the plaster layer), i.e., 2nd-degree damage. A vertical crack of considerable length formed in the metal gate valve of the penstock. The outer walls of the battery room and auxiliary building were broken by a rockfall caused by the earthquake; the diameter of the holes was 0.5-0.8 m. The station and equipment require repair.