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GEOPHYSICS

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Abstract

Full Text

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GEOPHYSICS

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THE EARTHQUAKE IN THE TOWN OF KAMEN-NA-OBI ON 15 FEBRUARY 1965

(Presented by Academician A. A. Trofimuk, 24 III 1965)

On 15 February 1965, at 19 hr 35 min local time, an earthquake occurred in the area of the town of Kamen-na-Obi (Altai Krai), the intensity of which at the epicenter, according to a preliminary estimate, reached 7 points on the GOST 6249-52 scale. Since, under the currently valid seismic zoning scheme of the territory of the USSR ⁽¹⁾, the town of Kamen-na-Obi is assigned to the 5-point zone, the Kamen earthquake requires study.

Instrumental data. Until 1964, the seismic stations of the USSR, including the highly sensitive expeditionary stations of the CSE and the recently commissioned stations of the Institute of Geology and Geophysics of the Siberian Branch of the Academy of Sciences of the USSR (IGG), had recorded in the area of the Ob arc only isolated weak shocks that were interpreted with uncertainty ⁽²⁾. A revival of seismic activity in this area began in the spring of 1964. After a fairly strong shock on 12 VII (8 in Fig. 1; epicenter coordinates $\varphi = 53^{\circ}54' N$, $\lambda = 81^{\circ}24' E$, time at the focus 20 hr 01 min 05 sec, focal depth from the *sP* phase 18 km, $K = 12.5$), there followed a complete lull. Until 1 XI, according to data from the highly sensitive temporary stations of the IGG, shocks of class $K \geq 5$ were absent; until 15 II, according to data from the network of permanent IGG stations, shocks of class $K \geq 7.5-8$ were absent.

Fig. 1. Isoseists of the earthquake of 15 II and epicenters of 1964-1965.

The main shock of the earthquake of 15 II (9 in Fig. 1) was recorded by all reference stations of the Unified System of Seismic Observations of the USSR (USSO). The coordinates of its epicenter, determined at the IGG, Siberian Branch of the Academy of Sciences of the USSR, were: $\varphi = 53^{\circ}43' N$; $\lambda = 81^{\circ}22' E$; origin time according to Greenwich, 12 hr 35 min 00 sec. Reprocessing of all USSO data on an electronic computer, carried out at the Institute of Physics of the

Earth, Academy of Sciences of the USSR ⁽³⁾, gave the epicenter coordinates $\varphi = 53^{\circ}46' \text{ N}$, $\lambda = 81^{\circ}25' \text{ E}$, and origin time 12 hr 34 min 57 sec. The earthquake magnitude was $M = 5\frac{1}{4}-5\frac{1}{2}$ ($K = 13.5$), and the focal depth from the *sP* phase was 16 km. By 10 III, about 40 aftershocks of class $K = 6$ and higher had been recorded instrumentally and noted by the population; of these, the strongest were the shocks on 16 II at 10 hr 57 min 00 sec, $\varphi = 53^{\circ}40' \text{ N}$, $\lambda = 81^{\circ}17' \text{ E}$, $K = 11$, and on 28 II at 19 hr 33 min 12 sec, $\varphi = 53^{\circ}36' \text{ N}$, $\lambda = 81^{\circ}37' \text{ E}$, $K = 11$ (14 and 17 in Fig. 1). The positions of the instrumental epicenters of the most important shocks are shown in Fig. 1; the shocks are numbered in the order of their occurrence. The mean error in determining the epicenters is 15–20 km.

Non-instrumental data. With the participation of N. V. Shebalin, staff members of the Institute of Geology and Geophysics examined 39 populated localities in the vicinity of the town of Kamen-na-Obi. The overwhelming majority of buildings here are wooden log houses, with stoves having iron, more rarely brick, flues. Among brick houses, one-story buildings with wooden floors predominate; as a rule they are built with low-quality mortar. In the epicentral zone the following are characteristic of such buildings: collapse or cracking of brick flues, stoves falling out of walls and cracking of their masonry, bricks falling out in stove shafts, through cracking of the masonry of main walls (oblique cracks through openings, vertical and oblique cracks in piers), cracks along the junction of foundations and walls, collapse of plaster, etc., which as a whole gives an estimate of the strength of the shock in the epicentral zone as 7, locally 7–8 points.

With distance from the town of Kamen-na-Obi by 15–20 km the damage decreases; however, the area over which perceptible vibrations were felt is very large: there are numerous reports from Novosibirsk and Barnaul (about 200 km from the epicenter), where the intensity of the vibrations reached 3–4 points, as well as isolated reports from Omsk, Krasnoyarsk, and Tomsk. A diagram of the first isoseists of the earthquake is given in Fig. 1. The area bounded by the 7-point isoseist exceeds 500 km². An estimate of the depth of the earthquake focus from the ratio of intensity at the epicenter to magnitude gives 15 km; from the arrangement of the isoseists (4), 15–20 km.

The territory of the town of Kamen-na-Obi is distinguished by a great variegation of ground conditions, which was clearly reflected in the manifestation of the earthquake of 15 February. The northern part of the town is characterized by a thick stratum of sands and loams, partly water-saturated, with a stable groundwater level at a depth of 15–18 m. Shaking here reached 7 points, increasing to 7–8 points toward the northwestern outskirts of the town. In the central part of the town, dense chlorite schists (Middle Devonian) occur directly at the surface; shaking here is estimated at 6 points, increasing to 6–7 points in places of local deepening of the bedrock, as well as in the shore zone. Still farther south there is a belt of heavily water-saturated loams (with individual outlets of groundwater to the surface) up to 10–12 m thick, overlying bedrock; the strength of the

shaking was 7 points, increasing to 7-8 points on the western outskirts of the town. The southern part of the town is composed of thick pebble deposits with a low groundwater level; shaking was 7 points.

Until recently, in seismic zoning, great importance was not attached to fragmentary information about perceptible earthquakes in the Ob Arc region (2). During the investigation it proved possible to collect clear information on a 6-point earthquake of 7 April 1914, as well as less certain data on several local 4-5-point earthquakes. A preliminary estimate on the basis of these data gives for Kamen-na-Obi an average recurrence of 7-point shocks of once in 160 years. The average recurrence of earthquakes of class 14 per each 1000 km² of the area adjacent to Kamen-na-Obi, with an area of approximately 8000 km², may be estimated as once in 1500-2000 years. If one takes into account that there are definite data on the Berdsk earthquake of 1882, as well as on a series of Kuznetsk earthquakes at the turn of the nineteenth and twentieth centuries (2, 5), it must be recognized that the seismic-zoning scheme for the territory of the quadrangle Novosibirsk–Novokuznetsk–Barnaul–Kamen-na-Obi needs serious refinement.

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Note: Figure translations are in progress. See original paper for figures.

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