

REGISTRATION OF EARTHQUAKES IN 2013 AND 2020 IN THE KHANTY-MANSIYSK OIL AND GAS PROVINCE

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In the Khanty-Mansiysk oil and gas province, in the 1980s, the Priobskoye oil field was discovered, one of the largest in terms of area, but with low-permeability reservoirs. To increase the level of oil production in this area, since 2006, powerful hydraulic fracturing (hydraulic fracturing) has been carried out. Mass hydraulic fracturing is the key technology for the development of the southern part of the Priobskoye field [Kolupaev et al., 2019]. According to various data, there are more than 50 cases when the development of hydrocarbon deposits has led to a noticeable change in the seismic regime of the area of work. These data are generalized into a certain dependence of the time of occurrence of seismicity on the time of the start of development and on the time of the beginning of fluid injection before the appearance of seismicity and before the occurrence of the maximum earthquake. It turned out that approximately 5–10 years elapse from the time when high-pressure fluid injection begins before the onset of noticeable seismicity and approximately 10–15 years before the maximum earthquake [Adushkin, Turuntaev, 2015]. The area of the Priobskoye deposit has always been classified as an aseismic area and, therefore, the network of seismic stations of the FRC EGS RAS has not been developed here. The possibilities of registering seismic events by regional networks of stations in the vicinity of the field have been evaluated in a number of works and are: for the Ural network, approximately $ML=3.0-3.2$ in [Malovichko et al., 2020], for the Altai-Sayan regional network, approximately the same level [Emanov et al., 2020]. For a more confident determination of earthquake parameters in the area of the Priobskoye field, data from the IMS CTBTO network, which consists of highly sensitive seismic arrays, are used. On February 21, 2020 at 20h58m with $M=3.5$, 30 km northeast of Khanty-Mansiysk, a seismic event was recorded by all seismic stations of the Ural region, many stations of the Altai-Sayan network, stations of the FRC EGS RAS at the EEP and -ove Yamal, station "Tiksi" in Yakutia, as well as individual stations of the Kazakhstan network of the IGI NNC RK, which made it possible to obtain a good environment for the epicenter and refine the parameters of the hypocenter, originally obtained from the limited MIRAS network in the Urals. It is known that an earthquake of comparable magnitude was recorded close to this source on March 22, 2013. Work has been carried out to refine the magnitude of the phenomena. It is assumed that the earthquakes under consideration, which occurred somewhat to the west of the center of the vast territory of the Priobskoye field, are most likely of an induced nature. They occurred 7 and 14 years after the first powerful hydraulic fracturing in this field. The capabilities of the network in this area do not allow recording weaker seismicity.