THE INTERNATIONAL CONFERENCE ON THE 120TH ANNIVERSARY OF THE BULNAY EARTHQUAKE: ADVANCES IN ASTRONOMY AND GEOPHYSICS

"STUDY OF SEISMIC REGIMES: A CASE STUDY OF SELENGE PROVINCE"

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Introduction

Selenge province is a seismically active region characterized by major faults formed as a result of strong earthquakes. On February 6, 1957, an earthquake with a magnitude of Ml=6.5 occurred in the Burenbuteel area, located within in study area. The earthquake was felt with intensities of VII–VIII in the Tsagaannuur-Zelter Valley, as well as in the districts of Sukhbaatar, Zuunburen, and Shaamar. More than 30 years later, on May 13, 1989, another earthquake with a magnitude of Ml=5.8 occurred in the same seismic source zone, indicating that the area remains seismically active. This study analyzes the seismic activity in the Selenge region, determines its spatial and temporal relationships, and presents a detailed distribution map of earthquake epicenters *(С.Д Хилько, Р.А.Курушин, В.М.Кочетков, Л.А.Мишарина, В.И Мельниква, Н.А.Гилева, С.В.Ласточкин, И.Балжинням, Д.Мөнхөө , "Землятрясения и основы сейсмического районирования монголии", Москва, 1985), ("Earthquake" Adyia M).*

Tectonic setting

Mongolia's territory is geologically divided into several zones, and Selenge Province belongs to the Orkhon-Selenge basin zone. More than 15% of all major earthquakes that have occurred in Mongolia have taken place within this zone. Selenge Province lies in a seismically active region, where most earthquake epicenters are associated with deep Cenozoic faults that follow the calderas of extinct volcanoes and areas with volcanic basalt formations. Among these, epicenters of strong earthquakes with magnitudes ranging from 5.0 to 6.5 are located along seismic fault zones in the Khangai and Burenbuteel ranges. For instance, on February 6, 1957, a magnitude 6.5 earthquake occurred at a seismic source located at 50.00°N latitude and 105.50°E longitude. According to seismologist L. Natsag-Yum, this region is considered the northern extension of the Mogod–Ongi Gol fault zone.

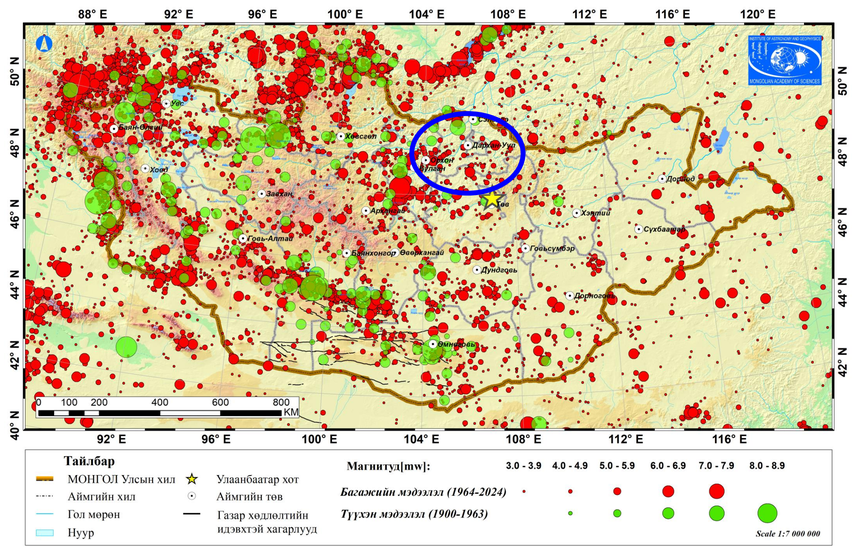

Figure 1. Map of earthquake epicenter distribution in Mongolia, with the study area marked in blue.

The Burenbuteel Earthquake

On February 6, 1957, at 20:34:58, a powerful earthquake with a magnitude of M = 6.5 occurred in the Burenbuteel of Selenge Province, located at 50.0°N latitude and 105.5°E longitude. At the time, Russian researchers S.I. Golenetsky and K.V. Pshennikov from the Institute of the Earth's Crust in Irkutsk conducted studies on the impact of this earthquake across various regions including Irkutsk and Ulan-Ude cities, the southern part of Lake Baikal, and the northern regions of Mongolia, particularly Selenge and Bulgan provinces. Based on their research, they developed a map showing the isoseismal zones (areas of equal seismic intensity). Following this major event, additional earthquakes with magnitudes ranging from M = 5.0 to 5.6 occurred in the same seismic source zone in the years 1989 and 2017, indicating that the area remains seismically active.

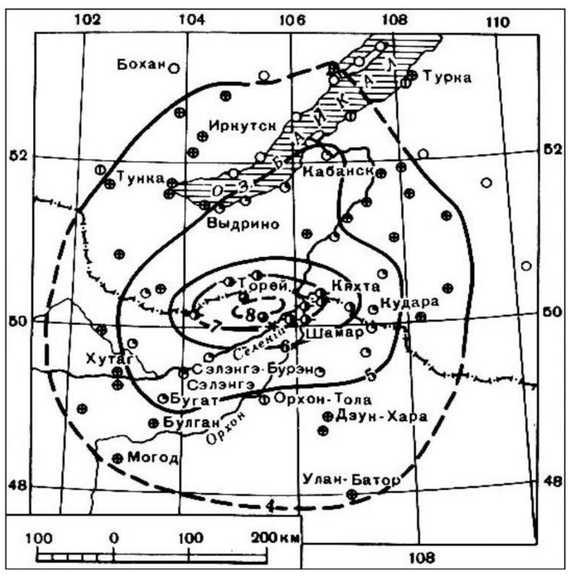

Figure 2. Isoseismal map of the M=6.5 earthquake that occurred on February 6, 1957, in the Burenbuteel.

(С.Д Хилько, Р.А.Курушин, В.М.Кочетков, Л.А.Мишарина, В.И Мельниква, Н.А.Гилева, С.В.Ласточкин, И.Балжинням, Д.Мөнхөө , "Землятрясения и основы сейсмического районирования монголии", Москва, 1985)

The seismic station in the Selenge Province was established in February 2014. In May of the same year, a broadband seismic station was installed. The establishment of this station made it possible to record and monitor earthquakes within the study area. We analysed the data of this station, including historical and instrumental earthquake database.

A total of 8,436 earthquake records that occurred between 1964 and 2024 in the Burenbuteel of the Selenge Province (between latitudes 48.49°–50.52° and longitudes 104.29°–107.10°) were obtained from the National Data Center. These accumulated database used for this study with the goal of calculating the *a* and *b* values, which are key parameters for analyzing the seismic regime of the region.

Data Accumulation

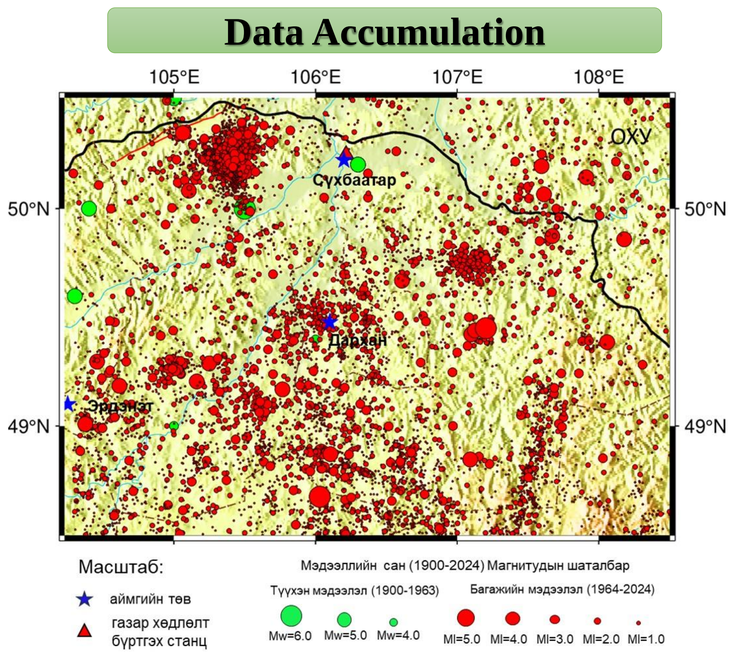

Figure 3. Epicenter distribution map of earthquakes in Selenge Province.

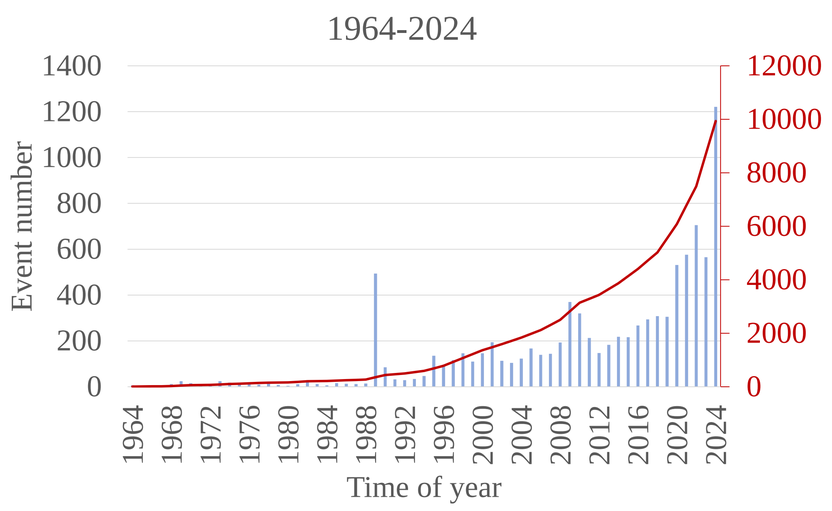

Figure 4. A time-dependence graph of all earthquakes with magnitudes ranging from M = 1.0 to 5.8 that occurred between 1964 and 2024 within the coordinates φ = 48.49˚–50.52˚ and λ = 104.20˚–107.10˚.

Results

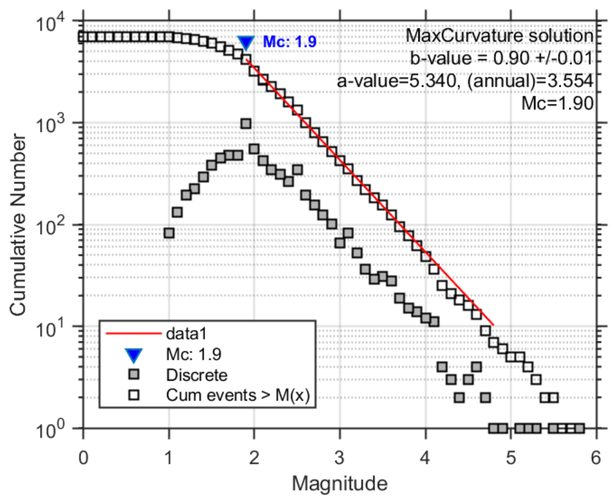

Figure 5.Gutenberg-Richter Relationship (1964–2024): Magnitude-frequency curve of earthquakes that occurred within a 300 km radius in the Burenbuteel and surrounding areas (results generated using ZMAP)

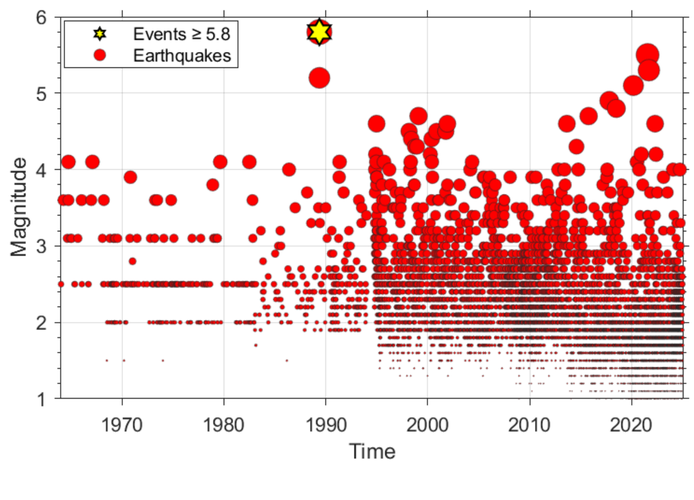

Figure 6 Time-magnitude graph of earthquakes recorded in the study area.

Discussion

From the graph showing the relationship between the number of earthquakes and time (Figure 6), it is observed that the number of earthquakes in this region has increased in recent years. This increase can be attributed to two main factors:

- ❖ The enhancement of the capacity of seismic monitoring stations in the region and the increase in the number of stations
- ❖ Increased seismic activity in the area, such as foreshocks and aftershocks