

**GOVERNMENT OF PAKISTAN
MINISTRY OF DEFENCE
NATIONAL SEISMIC MONITORING CENTRE, PMD**



**PRELIMINARY SEISMOLOGICAL HAZARD ASSESMENT OF
CHIPURSON VALLEY, GILGIT BALTISTAN-PAKISTAN**



By

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1. Introduction

1.1 Background

In recent months, residents of Chipurson Valley, Gilgit-Baltistan, have reported mysterious explosions accompanied by mild tremors. These events have raised concerns about potential seismic activity or other geological phenomena in the region. The National Disaster Management Authority (NDMA) tasked the National Seismic Monitoring Centre (NSMC) of the Pakistan Meteorological Department (PMD) with investigating these disturbances through a seismic survey and the collection of field data.

1.2 Objective

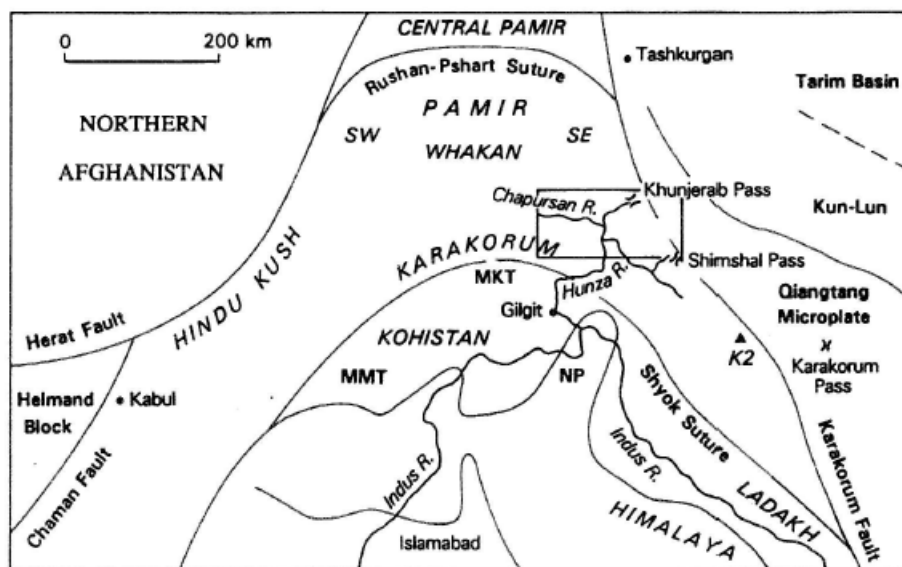
The objectives of the investigation were:

- To monitor seismic activity in Chipurson Valley using a portable seismometer for more than three days.
- To determine whether the reported explosions and tremors were due to seismic or geological events.
- To collect feedback from local residents through a field survey to understand the nature and extent of the disturbances.

2. Tectonic and Geological Setting

2.1 Tectonic Setting

Chipurson Valley lies in the Karakoram Range, an active tectonic region resulting from the collision between the Indian Plate and the Eurasian Plate. The valley is situated north of the Main Karakoram Thrust (MKT), which separates the Karakoram terrane from the Kohistan-Ladakh arc. The region is characterized by active faulting, with strike-slip and thrust faults accommodating tectonic movement, leading to seismic activity.



MMT = Main Mantle Thrust MKT = Main Karakoram Thrust NP = Nanga Parbat

Figure 1: Tectonic Map of the Area (Zanchi, A., & Gaetani, M. (2011))

2.2 Geology of Chipurson Valley

- The valley is dominated by granite and granodiorite from the Karakoram Axial Batholith, which forms the core geological structure (Zanchi & Gaetani, 2011).
- Sedimentary units, including sandstones, shales, and carbonates, from the Permian to Cretaceous periods, are found to the north of the batholith (Searle, 1996).
- Quaternary deposits, such as glacial tills and moraine complexes, cover the valley floors, indicating past glacial movements in the region (Hewitt, 2007).

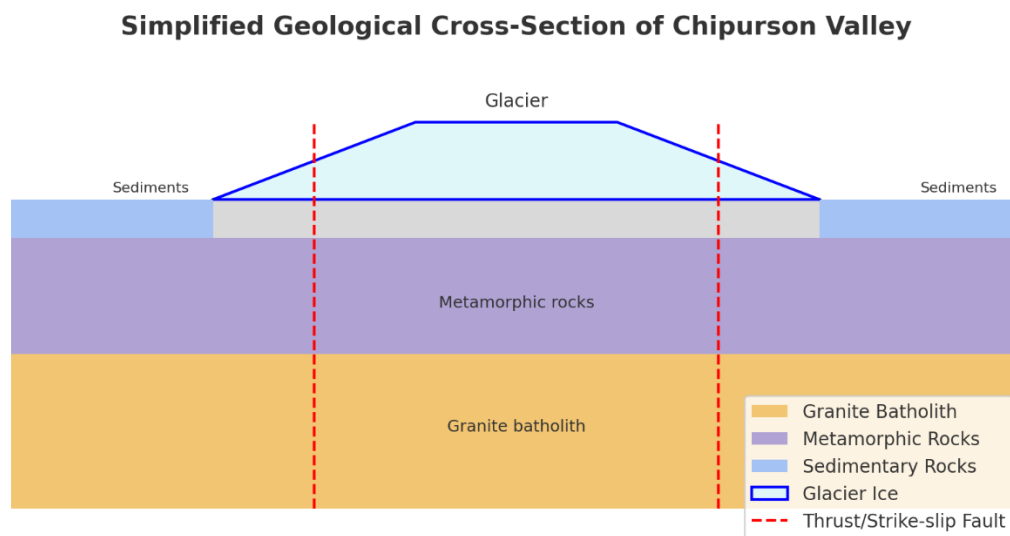


Figure 2: Geology of Chipurson Valley

These geological features, along with active faulting, contribute to the region's seismicity, which may be linked to the reported disturbances.

3. Methodology

3.1 Seismic Monitoring

A portable GL-PS2 short-period seismometer, sensitive to ground motions in the 2-second to 50 Hz frequency range, was deployed at Markah Guest House (Lat: 36°49' N, Long: 74°30' E) in Reshit Village, Chipurson Valley. The seismometer was strategically positioned to capture any seismic activity, particularly low-magnitude tremors that might be linked to the reported explosions. Key parameters recorded included:



Figure 3: Seismometer installation location in Chipursan Valley

- Amplitude and frequency of seismic waves
- Types of seismic waves (P-waves, S-waves, surface waves)
- Time intervals between seismic events

3.2 Seismic Data Processing

Seismic data collected from the monitoring station is processed using Geopsy SAC (Seismic Analysis Code) Environment, which is designed for analyzing seismic signals. The software allows for the extraction of key parameters such as amplitude, frequency, and wave type from raw data. Geopsy provides tools for spectral analysis, event detection, and visualization, enabling a detailed understanding of seismic events, including their magnitude, depth, and location. This helps in accurately interpreting the seismic activity in the region.

3.3 Field Survey

- Simultaneously, a field survey was conducted with local residents to gather information about the reported explosions in various villages (Reshit, Sherbaz, Zoodkhun, Shutmerg, Khill) of Valley. The survey included:
- Structured interviews to gather consistent data regarding the timing, frequency, and intensity of the disturbances.
- Open-ended questions to allow residents to describe their experiences in detail.

The survey aimed to establish the geographical spread of the disturbances, identify areas with higher reports of explosions, and determine the consistency of responses.

4. Results

4.1 Seismic Data Analysis

The seismic data collected over three days monitoring period revealed:

- Minor seismic events with magnitudes ranging from 1.0 to 2.2.
- These events were consistent with natural tectonic activity in the region but did not exhibit the characteristics of explosions.
- The recorded events were low-magnitude, which could be attributed to minor fault movements, landslides, or glacial movements rather than large-scale explosive events.

Below is the table of recorded seismic events:

No of EQ. Events	Date	Time (PST)	Magnitude	Depth (KM)	Epicentral Distance
1.	25/9/2025	00:12:10	1.8	17	35
2.	25/9/2025	06:13:09	1.9	14	28
3.	25/9/2025	07:54:03	2.2	10	4
4.	25/9/2025	10:01:47	2.0	-----	8
5.	25/9/2025	15:03:14	1.8	-----	7
6.	25/9/2025	23:06:01	1.6	-----	8
7.	26/9/2025	0.:20:45	1.8	13	12
8.	26/9/2025	04:34:19	1.9	12	05
9.	27/9/2025	01:45:02	1.6	14	09
10.	27/9/2025	06:46:20	1.5	12	06
11.	28/9/2025	05:19:02	1.7	10	22
12.	28/9/2025	16:33:25	1.5	-----	18
13.	28/9/2025	22:37:16	1.9	12	23
14.	29/9/2025	03:33:45	1.8	15	12
15.	29/9/2025	04:53:23	2.0	13	07

4.2 Field Survey Results

- About half of respondents reported experiencing mysterious explosions, often accompanied by slight tremors and loud subterranean noises. Some reported that the explosions were isolated incidents, while others described them as recurring.
- Remaining respondents either denied experiencing explosions or provided ambiguous responses, stating they had not felt any unusual activity or were unsure about the nature of the disturbances.
- The survey team did not observe any explosions or experience tremors during their stay.

The mixed responses from residents suggest that the disturbances could be localized or misinterpreted, with some residents more sensitive to tremors than others.

5. Discussion

5.1 Interpretation of Seismic Data

The recorded seismic events show low magnitudes (ranging from 1.0 to 2.2) and moderate depths (10-17 km), indicating minor tremors likely due to local fault movements or tectonic activity. These shallow events suggest ongoing tectonic stress in the region, possibly from crustal adjustments or active fault systems. The epicentral distances (7-35 km) and frequency of events further support the idea of local seismic activity rather than larger earthquakes or explosions.

Possible Causes:

Tectonic Faulting: Minor fault movements due to the tectonic collision between the Indian Plate and the Eurasian Plate (Searle, M. P. (1996)).

Crustal Adjustments: Small shifts in the Karakoram Fault Zone or surrounding fault lines.

Seismic Noise: Caused by landslides creeping or glacial movements (Hewitt, 2007).

5.2 Interpretation of Field Survey

The field survey indicated a divergence in residents' responses, with half of the residents reporting explosions and the other half either denying or expressing uncertainty. This suggests that:

The disturbances may be linked to localized geological events, such as small fault movements, glacial shifts, or landslides.

Differences in sensitivity to seismic events, along with subjective interpretation of minor tremors, may explain the discrepancies in reported experiences.

6. Conclusions

- The seismic survey did not identify any significant seismic events or mysterious explosions, with tremors consistent with minor tectonic activity in the region.
- The field survey revealed mixed responses from residents, with some reporting explosions and others being unsure or denying the disturbances.
- The cause of the reported disturbances remains uncertain, but the results suggest that natural seismic activity, glacial movements, or landslides could be responsible for the tremors.

7. Recommendations

1. *Monitoring Status:* Based on the findings, the tremors recorded are minor and may fall within normal seismic activity; however, their exact cause could include natural seismicity, glacial movements, or localized geological processes, so further monitoring could be considered optional.
2. *Public Awareness:* Conduct a public awareness campaign to educate residents about seismic activity and how to distinguish between minor tremors and other possible disturbances.
3. *Geological Survey:* Although no further seismic monitoring is recommended, a detailed geological survey could be conducted to explore the potential impact of Geo-Physical Hazards including: local landslides, glacial movements, or minor tectonic shifts in the region.
4. *Voluntary Check-ins:* If necessary, periodic check-ins could be conducted by local authorities to monitor any future disturbances.

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