Royal Norwegian Council
for Scientific and Industrial Research
(NTNF)

NORSAR

NORSAR Scientific Report No. 1-92/93

Semiannual Technical Summary

1 April — 30 September 1992

Kjeller, November 1992

APPROVED FOR PUBLIC RELEASE, DISTRIBUTION UNLIMITED

7.6 The Ukrainian event of 16 September 1979

On 28 June 1992, an article appeared in the *New York Times* of considerable interest to scientists working in the field of seismic monitoring:

Excerpt from the New York Times, 28 June 1992

> "(headline) Izvestiya Reports '79 A-Test at Ukraine Mine
>
> MOSCOW, June 27 (AP) -- Soviet scientists set off a nuclear blast in 1979 next to a Ukrainian coal mine, then sent thousands of miners back to the shaft a day later without telling them, the newspaper Izvestiya reported.
>
> The article, published on Friday, may shed some light on long-standing assertions by miners that a nuclear blast caused unusually high levels of radiation around a town it identified as Yunokommunarsk.
>
> Izvestiya said officials have previously attributed the level of radiation in the area, which has registered three or four times normal, to industrial waste and to the 1986 nuclear disaster at Chernobyl, 625 miles to the northwest.
>
> Izvestiya did not report higher incidences of death, cancer or other diseases in the area near the mine, and officials could not be reached for comment today.
>
> The report said the bomb had been detonated to see if the explosion would clear the mine of dangerous methane gas. It added that officials had disguised the incident by staging a civil defense drill and evacuating the town's 8,000 residents, most of whom were miners."

It turned out that the original release from AP had more information than used by the *New York Times*. Thus AP stated that the detonation occurred at noon Sept 16, 1979 and that the yield was 1/3 kt. The location of the town, Yunokommunarsk, is approximately 48.22^{o}N, 38.30^{o}E.

Based on this information, we examined available seismic event lists in detail to see if this event could be confirmed. We searched for an event with origin time near 09.00.00 GMT, which corresponds to noon Moscow time. However, the event was not reported, neither by agencies using global network data (ISC, NEIC) nor by other available sources.

The Ukrainian event was not reported in the NORSAR monthly bulletin. However, the NORSAR automatic detector operates at a very low threshold, and many small events, especially at regional distances, are detected but not included in the monthly bulletins.

For this reason, we decided to check the original automatic detection lists in the NORSAR archive. It turned out that the automatic (unedited) NORSAR bulletin for 16 Sep 79 contains an event with the following parameters:

Origin time (GMT): 08.59.53
Location: 45N, 34E, Crimea region
Magnitude (m_b): 3.3

The automatic plot for this event has been saved (Fig. 7.6.1), and shows a high frequency signal, visible on at least 4 subarrays, but with poor signal coherency across the full NORSAR array. The analyst did not consider the event solution to be of high enough quality to include it in the final NORSAR bulletin, although there is no question that the event is real (and not a noise detection).

Unfortunately, at the time when this event occurred NORSAR could save only selected data intervals on tape. At the time, there seemed to be no reason to save this event, so the digital data is no longer available. Only the event plots and the detector listings have been retained.

The automatic location estimate (45N 34E) is somewhat different from the location of Yunokommunarsk, but well within the uncertainty for an event with such low signal coherency. The estimated origin time is 7 seconds before the hour. As is well known, the traditional Soviet PNE practice has been to detonate such explosions exactly on the hour.

Next, we tried to constrain the origin time of the event, under the assumption that its location was near Yunokommunarsk (see Fig. 7.6.2). Under the assumption that the event in question had an epicenter 48.22°N, 38.30°E, its origin time is estimated to be as follows:

08.59.59.6 (using the IASPEI 1991 travel-time tables)
08.59.56.7 (using the Jeffreys-Bullen tables).

In both cases, zero depth has been assumed. The signal arrival time was re-read visually from the plot (the correction was minor relative to the automatic arrival time estimate).

As is well known, the Jeffreys-Bullen tables tend to give 2-3 seconds too early origin time estimates for Eurasian explosions, so the data are consistent with an origin time exactly on the hour and a location approximately as given in the press report.

In terms of nuclear monitoring research, there are some important lessons to be learned from this case study. Most importantly, automatic detector information is valuable. It should not be discarded, even when the analyst determines that the signal is of poor quality, or the signal parameters are poorly defined. This is consistent with the conclusions reached by the Geneva Group of Scientific Experts, which has repeatedly stressed that all detected seismic signals should be reported by the participating stations in a future global seismic network.

This case study also highlights an important consideration for CTB verification: seismic methods will be only one of several monitoring tools. If an indication is obtained from some other source that a clandestine explosion might have taken place, it is important to be able to confirm it through seismic recordings. This requires that at least one station in a global network is sensitive enough to provide such confirmation.

Finally, it should be noted that at the time this event occurred there was no advanced regional array network in northern Europe. Today, the network of high-quality regional seismic arrays NORESS, ARCESS, FINESA, GERESS, as well as other contributing arrays, are in continuous operation. Their recordings are regularly analyzed using the advanced Intelligent Monitoring System (IMS). Had such an event occurred today, it would with high probability have been detected, accurately located and reported. However, an event this small would probably still be unidentified if the only data available were recorded at teleseismic distances. Even with regional data available, it can often be difficult to identify such low-magnitude events reliably using current methods. Event identification at low magnitudes remains one of the most important research topics in the field of seismic monitoring.

F. Ringdal, NORSAR
P.G. Richards, Columbia University

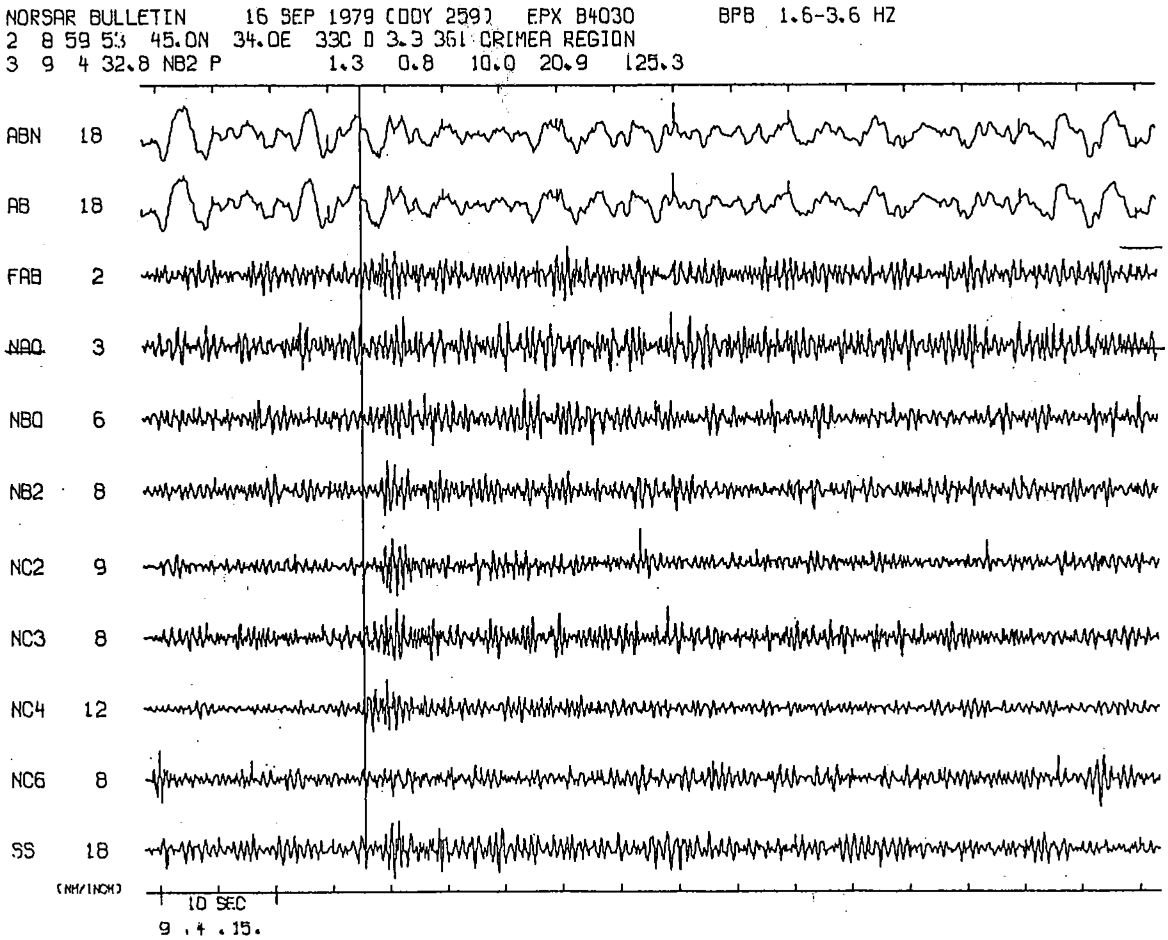

Fig. 7.6.1. NORSAR automatic event processing result for the event described in the text. The upper three traces are array beams, and the next 7 traces are subarray beams, filtered in the band 1.6-3.6 Hz. The vertical line marks the estimated arrival time. The three lines of text at the top summarize the automatically determined event parameters.

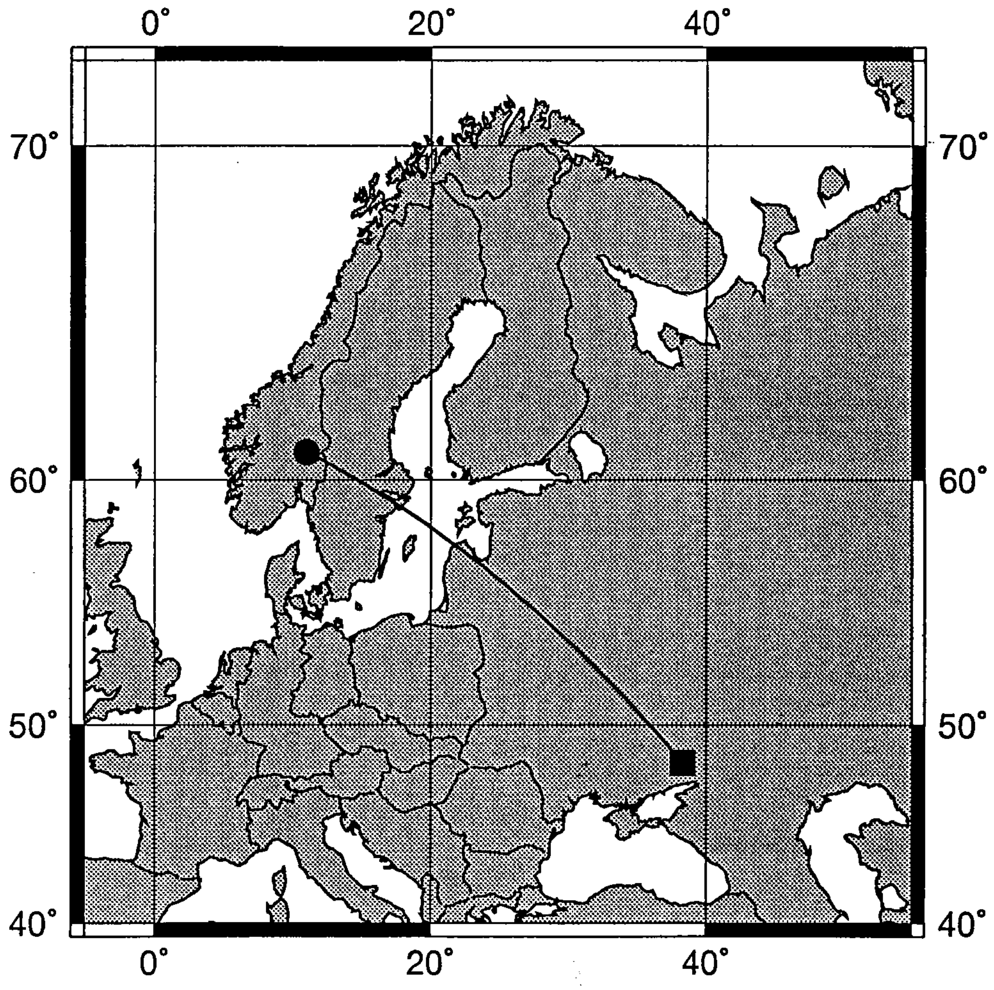

Fig. 7.6.2. Map showing the location of the town Yunokommunarsk in Ukraine (filled square) together with the great circle path to the NORSAR array (filled circle). The distance is approximately 2200 km.