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# Swedish National Seismic Network (SNSN)

## A short report on recorded earthquakes during the first quarter of the year 2004

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April 2004

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*Keywords:* Seismic network, Earthquakes.

# Abstract

According to an agreement with Swedish Nuclear Fuel and Waste Management Company (SKB) and Uppsala University, the Department of Earth Sciences has continued to carry out observation and additional construction of new seismic stations within the Swedish National Seismic Network (SNSN). This report gives some information about the recorded seismicity during January through March 2004.

At present 43 stations are in operation and two additional stations will be put into operation during April or May 2004. During the period January through March 2004, 1402 events were located whereof 122 are estimated as real earthquakes, 1197 are estimated as explosions and 83 events are uncertain but these are mainly outside the network. There were 122 located events where of 2 with magnitude above 2.0 and additional 24 earthquakes had magnitudes above or of 1.0. The range of the hypocentral depth varies between 0.1 and 37.4 km.

The largest earthquakes with magnitude 2.2 occurred on February 22nd in Öresund 26.5 km W of Malmö and on March 27th in Bottenviken, 87 km ENE of Umeå.

# Sammanfattning

Enligt avtal mellan Svensk Kärnbränslehantering AB (SKB) och Uppsala Universitet, Institutionen för Geovetenskaper, fortsätter Uppsala Universitet att driva och bygga ut seismiska mätstationer i det svenska seismiska nätet (SNSN). Denna rapport ger information om registrerade händelser under tidsperioden januari till mars, 2004.

För närvarande är 43 stationer i drift och ytterligare två stationer kommer att tas i drift i slutet på april eller i maj 2004. Under perioden januari till mars, 2004 var det 1402 registrerade händelser varav 122 bedömdes som äkta jordskalv, 1197 bedömdes vara förorsakade av explosioner eller sprängningar samt 83 var osäkra händelser, men dessa var lokaliserade utanför det seismiska nätet. Av de 122 bedömda jordskalven var det 2 med en magnitud över 2,0 och ytterligare 24 jordskalv med en magnitud över eller lika med 1,0. Djupet till hypocentrum, där skalven genereras, varierar från 0,1 upp till 37,4 km.

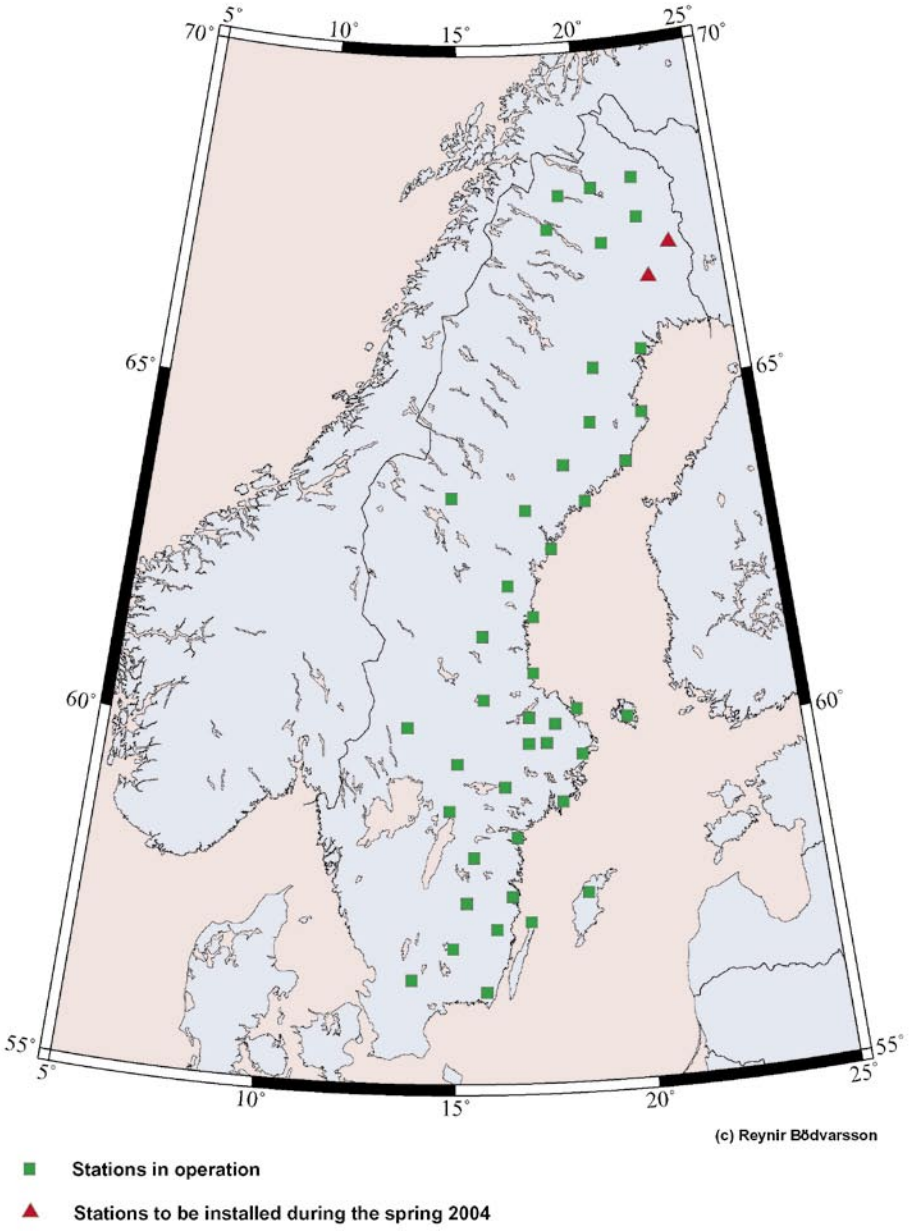
Det största jordskalvet med en magnitud på 2,2 inträffade den 22 februari i Öresund, 26,5 km väster om Malmö och den 27 mars i Bottenviken, 87 km ostnordost om Umeå.

# Contents

# 1 Introduction

This is the first quarterly report on seismic events recorded by the Swedish National Seismic Network (SNSN) for the year 2004. At present 43 stations are in operation and the instrumentation for the two remaining stations are under testing in Uppsala and if passing the test they will be installed in late April.

The report includes fundamental information about the seismic events, including origin time and hypocenter location. Information about the source parameters is not included in the present report but is delivered as a separate ASCII-text. This report is a preliminary report including only the automatic and the brief interactive analysis done on the routine bases at SNSN.




***Figur 1-1.*** *The present Swedish National Seismic Network (SNSN).*

# 2 Objective and scope

According to an agreement with Swedish Nuclear Fuel and Waste Management Company (SKB) and Uppsala University, the Department of Earth Sciences continues to carry out observation and additional construction of new seismic stations within the Swedish National Seismic Network (SNSN).

The goal is to complement the existing regional seismic network to establish a local seismic network that also permits registration of small earthquakes in order to obtain relatively long time series and thereby gain a better understanding of the causes of seismic events in the site investigation areas.

Fundamental information about the seismic events, including origin time, hypocenter location and information about the source parameters will be given after every three month period.

Expected results are to obtain information on location, magnitude and source parameters of small earthquakes down to a magnitude of 0.0 near the investigation sites.

# 3 Recorded earthquakes during the first quarter of 2004

Figure 3-1 shows earthquake activity in Sweden during January through March 2004. During this period there were 1402 located events, Figure 3-2. Out of these 1197 are explosions, 122 are true earthquakes and 83 are still uncertain but these are mainly outside the network.

There were 122 located events where of 2 with magnitude above 2.0 and additional 24 earthquakes had magnitudes above or of 1.0. The range of the hypocentral depth varies between 0.1 and 37.4 km.

The largest earthquakes with magnitude 2.2 occurred on February 22nd in Öresund 26.5 km W of Malmö and on March 27th in Bottenviken, 87 km ENE of Umeå.

Event lists for January through March 2004 are given in sections 3.1 to 3.3.

## 3.1 January

Event list for January is given in Table 3-1 with date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML). In January 45 events were located whereof one with magnitude 1.8 which was located 50 km SW of Umeå and 2.1 km North of Järnäs and another earthquake with magnitude 1.7 was located 2.3 km W of Hudiksvall. Additional 9 earthquakes with magnitude above 1.0 were located. The depth range of the events varies between 0.5 and 37.4 km.

**Table 3-1. Date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML) of recorded earthquakes in January.**

| DATE | TIME (UTC) | LATITUDE | LONGITUDE | X RT90 km | Y RT90 km | DEPTH km | ML Local Magnitude |
|---|---|---|---|---|---|---|---|
| 20040101 | 221727.5 | 64.601 | 21.760 | 7179.5 | 1784.6 | 19.6 | 0.4 |
| 20040103 | 092005.9 | 64.796 | 20.406 | 7195.8 | 1718.4 | 7.7 | 0.3 |
| 20040104 | 003923.3 | 63.065 | 23.480 | 7018.1 | 1887.1 | 17.1 | 0.6 |
| 20040104 | 035745.0 | 68.048 | 20.240 | 7557.0 | 1684.8 | 27.5 | 0.8 |
| 20040104 | 053021.3 | 63.161 | 23.598 | 7029.5 | 1891.8 | 7.5 | 0.5 |
| 20040105 | 030002.7 | 68.164 | 19.994 | 7569.2 | 1673.7 | 18.1 | 0.3 |
| 20040105 | 044502.8 | 64.410 | 20.688 | 7153.8 | 1735.1 | 20.6 | 1.1 |
| 20040106 | 115151.5 | 67.397 | 18.931 | 7481.2 | 1633.9 | 16.3 | 0.0 |
| 20040106 | 123401.1 | 65.029 | 21.036 | 7224.0 | 1746.1 | 19.8 | 0.1 |
| 20040106 | 153603.9 | 64.395 | 20.538 | 7151.6 | 1728.0 | 17.0 | 0.3 |
| 20040106 | 211713.4 | 62.988 | 18.572 | 6989.4 | 1640.1 | 18.4 | 1.5 |
| 20040107 | 100456.6 | 67.775 | 19.612 | 7524.9 | 1660.5 | 9.9 | –0.3 |
| 20040107 | 152141.8 | 64.242 | 18.191 | 7128.3 | 1615.5 | 33.2 | 1.1 |
| 20040107 | 232603.2 | 65.384 | 17.963 | 7255.1 | 1600.2 | 5.2 | 1.4 |
| 20040109 | 120713.1 | 64.639 | 21.803 | 7183.9 | 1786.2 | 24.0 | 0.7 |
| 20040109 | 173521.2 | 61.639 | 16.915 | 6836.5 | 1558.7 | 9.2 | –0.3 |
| 20040110 | 073915.8 | 58.933 | 15.162 | 6534.7 | 1462.8 | 5.2 | –0.7 |
| 20040110 | 110555.6 | 67.084 | 19.680 | 7448.2 | 1668.2 | 12.6 | 0.5 |
| 20040112 | 093940.2 | 64.351 | 20.461 | 7146.5 | 1724.6 | 9.9 | 1.6 |
| 20040113 | 002019.9 | 59.549 | 13.286 | 6605.9 | 1357.4 | 10.5 | 1.1 |
| 20040113 | 175440.1 | 61.654 | 19.088 | 6842.0 | 1673.7 | 5.6 | 0.8 |
| 20040113 | 235237.9 | 64.504 | 21.377 | 7167.0 | 1767.3 | 22.1 | 0.6 |
| 20040116 | 194921.7 | 67.361 | 22.095 | 7487.5 | 1769.7 | 12.0 | –0.2 |
| 20040116 | 214707.6 | 63.495 | 19.655 | 7048.5 | 1691.5 | 17.3 | 1.8 |
| 20040118 | 080608.3 | 61.875 | 17.134 | 6863.0 | 1569.7 | 2.7 | –0.3 |
| 20040118 | 191239.9 | 64.453 | 19.785 | 7155.6 | 1691.3 | 26.0 | 0.3 |
| 20040119 | 174348.1 | 61.278 | 16.220 | 6795.9 | 1522.1 | 22.3 | 0.3 |
| 20040120 | 221641.9 | 67.841 | 20.212 | 7533.9 | 1685.3 | 0.5 | 0.6 |
| 20040121 | 005552.9 | 64.464 | 20.825 | 7160.4 | 1741.2 | 17.9 | 0.7 |
| 20040121 | 081133.3 | 55.879 | 11.573 | 6202.6 | 1235.0 | 14.0 | 1.4 |
| 20040122 | 193345.7 | 68.299 | 22.853 | 7595.1 | 1790.2 | 6.9 | 0.7 |
| 20040123 | 185909.7 | 62.490 | 16.888 | 6931.2 | 1555.7 | 26.1 | 0.6 |
| 20040124 | 121016.7 | 62.206 | 16.878 | 6899.6 | 1555.7 | 6.6 | –0.2 |
| 20040124 | 155256.4 | 67.843 | 19.581 | 7532.4 | 1658.7 | 19.8 | 0.3 |
| 20040125 | 015737.1 | 60.869 | 17.567 | 6751.5 | 1595.5 | 16.7 | 0.8 |
| 20040125 | 202535.8 | 68.047 | 19.793 | 7555.7 | 1666.2 | 15.8 | 0.3 |
| 20040126 | 073620.0 | 63.108 | 19.190 | 7004.2 | 1670.7 | 37.4 | 0.4 |
| 20040126 | 162759.9 | 65.153 | 21.139 | 7238.2 | 1749.8 | 24.4 | 0.5 |
| 20040126 | 235102.2 | 64.977 | 20.918 | 7217.8 | 1741.0 | 23.9 | 0.9 |
| 20040127 | 105649.8 | 65.322 | 18.258 | 7248.7 | 1614.1 | 4.5 | 1.1 |
| 20040127 | 202431.5 | 67.446 | 19.386 | 7487.7 | 1653.1 | 21.7 | 1.5 |
| 20040129 | 024614.6 | 64.351 | 20.573 | 7146.9 | 1730.0 | 24.5 | –0.1 |
| 20040129 | 174414.4 | 64.483 | 21.272 | 7164.2 | 1762.4 | 5.4 | –0.2 |
| 20040129 | 205830.8 | 63.858 | 21.545 | 7096.0 | 1781.8 | 10.0 | 0.3 |
| 20040131 | 234417.3 | 61.719 | 17.068 | 6845.5 | 1566.6 | 9.9 | 1.7 |

## 3.2 February

Event list for February is given in Table 3-2 with date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML). In November 23 events were located whereof one with magnitude 2.2 located in Öresund, 26.5 km W of Malmö, one earthquake with magnitude 1.9 was located 29 km SW of Kiruna. Additional four earthquakes were located with magnitude above or of 1.0. The depth range of the events varies between 0.1 and 32.2 km.

**Table 3-2. Date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML) of recorded earthquakes in February.**

| DATE | TIME (UTC) | LATITUDE | LONGITUDE | X RT90 km | Y RT90 km | DEPTH km | ML Local Magnitude |
|---|---|---|---|---|---|---|---|
| 20040204 | 080845.5 | 60.283 | 18.350 | 6687.6 | 1640.6 | 16.4 | 0.5 |
| 20040204 | 125630.7 | 62.974 | 18.160 | 6986.9 | 1619.3 | 19.8 | 1.3 |
| 20040207 | 231331.7 | 64.463 | 20.470 | 7158.9 | 1724.1 | 11.3 | 0.4 |
| 20040211 | 045418.2 | 58.524 | 15.482 | 6489.0 | 1481.0 | 8.6 | 0.3 |
| 20040212 | 001400.9 | 62.803 | 17.841 | 6967.4 | 1603.7 | 7.1 | 0.4 |
| 20040212 | 111452.6 | 61.864 | 17.186 | 6861.8 | 1572.5 | 19.7 | –0.0 |
| 20040213 | 024944.3 | 64.334 | 20.565 | 7144.9 | 1729.8 | 19.9 | 0.2 |
| 20040214 | 050847.4 | 63.896 | 20.112 | 7094.7 | 1711.2 | 5.5 | 0.0 |
| 20040215 | 075138.8 | 68.219 | 20.060 | 7575.6 | 1676.0 | 21.0 | 0.8 |
| 20040215 | 160526.1 | 64.411 | 20.716 | 7154.0 | 1736.4 | 3.9 | 0.8 |
| 20040216 | 093907.5 | 65.288 | 20.882 | 7252.2 | 1736.5 | 25.3 | 0.5 |
| 20040216 | 180221.5 | 67.382 | 19.497 | 7480.8 | 1658.3 | 0.1 | 0.2 |
| 20040217 | 110831.0 | 67.337 | 19.477 | 7475.8 | 1657.7 | 32.2 | 0.3 |
| 20040218 | 090939.9 | 67.720 | 19.634 | 7518.8 | 1661.8 | 0.1 | 1.9 |
| 20040218 | 185435.1 | 61.440 | 17.858 | 6815.5 | 1609.3 | 8.4 | 1.4 |
| 20040218 | 210907.1 | 64.490 | 21.224 | 7164.8 | 1760.1 | 24.2 | 0.2 |
| 20040221 | 161006.1 | 61.787 | 17.023 | 6853.0 | 1564.1 | 18.9 | 1.0 |
| 20040223 | 045711.1 | 56.896 | 16.469 | 6307.9 | 1540.2 | 17.2 | 0.7 |
| 20040223 | 083826.9 | 55.523 | 12.576 | 6159.5 | 1295.9 | 14.7 | 2.2 |
| 20040225 | 085417.7 | 65.012 | 20.876 | 7221.5 | 1738.7 | 3.0 | 1.7 |
| 20040227 | 234051.3 | 58.753 | 15.731 | 6514.5 | 1495.5 | 18.0 | –0.2 |
| 20040228 | 010908.3 | 65.131 | 22.196 | 7240.4 | 1799.4 | 19.8 | 0.3 |
| 20040228 | 163405.9 | 64.356 | 20.727 | 7148.0 | 1737.4 | 18.3 | 0.6 |

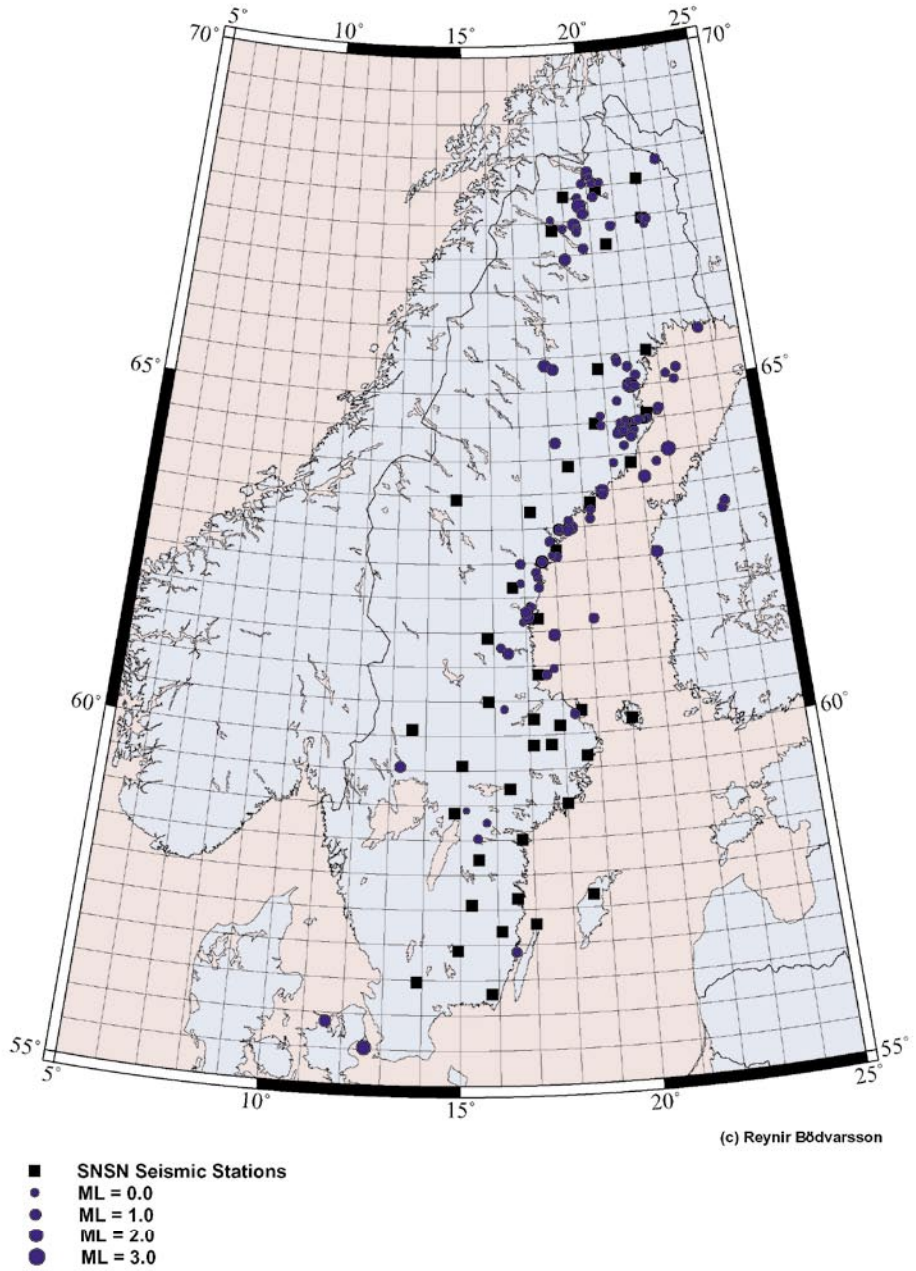
## 3.3 March

Event list for March is given in Table 3-3 with date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML). In March 54 events were located whereof one with magnitude 2.2 in Bottenviken, 87 km ENE of Umeå. Additional 8 earthquakes were located with magnitude above or of 1.0. The depth range of the events varies between 0.1 and 29.2 km.

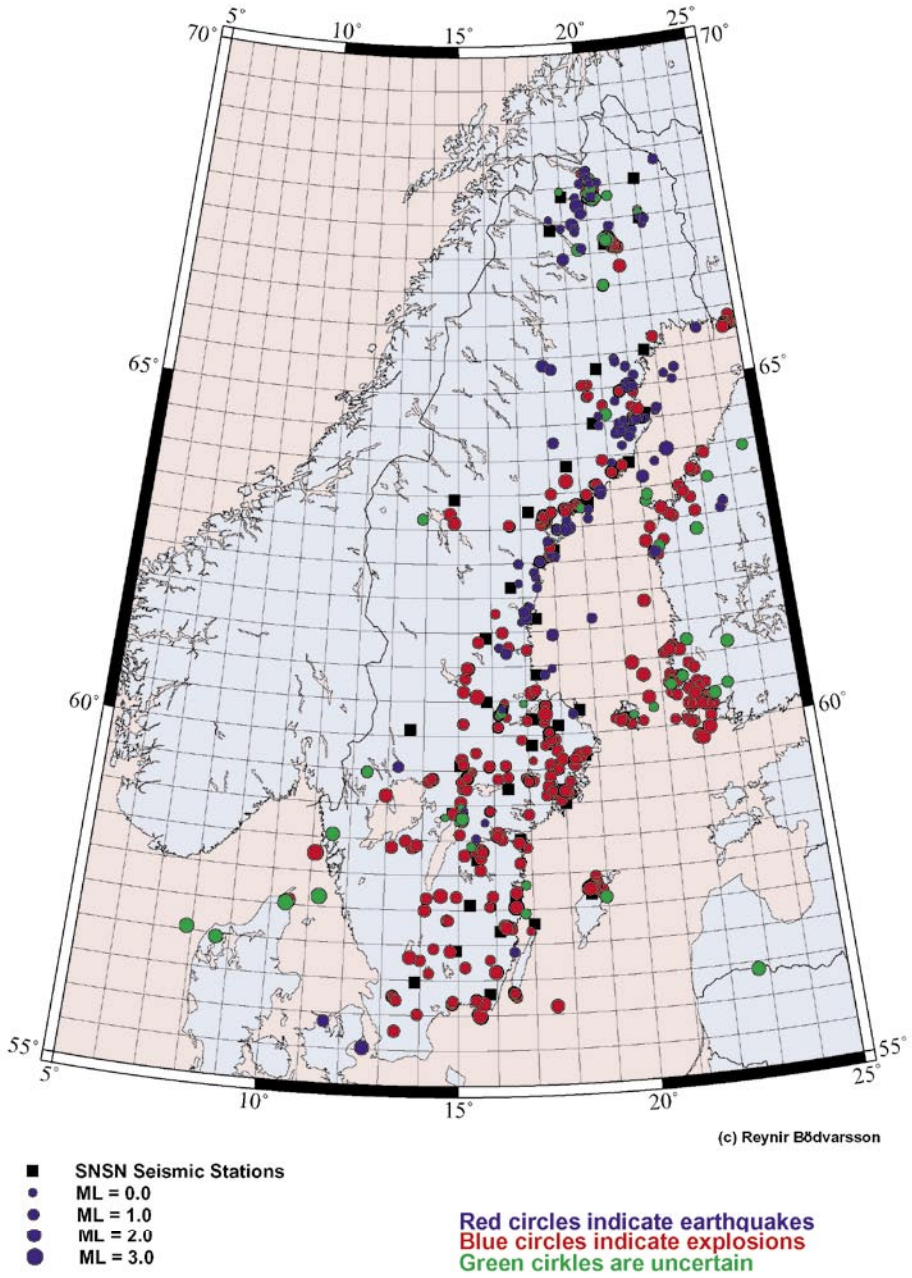
**Table 3-3. Date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML) of recorded earthquakes in March.**

| DATE (UTC) | TIME | LATITUDE | LONGITUDE | X RT90 km | Y RT90 km | DEPTH km | ML Local Magnitude |
|---|---|---|---|---|---|---|---|
| 20040301 | 074736.1 | 62.580 | 18.049 | 6942.8 | 1615.2 | 18.3 | 0.7 |
| 20040301 | 150652.1 | 62.957 | 18.458 | 6985.7 | 1634.4 | 2.5 | 1.2 |
| 20040302 | 180450.7 | 64.495 | 20.644 | 7163.1 | 1732.2 | 18.3 | 0.1 |
| 20040303 | 100904.6 | 62.514 | 17.572 | 6934.8 | 1590.9 | 20.4 | 1.1 |
| 20040303 | 102646.6 | 62.515 | 17.584 | 6934.9 | 1591.4 | 21.7 | 0.3 |
| 20040303 | 103730.7 | 62.515 | 17.573 | 6934.8 | 1590.9 | 20.9 | 0.7 |
| 20040303 | 105404.3 | 62.513 | 17.581 | 6934.7 | 1591.3 | 21.8 | 1.5 |
| 20040303 | 112540.6 | 62.514 | 17.575 | 6934.7 | 1591.0 | 20.6 | 0.9 |
| 20040303 | 114209.6 | 62.515 | 17.585 | 6934.8 | 1591.5 | 22.4 | 0.5 |
| 20040303 | 115615.5 | 62.518 | 17.574 | 6935.1 | 1590.9 | 21.6 | –0.0 |
| 20040303 | 120824.4 | 62.541 | 21.234 | 6948.3 | 1779.0 | 0.1 | 1.4 |
| 20040303 | 124352.1 | 62.516 | 17.572 | 6934.9 | 1590.8 | 20.3 | 0.8 |
| 20040303 | 130251.3 | 62.515 | 17.583 | 6934.9 | 1591.4 | 22.1 | 0.3 |
| 20040303 | 140743.0 | 62.514 | 17.579 | 6934.7 | 1591.2 | 21.2 | 0.7 |
| 20040304 | 022502.4 | 64.138 | 20.514 | 7123.0 | 1728.9 | 2.8 | 0.2 |
| 20040305 | 035244.6 | 63.444 | 19.656 | 7042.9 | 1691.9 | 4.0 | 0.5 |
| 20040305 | 071101.8 | 63.653 | 21.096 | 7071.2 | 1761.7 | 9.1 | 1.6 |
| 20040306 | 111904.4 | 62.975 | 18.152 | 6987.0 | 1618.8 | 16.3 | 0.3 |
| 20040307 | 161241.8 | 68.044 | 20.501 | 7557.4 | 1695.7 | 18.0 | 0.0 |
| 20040307 | 222626.2 | 67.534 | 18.484 | 7495.6 | 1614.1 | 5.3 | –0.3 |
| 20040307 | 231737.6 | 60.953 | 17.795 | 6761.2 | 1607.6 | 7.8 | 0.1 |
| 20040308 | 161517.9 | 67.464 | 22.027 | 7498.6 | 1765.7 | 12.5 | 0.1 |
| 20040309 | 050935.0 | 61.201 | 16.439 | 6787.4 | 1533.9 | 13.8 | –0.0 |
| 20040309 | 205251.7 | 62.596 | 17.898 | 6944.3 | 1607.3 | 5.3 | –0.3 |
| 20040310 | 113646.3 | 63.092 | 18.489 | 7000.8 | 1635.4 | 23.6 | 0.4 |
| 20040310 | 201508.3 | 65.059 | 20.888 | 7226.8 | 1738.9 | 27.8 | –0.1 |
| 20040311 | 023502.8 | 65.036 | 22.463 | 7231.1 | 1813.1 | 20.3 | 0.2 |
| 20040311 | 040354.7 | 67.599 | 19.752 | 7505.7 | 1667.7 | 0.1 | 1.0 |
| 20040312 | 014526.8 | 62.289 | 17.423 | 6909.5 | 1583.8 | 13.8 | 0.3 |
| 20040312 | 030408.7 | 67.436 | 22.203 | 7496.3 | 1773.5 | 5.3 | 0.3 |
| 20040312 | 073727.3 | 64.350 | 20.615 | 7146.9 | 1732.0 | 5.7 | 0.1 |
| 20040313 | 080543.1 | 65.729 | 23.558 | 7313.8 | 1854.8 | 14.5 | 0.9 |
| 20040313 | 130039.1 | 64.324 | 20.357 | 7143.1 | 1719.8 | 17.6 | 0.9 |
| 20040313 | 192335.2 | 62.138 | 17.448 | 6892.7 | 1585.5 | 3.8 | 0.4 |
| 20040314 | 144432.1 | 64.384 | 20.651 | 7150.8 | 1733.5 | 17.1 | 0.5 |
| 20040314 | 210027.3 | 64.480 | 20.947 | 7162.6 | 1746.9 | 18.2 | 0.3 |

| DATE (UTC) | TIME | LATITUDE | LONGITUDE | X RT90 km | Y RT90 km | DEPTH km | ML Local Magnitude |
|---|---|---|---|---|---|---|---|
| 20040316 | 054901.9 | 61.191 | 16.437 | 6786.2 | 1533.8 | 5.4 | 1.1 |
| 20040318 | 021613.8 | 64.591 | 19.787 | 7170.9 | 1690.4 | 29.2 | 0.1 |
| 20040318 | 031915.7 | 68.142 | 20.129 | 7567.2 | 1679.4 | 12.0 | –0.5 |
| 20040320 | 190251.3 | 63.240 | 19.225 | 7019.0 | 1671.6 | 4.3 | 0.4 |
| 20040320 | 233411.9 | 64.500 | 21.207 | 7165.9 | 1759.1 | 28.4 | 0.3 |
| 20040323 | 233930.6 | 64.494 | 21.086 | 7164.7 | 1753.4 | 19.9 | 0.4 |
| 20040324 | 020458.5 | 65.421 | 20.503 | 7265.6 | 1717.8 | 19.1 | 0.2 |
| 20040325 | 093637.1 | 66.940 | 18.950 | 7430.3 | 1637.3 | 23.4 | 1.2 |
| 20040325 | 211906.8 | 64.354 | 20.921 | 7148.5 | 1746.8 | 21.2 | –0.1 |
| 20040327 | 014219.4 | 65.372 | 20.534 | 7260.3 | 1719.7 | 23.0 | 0.4 |
| 20040327 | 101456.1 | 64.021 | 21.987 | 7116.1 | 1801.7 | 11.4 | 2.2 |
| 20040328 | 001422.1 | 64.259 | 20.780 | 7137.3 | 1740.8 | 9.9 | 0.7 |
| 20040329 | 015238.8 | 64.992 | 21.080 | 7220.1 | 1748.5 | 12.1 | 0.6 |
| 20040329 | 150231.3 | 65.202 | 22.581 | 7250.1 | 1816.6 | 2.8 | 0.6 |
| 20040329 | 161438.6 | 67.387 | 20.795 | 7485.4 | 1713.8 | 26.9 | 0.5 |
| 20040330 | 003447.0 | 64.349 | 20.546 | 7146.5 | 1728.7 | 16.7 | 0.4 |
| 20040330 | 221510.7 | 62.362 | 17.377 | 6917.6 | 1581.2 | 13.7 | 0.4 |
| 20040331 | 015601.0 | 60.387 | 16.284 | 6696.6 | 1526.2 | 0.5 | –0.1 |




***Figur 3-1.*** *Earthquake activity in Sweden during January through March 2004.*




***Figur 3-2.*** *Recorded events including explosions in the SNSN network during the period January through March 2004.*