CRUISE REPORT TN152
R/V Thomas Thompson and DSL-120A
Dec 2 2002 - Jan 12 2003

Deeptow Magnetic Survey of the Jurassic Quiet Zone
Pigafetta Basin, Western Pacific Ocean

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Cruise Report

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Apra, Guam to Apra, Guam

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R/V Thomas Thompson TN152
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INTRODUCTION

The primary goal of this research project was to collect near-bottom magnetic field data over the Japanese magnetic anomaly lineations in the Pigafetta basin of the western Pacific Ocean (Fig. 1) in order to understand the nature of the "Jurassic Quiet Zone" (JQZ) and to establish a framework for the construction of a provisional geomagnetic polarity timescale (GPTS). Understanding the nature of the JQZ is of fundamental importance to many earth science disciplines ranging from global geomagnetic research in terms of geodynamo models, polarity reversal mechanisms and geomagnetic field behavior, to marine magnetic anomaly research into how and what portion of the ocean crust records and preserves the geomagnetic field, to the extension of the Geomagnetic Polarity Time Scale (GPTS) into the Jurassic, and to the tectonic implications for the early evolution of the Pacific plate. The true nature of the JQZ period remains unresolved because Jurassic ocean crust is limited to a few areas of the world. The best exposure of JQZ crust is in the Pacific, but it is located near the equator where diurnal variations are large and great ocean depths severely attenuate magnetic anomaly patterns. In the Atlantic, the JQZ is found close to the continent-ocean transition and thus is generally buried under significant margin deposits [Barrett and Keen, 1976]. The JQZ record is further compounded by poor magnetostratigraphic sections on land due to low sedimentation rates and the lack of any presently known long sedimentary sections of appropriate age [Opdyke and Channell, 1996].

The nature, age and even existence of the Jurassic Quiet Zone (JQZ) remains a topic of considerable debate. The JQZ was originally defined by the disappearance of correlatable oceanic magnetic anomalies in both the Atlantic and Pacific Oceans [Larson and Chase, 1972; Larson and Hilde, 1975; Cande et al., 1978; Vogt and Einwich, 1979]. The existence of the JQZ as a true polarity superchron, similar to the Cretaceous Normal Superchron (CNS) has been questioned by continental magnetostratigraphic studies [Steiner et al., 1985] that suggest the JQZ was a period of rapid polarity reversals [Steiner and Ogg, 1988; Ogg, 1995; Ogg and Gutowski, 1996]. Similarly, the definition of the age of the JQZ has changed substantially over the past few decades. The age of the young boundary of the JQZ was originally defined as Chron M22 [Larson and Chase, 1972] and then pushed back to M25 by Larson and Hilde [1975], to M29 by Cande et al. [1978] and then to M38 (163 Ma) [Handschumacher et al., 1988]. We identified additional anomalies back to M41 in our previous deeptow study of the Pigafetta lineations (Fig. 2), which brought into question the idea that there was a period with no reversals at all i.e. a magnetic "quiet" zone [Sager et al., 1998].

The Pacific has by far the best exposure of Jurassic aged crust and the JQZ is marked by low amplitude magnetic anomalies. Low amplitudes are a prominent feature of the Mesozoic M-series anomalies in general, which show a gradual decrease in anomaly amplitudes with increasing age beginning at chron M20 (149 Ma) and continuing into the JQZ [Larson and Pitman, 1972; Cande, et al., 1978; Vogt, 1986; Roest et al., 1992]. Because this phenomenon appears global, it has been attributed to a long-term trend of geomagnetic field strength. There also appears to be a systematic increase in polarity reversal rate with increasing age beginning at the 'old' Cretaceous Normal Superchron boundary and also continuing up to the JQZ [McFadden and Merrill, 1984; Merrill and McFadden, 1990; Merrill et al., 1998; Tarduno et al., 1991; Johnson et al., 1995]. This increase in reversal rate could be linked to the decrease in amplitude if, for example, the crustal recording process captures several reversals in a given vertical crustal section thus reducing its overall magnetization.

In 1989/90, the Ocean Drilling Program (ODP) drilled Sites 800 and 801 in the Pigafetta basin and Site 802 in the East Mariana basin of the western Pacific to investigate the Jurassic ocean crust [Leg 185, 2000; Lancelot et al., 1990]. Holes at Sites 800 and 802 bottomed in the ubiquitous Cretaceous volcanics, but drilling did penetrate Jurassic basement at Site 801. The magnetization of the Jurassic crustal section yielded several zones with differing inclination groups that were interpreted as multiple polarity intervals, implying frequent geomagnetic polarity reversals [Wallick and Steiner, 1992], consistent with continental magnetostratigraphic results [Ogg and Gutowski, 1996]. In 1999, Hole 801C was deepened to ~400 m into extrusive basement and logged with a downhole magnetometer [Larson et al., 1999]. The paleomagnetic results indicate that up to 6 polarity intervals [Steiner et al., 1999] are found within the 400 m thick extrusive layer and a similar number of magnetization units are also observed in the logging results [Larson et al., 1999] (Fig. 3). The rapid reversals in Hole 801C suggest that the field was in either continuous transitional mode or the crustal recording process has somehow distorted the record [Steiner et al., 1999]. Do these multiple reversals found downhole translate into seafloor lineations? Regardless of the source, the field behavior in the Jurassic appears to be unlike that during any other period of the well-known GPTS. Determining the characteristics of this field behavior is thus vitally important in understanding how and why Earth's field reverses and how it is generated, both fundamental questions of broad interest and importance.

Cruise Objectives

The cruise had a number of specific objectives:

1) Collect a detailed grid of survey lines around Hole 801C in order to understand the recent results from Ocean Drilling Program (ODP) Hole 801C which penetrates Jurassic-aged crust (165 +/- 4.5 Ma, Pringle, 1990) and reveals multiple reversals downhole [Leg 185, 2000; Larson et al., 1999; Steiner et al., 1999]. The ultimate goal is to confirm or dismiss the presence of lineated magnetic anomalies in this area.

2) To extend our original 1992 deeptow lines south to the Rough-Smooth boundary [Handschumacher et al., 1988] that may mark the end of the crustal accretion sequence in the Pigafetta basin and the oldest in situ ocean crust remaining in the ocean basins today.

3) To add a long line from just south of Golden Dragon seamount (~M34 age) and extend it through to Hole 801C. This line was located to bisect our existing 1992

lines to improve the lateral resolution and correlation between the survey lines, especially in the difficult very low amplitude M38-M40 section.

4) Finally, we planned to collect a second detailed survey of closely-spaced lines in the M33-M34 sequence south and west of Golden Dragon seamount. In our 1992 deeptow data set, the M34 sequence has both large and small anomalies that suggest longer chrons interspersed with a sequence of very rapid reversals. With this detailed survey we wished to verify and extend this correlation.

The primary survey platform for the survey was the deeptowed DSL-120A 120 khz sidescan sonar system (Figs. 4 and 5) operated by the Deep Submergence Lab of Woods Hole Oceanographic Institution and the Hawai'i Mapping Research Group. The deeptowed sidescan utilized a fiberoptic cable and traction winch system mounted on the University of Washington UNOLS Research Vessel Thomas G. Thompson, which had both the room to accommodate the NSF winch and dynamic positioning capability (although the latter was rarely used). Magnetic field measurements were made using a 3-axis Honeywell HMR2300 magnetoresistor digital magnetic field sensor (Fig. 6) mounted on the starboard wing of the DSL-120A sidescan vehicle. Co-chief scientist Dr. Sang-Mook Lee of KORDI also provided an absolute measuring magnetic field sensor in the form of a Marine Magnetics Overhauser magnetometer that was towed 30 meters behind the DSL-120 (Fig. 7). Thus, we collected simultaneously: vector magnetic field, absolute magnetic field intensity, sidescan backscatter of the seafloor and phase bathymetry from the DSL-120A vehicle.

General Cruise Operations and Logistics

The RV Thomas Thompson left US Navy Base in Apra, Guam Dec 2nd at 9:00 am (2300 UT, 1 Dec) and began transiting to the Hole 801C survey site at 10:30 local. We arrived at the Hole 801C survey site Dec 5th at 1202 (UT) and carried out a CTD for sound speed velocity profile. We then deployed four acoustic transponders and surveyed in the net (see Table 1). By the time the net was surveyed in the weather had deteriorated such that DSL operations were not possible. We carried out a sea surface magnetometer survey around the 801C site until the following morning. On Dec. 7th the weather was still rough enough and the threat of soon to be typhoon "Pongsona" forced us to continued to survey with the sea surface magnetometer south to the "Rough-Smooth" boundary. Upon reaching this area the weather had improved sufficiently to allow us to launch the DSL-120 for the first time. This Tow-01 ran from the Rough-Smooth (RS) boundary northwest to the 801C Hole location. We subsequently carried out 4 more DSL tows for a total of 5 DSL lowerings (Table 2; Fig. 8). During DSL Tows 2 and 3 we collected 6 detailed deeptow survey lines around the 801C survey site with part of the survey navigated within the transponder net. On Tow-3 we also completed the second of two long lines from just north of the 801C survey site that extended our original 1992 deeptow survey south to the Rough-Smooth (RS) boundary. After these 3 tows we recovered the transponders, however, we were unable to communicate with transponder "B". We were forced to assume it was either dead and or had been lost. We then transited north to just south of Golden Dragon seamount and deployed the DSL-120A for

Tow 4, which completed a long tow southward to a spot north of the Hole 801C site, bisecting our original 1992 survey lines. We recovered the DSL-120A and made a transit back north to the M34 anomaly sequence to the west of Golden Dragon seamount. We launched the DSL-120A for Tow-5 and carried out 3 relatively closely spaced lines approximately 3 and 10 km apart that showed the lateral correlatability of the near bottom magnetic data. The final line was extended south to the M38 anomaly. We recovered the DSL-120 on Jan $9^{th}/10^{th}$ and transited to Guam arriving on Jan 12^{th} (Fig. 8).

Sensors and Data Overview

DSL Vector Magnetometer Sensor

The vector magnetic data was collected using a Honeywell HMR2300 digital magnetoresistor sensor mounted on the starboard wing of the DSL-120A sidescan tow fish (Fig. 6). Communication with the device is via RS232 and is integrated into the sidescan telemetry system. The raw millivolt output is converted to nanotesla by multiplying by 6.667 nT per millivolt. In addition to this correction, the sensor must be calibrated for the permanent and induced field effects of the DSL-120A vehicle. This was accomplished by having the ship tow the DSL-120A in a circle while the fish was at 500 meters depth at the beginning of the survey. The resulting heading corrections could then be applied. Calibration utilized the attitude data obtained from the DSL-120A Octans laser gyro sensor (pitch, roll, heading). We used the full vector correction approach of Izesaki [1986] as modified by Korenaga [1995]. The required estimate of the ambient Earth's field utilized the KORDI magnetometer absolute measurement value that was collected simultaneously. The resultant computed coefficient matrix was applied to the reminder of the vector magnetometer data. The magnetic data for all five tows are shown in Figures 9-13.

KORDI Magnetometer

A total field magnetometer based on overhauser technology, referred to as the KORDI magnetometer, was brought from Korea by Sang-Mook Lee and was configured for towing by the DSL-120A vehicle. The advantage of proton precession magnetometer is that it provides an absolute field value, and thus can be used to calibrate vector magnetometer as well. The magnetometer was custom-built by Marine Magnetics three years ago and has undergone a series of tests at KORDI. Although it was rated to full-ocean depth, it was only tested to a depth of 1800 m prior to this cruise and was untested for 6000-m water depth of the Jurassic Quiet Zone. Except for a minor problem at the beginning of the cruise, the magnetometer performed extremely well. The magnetic data for tows 3-5 are shown in Figs. 14-16.

The problem at the beginning of the cruise occurred because the tow cable was terminated inside the DSL-120A junction box, which contained mineral oil. The 30-m long maggie cable was not blocked to fluid access and the ambient water pressure forced oil from the junction box along the inside of the maggie cable. The oil pressure in the cable caused the sensor end bulkhead connector to fail at ~4600-m depth and the connection was lost. Fortunately, upon retrieval of the DSL-120 and magnetometer two days later, the sensor was found to be unaffected and no seawater had entered the cable or magnetometer sensor housing. The magnetometer was fixed during tow-2 and used again on tow-3 for the remainder of the cruise. The maggie cable was terminated with a blocked connector outside of the mineral oil junction box. With this new connection between the junction box and magnetometer cable and the replacement of connector bulkhead screws, the magnetometer was put back into the water, and it has worked very well throughout the remainder cruise. Owing to the magnetometer's negative buoyancy, a glass sphere buoy was tied to the end of the magnetometer for extra floatation.

For the KORDI magnetometer to run with the DSL-120, some integration work had to be performed prior to the cruise. The electronic integration of the magnetometer to the DSL-120 was achieved through a separate interface card that was purchased from Marine Magnetics Corp. The interface card allowed the magnetometer to receive 24 VDC from the DSL-120A and uplink the digital data to the surface ship via DSL-120 fiber optic cable. Onboard the ship, the magnetometer data were multiplexed and transmitted to a logging PC via RS232. The absolute field measurement was then combined with ship's navigational information provided by another RS232 line into the PC. The measurements were graphically displayed on the PC monitor, and at the same time they were written to an output file at a rate of once per second. The logging software (SeaSPY) allowed a sequence of output files to be generated without over-writing the previous files. The program was menu driven and was easy to use. It also enabled the magnetometer clock to be synchronized with the GPS clock. In addition, the magnetometer was equipped with a pressure sensor and hence one could monitor the depth of the magnetometer fish as well. It is important to note that a slight offset exists in the pressure reading and that 100 m has to be subtracted from the reading to get the actual depth.

A typical output on the screen should look like below upon start:

```
*02.342/03:27:16.5 F:035072.906 S:168 D:+239.8m  L0 0465ms Q:99     <interpolating...>
*02.342/03:27:17.5 F:035072.675 S:167 D:+239.8m  L0 0465ms Q:99     <interpolating...>
*02.342/03:27:18.5 F:035072.304 S:167 D:+244.1m  L0 0465ms Q:99     <interpolating...>
*02.342/03:27:19.5 F:035072.235 S:167 D:+242.0m  L0 0465ms Q:99     <interpolating...>
*02.342/03:27:20.5 F:035071.796 S:167 D:+239.8m  L0 0465ms Q:99     <interpolating...>
*02.342/03:27:21.5 F:035071.509 S:168 D:+239.8m  L0 0465ms Q:99     <interpolating...>
*02.342/03:27:22.5 F:035072.540 S:167 D:+239.8m  L0 0465ms Q:99     <interpolating...>
*02.342/03:27:23.5 F:035070.949 S:167 D:+242.0m  L0 0465ms Q:99     <interpolating...>
*02.342/03:27:24.5 F:035071.172 S:167 D:+242.0m  L0 0465ms Q:99     <interpolating...>
*02.342/03:27:25.5 F:035072.340 S:168 D:+244.1m  L0 0465ms Q:99     <interpolating...>
*02.342/03:27:26.5 F:035073.028 S:168 D:+242.0m  L0 0465ms Q:99     N:17.749144 E:157.339786
*02.342/03:27:27.5 F:035073.360 S:167 D:+244.1m  L0 0465ms Q:99     N:17.749126 E:157.339756
*02.342/03:27:28.5 F:035073.807 S:168 D:+244.1m  L0 0465ms Q:99     N:17.749108 E:157.339746
*02.342/03:27:29.5 F:035073.617 S:167 D:+244.1m  L0 0465ms Q:99     N:17.749072 E:157.339739
*02.342/03:27:30.5 F:035072.718 S:167 D:+244.1m  L0 0465ms Q:99     N:17.749040 E:157.339751
*02.342/03:27:31.5 F:035072.052 S:168 D:+244.1m  L0 0465ms Q:99     N:17.749022 E:157.339767
```

In general, the magnetometer required little attention. However, during redeployment or restart of SeaSPY program, the clock inside the magnetometer automatically reset to zero, and therefore in some files there may be a time shift . To monitor the status of our survey, the output data of the magnetometer were regularly retrieved and were plotted using UNIX scripts and GMT software.

An important advantage which DSL-120A engineers realized during our operation was that the towed magnetometer provides the extra stability to the DSL-120A. The comparison of pitch angle with and without the towed magnetometer shows that having this 30-m-long magnetometer behind the deeptow sonar reduces the pitch by a factor of 4-5. So the magnetometer also contributed to obtain a better DSL-120A sonar images.

Sea Surface Magnetometer

A Geometrics G-866 marine magnetometer was used for making sea surface magnetic measurements during portions of the cruise. The magnetometer was deployed from a small special-purpose winch on the starboard side of the fantail. The magnetometer cable was 300 m in length. Data from the magnetometer were logged directly to a PC computer, synchronized with GPS navigation and time. Use of the magnetometer during deeptow operations was impossible because the cable has insufficient flotation to keep it from sinking at slow deeptow profiling speeds (~1.2 kt). The magnetometer was also not used during most transits because UW MAROPS refused to let the magnetometer be towed at a speed in excess of 8 kts. Sea surface magnetic profile times are listed in Table 2. A map of tracks and the anomalies are shown in Figs. 17 and 18.

DSL Sidescan data

The deep submergence laboratory (DSL) 120 kHz sidescan sonar vehicle DSL-120A was used for all of the deeptowed operations of the cruise. The DSL-120A collects a swath width of approximately 1200 meters at an altitude of approximately 100 meters. The system also collects data for phase bathymetry, which results in a bathymetric swath about half of the sidescan swath i.e. 600 meters. Tow speed averaged between 1.1 to 1.4 knots with wire out ranging between 6500 and 8500 meters. The DSL-120A had only one telemetry failure during the entire cruise, which cut short the first lowering. The J-box had taken on some seawater due to the KORDI magnetometer problem discussed later, however, the problem with the telemetry was at the clump weight junction. Gary Austin found some longline fishing gear wrapped around the cable, which may have contributed to the failure. After the clump weight junction was repaired and the vehicle J-box resealed the vehicle worked flawlessly for the rest of the cruise, without any failures.

A total of 5 lowerings were completed with the longest lasting 8.8 days and the shortest lasting 3 days (Table 3). A total of 28.5 days of sonar survey was completed. Total bottom time logged was approx. 27 days with 1863 sq kilometers of sidescan coverage and 930 sq km of phase bathymetry coverage. Raw sonar data amounted to 323 Gbytes of data (See appendix 1).

Navigation DAS and LBL

Navigation was generally excellent on board the RV Thompson for most of the cruise. There were five Global Positioning System (GPS) receivers available. The C&C Technologies C-NAV World D-GPS receiver was the primary navigation source for the cruise. Occasional loss of signal from the C&C sensor was compensated by two P-code

GPS receivers. DSL-120A navigation used layback from the ship GPS position and utilized acoustic slant range between the ship's transducer and the DSL-120A fish. This proved to be the most accurate method of layback in comparison to simple depth and wire-out when in layback mode. A long base line (LBL) acoustic transponder net was deployed for the detailed surveys around the 801C survey site. A square net of 4 Benthos transponders with baselines of about 6.5 kilometers was laid out. The computed layback navigation was calibrated against the long-baseline navigation when the fish was in the net. Some problems were encountered with the extreme length of wire out resulting in the ship being on one side of the baseline and the fish on the other for significant periods of time while in the vicinity of the LBL net. While the DSL-120A vehicle also used a doppler velocity logger for the first time, this system was not incorporated into the real-time calculation of fish position. This may be possible in the post-processing stage. Some interference of the doppler with the sidescan acoustic pulse returns was apparent.

BATHY-2000 Sub-Bottom Profiler

Shallow sub-bottom acoustic profiling was carried out using BATHY-2000 3.5/12 kHz Dual Frequency System by Ocean Data Equipment Corporation onboard the vessel. The system can be used as a bathymetric echo-sounder to obtain water depth directly below the vessel in 12 kHz mode. During the cruise, however, we employed the BATHY-2000 in 3.5-kHz-mode, allowing the acoustic signal to penetrate below the seafloor as well. The quality and the maximum penetration depth vary depending on the setting. In general, sub-bottom profiler provided sediment structure of 150-200 mbsf. Although there was an option to store the digital data of SEG-Y format on the mass optical storage device, this was not done during this cruise, and therefore only hardcopies produced by EPC 9800 gray-scale thermal printer were obtained. The EPC recorder has a resolution of 203 dpi using a pair of printer heads, where one prints the upper half and the other the bottom half on the 20.16-inch record sheet. However, there was some problem in the consistency between the recorder heads as two heads produced different tones. The upper half printed with a noticeably darker than the bottom half. However, it was not possible to fix this problem onboard. Except for this problem, the system as a whole performed well, and during the cruise we were able to obtain a large amount of sub-bottom profile data over 5800-6200-meter-deep ocean floor. Figs. 19 and 20 show composite images of the entire north to south transect from Golden Dragon seamount (M34) to the RS boundary and details around the 801C site respectively

BATHY-2000 parameter settings were written on the record sheet with a marker pen. During most of the time, the operation was done in FM-mode. This mode utilizes a sweep frequency (Chirp) transmission, which can be of varying pulse length, primary frequency, and sweep bandwidth. The received signal is then correlated with the transmitted signal using a match filter, which enhances the detection of bottom return over the conventional CW mode. A uniform sound speed of 1500 m/sec was used throughout the survey to estimate water depth. Typical setting is summarized in the table below. The power level, pulse length, fixed gain, and time varying gain (TVG) were sometimes changed for better clarity of features on the record sheet.

Table. Data acquisition parameters

Parameters	**Setting**	**Remark**
Power Level	O dB	
System Gain/Fixed Gain	36 dB	varied
TVG	1 dB/m	varied
Pulse Length	25 msec	
Primary Frequency	3.5 kHz	
Sweep Bandwidth	4 kHz	
Pulse Window	rectangular	

Multibeam Bathymetry

The R/V Thompson has two multibeam sonars, an early-1990s vintage Krupp Atlas Elektronik Hydrosweep system, and a nearly-new Kongsberg Simrad EM3000 sonar. Neither were used much on Cruise TTN152. The high frequency (30 kHz) of the Simrad system only works well in water shallower than ~3000 m. It was tested in deep water on the transit out of Guam but it did not receive sufficient bottom returns to work well. The Hydrosweep sonar was designed for deep water, but was used only sparingly because it did not work well. There was some concern, unfounded as it turned out, that the sonar would interfere with the transponder navigation or the DSL-120 sonar imagery. It did not. One problem was improper maintenance. During the Site 801 area survey, it was noticed that athwartship profiles over flat seafloor were not flat, and individual pings had different slopes. Troubleshooting by the marine techs identified the problem as improperly-installed attitude sensor boards in the processing electronics. The attitude of the ship also gave problems. Instead of traveling straight down a line, the ship usually crabbed sideways, often at a large angle to the direction of motion. The Hydrosweep was ill-equipped to deal with this non-standard geometry. Finally, even when the data appeared "good," upon later plotting they were noisy, showed little of interest, and gave noisy contours over the flat seafloor surveyed on the cruise. As a result, Hydrosweep data were only collected sporadically.

Initial Results

DSL vector magnetic profiles for Tows 1 through 5 are shown projected along track in Figs. 21 through 26 and the corresponding KORDI magnetometer profiles for tows 3 through 5 are shown in Figs. 27 through 30. Below we present a brief report on the results of the survey.

Objective 1

The first objective was to carry out a detailed survey around ODP Hole 801C to investigate the presence or absence of lineated seafloor magnetic anomalies and how they relate to the downhole results. We completed a detailed transponder navigated survey of the region around Hole 801C and tied the hole into a continuous deeptow magnetic record extending from M29 to the north of Hole 801C south to the "Rough-Smooth" boundary ~100 km southeast of Hole 801C. As part of DSL-Tows 1,2 and 3 we collected

6 parallel lines, each approximately 30 km long, that encompass the Hole 801C location. We believe we have collected conclusive evidence of spatially correlatable anomalies in the vicinity of Hole 801C that indicate seafloor spreading magnetic anomalies are present (Figs 21-23). The strike of the lineations appears to be about 25 degrees from north. Due to initial equipment problems, no KORDI absolute magnetic field data were available for Tows 01 and 02. However, two survey lines from Tow-03 were collected with the KORDI magnetometer including those lines that passed directly over the top of the Hole 801C location. All the tows collected vector magnetic data, which will help to define the two-dimensionality and sense of strike of the seafloor magnetic anomaly lineations. Exact details of how the measured magnetic reversal sequence ties into the downhole resultsremain to be determined.

Objective 2

The second objective of the cruise was to extend our previous 1992 survey lines south to the Rough-Smooth (RS) boundary and to place the Hole 801C in the proper context with respect to the geomagnetic polarity reversal timescale. We were able to complete two long lines (DSL Tow-1 and Tow-3) spaced approx. 30 kilometers apart, that extended south from Hole 801C to the RS boundary. Preliminary results show magnetic reversals continuing all the way to the RS boundary with strong amplitudes (~200 nT). At the RS boundary, magnetic anomaly amplitudes abruptly increase by a factor of 2 (i.e. 500 nT) (Fig. 21). We also believe that we can correlate the anomaly sequences between the two lines. Although the KORDI absolute measuring magnetometer was not working for Tow-01 it did record complete data for Tow-03. Again, both tows collected vector magnetic data, which we will be able to use to help define the two-dimensionality and sense of strike of the anomalies.

Objective 3

The third objective was to add a long line from just south of Golden Dragon seamount (21°30'N, 153°E) and extend it south to Hole 801C so that it bisected our existing 1992 lines (Figs. 24, 28). The primary purpose was to improve the lateral resolution and correlation between the 1992 survey lines, which were spaced approximately 30-50 km apart and were especially difficult to correlate in the very low amplitude M38-M40 section. We completed this long line during DSL-Tow04. The line ties into our line heading south to the RS boundary. Interestingly the line shows a southward decrease in the amplitude of magnetic anomalies (~400 to 100 nT) as was seen in the 1992 survey around the M38-M40 sequence. Magnetic anomaly amplitude then increases again just north of the Hole 801C location. Both the absolute KORDI magnetometer and the vector magnetometer collected data during this tow and thus we expect to be able use these data to verify and correlate with the 1992 profiles.

Objective 4

The fourth and final objective of the cruise was to investigate the rapid reversals at M33-M34 time and to verify our 1992 results. An area was picked just west of Golden Dragon seamount to carry out the detailed survey. We completed three lines that crossed the M34 sequence and verified both the correlation and rapid reversal nature of this anomaly sequence (Figs. 25,26,29,30). We also extended one of these lines south to cross the reversal sequence between M34 and M38 at an oblique angle to help with correlations further south. The rapid reversals confirm our original measurements and provide even stronger evidence that rapid geomagnetic reversals (>five reversals per million years) can be clearly and unambiguously recorded by oceanic crust.

Sidescan and Sub-bottom Results

The sidescan backscatter, phase bathymetry, and sub-bottom data show a number of surprising features for such a presumed quiescent abyssal ocean environment. Based on the drilling results of Holes 800 and 801, the volcanic basement in the Pigafetta basin is buried by 400 to 500 meters of sediment. The 3.5 khz shipboard sub-bottom data did not penetrate to volcanic basement but we estimate that the system did penetrate to depths of ~75 m. A common feature of the sub-bottom record was a strong acoustic reflector that was often buried at a depth of ~40 meters, but that in some places crops out onto the seafloor. While the seafloor topography and backscatter varied only slightly over the region there were areas with some curious properties. In a regional sense, Hole 801C appears to sit on a topographically raised area compared to the terrain to the north or south (Figs. 19,20), although the magnitude of this elevation is only on the order of a 125 meters or so. The Hole 801C results document a late stage alkalic lava sequence that overlies the Jurassic basement and it could be that this lava sequence is responsible for the height of the 801C site.

In terms of backscatter properties, the region immediately surrounding Hole 801C is typical of the backscatter character for the majority of the Pigafetta basin area with relatively featureless, monochromatic, sidescan backscatter and sediment draped terrain (see for example Fig. 31). A small seamount or mound is found about 15 kilometers south of 801C and other small seamounts are also found a similar distance to the north of the hole. Several tens to hundreds of kilometers north of 801C, however, there are number of features in the sidescan backscatter and phase bathymetry that suggest a potentially more dynamic sedimentary environment does exist in the deep abyssal ocean.

1) In the region around 20°N 154°45'E, the sidescan backscatter records show areas with pock-mark-like depressions about 5 m deep and 100 m or so in diameter, often circular, but sometimes elongate in plan view (Fig. 32). The bottom of the pock-marks are apparently zones of strong acoustic attenuation with very low backscatter intensity. The phase bathymetry shows the plan view and depth of some of these pock-mark features. No obvious disruption of the sub-bottom 3.5 khz record was seen in the water column above these features which implies that no gas is currently escaping from these features. The seafloor depth varies from 5650 to 6000 m in the pock-mark area.

2) The pock-mark terrain above gives way northwards to a zone of large mound-like features, several hundred meters long with distinctive rippled surfaces (Fig. 33). The transition between this mound and ripple terrain and pock-marked terrain occurs around 20°15'N and is marked by a variegated terrain of interfingering strong and weak backscatter returns.

3) The “mound and ripple” terrain in turn gives way to the north of 20°20’N to a completely low backscatter region that covers the floor of a deep basin (~6200 m deep) just south of Golden Dragon seamount (Fig 19). The northward extent of this very low backscatter amplitude is approximately 20°52’N where it transitions back via the same variegated terrain mentioned above to stronger backscatter amplitude. There are also mounds and occasional pock-marks in this transition area.

Acknowledgments

The Co-chief scientists of the cruise would like to thank the efforts of the HMRG and DSL groups for an outstanding effort in the mobilization, and operation of the DSL-120A system and for processing the vast amount of sidescan, phase bathymetry and magnetic data. We thank the ships crew, from the captain and mates to the engineers and deck crew who all made the ship operations go smoothly for the entire trip.

References

Abrams L.J. R.L. Larson, T.H. Shipley, Y. Lancelot, *in The Mesozoic Pacific: Geology, Tectonics, and Volcanism*, M.S. Pringle W.W. Sager, S. Stein, Eds, Geophys. Monogr. Series, 77, AGU Washington D.C., 77-101, 1993.

Barrett, D.L., and C.E. Keen, Mesozoic magnetic lineations, the magnetic quiet zone and sea floor spreading in the northwest Atlantic, J. Geophys. Res., 81, 4875-4884, 1976.

Blakely, R. J., Statistical averaging of marine magnetic anomalies and the aging of oceanic crust, J. Geophys. Res., 88, 2289-2296, 1983.

Cande. S.C., J.L. LaBrecque, and R.L. Larson, Magnetic anomalies in the Pacific Jurassic Quiet Zone, Earth Planet. Sci. Lett., 41, 434-440, 1978.

Cande, S. C., and D. V. Kent, Ultrahigh resolution marine magnetic anomaly profiles: A record of continuous paleointensity variations?, J. Geophys. Res., 97, 15,075-15,083, 1992a.

Cande, S.C., and D.V. Kent, A new geomagnetic polarity timescale for the late Cretaceous and Cenozoic, J. Geophys. Res., 97, 13,917-13,951, 1992b.

Carbotte, S., K. Macdonald, East Pacific Rise 8°-10°30'N: Evolution of ridge segments and discontinuities from SeaMARC II and three-dimensional magnetic studies, J. Geophys. Res., 97, 6959-6982, 1992.

Christeson, G. L., G. M. Purdy, G. J. Fryer, Seismic constraints on shallow crustal emplacement processes at the fast spreading East Pacific Rise, J. Geophys. Res., 99, 17,957-17,973, 1994.

Guspi, F., Frequency-Domain reduction of potential field measurements to a horizontal plane, Geoexploration, 24, 87-98, 1987.

Handschumacher, D.W., W.S. Sager, T. W.C. Hilde, and D.R. Bracey, Pre-Cretaceous tectonic evolution of the Pacific plate and extension of the geomagnetic polarity reversal timescale with implications for the origin of the Jurassic "Quiet Zone", Tectonophys., 155, 365-380, 1988.

Harding, A. J., G. M. Kent, and J. A. Orcutt, A multichannel seismic investigation of upper crustal structure at 9°N on the East Pacific Rise: Implications for crustal accretion, J. Geophys Res., 98, 13,925-13,944, 1993.

Harland, W. B., R. L. Armstrong, A. V. Cox, L. E. Craig, A. G. Smith, and D. G. Smith, A Geologic Time Scale 1989, 263 pp., Cambridge University Press, 1990.

Hayes, D.E., and P.D. Rabinowitz, Mesozoic magnetic lineations and the magnetic quiet zone off northwest Africa, Earth Planet. Sci. Lett., 28, 105-115, 1975.

Isezaki, N., A new shipboard three-component magnetometer, Geophysics, 51, 1992-1998, 2986.

Johnson, H. P. and J. E. Pariso, Variations in oceanic crustal magnetization: Systematic changes in the last 160 million years, J. Geophys. Res., 98, 435-446, 1993.

Johnson, H.P., D. Van Patten, M.A. Tivey and W.W. Sager, Geomagnetic polarity reversal rate for the phanerozoic, EOS Trans. AGU, 75, 44, 202, 1994.

Johnson H.P., D. Van Patten, M.A. Tivey, and W.W. Sager, Geomagnetic polarity reversal rate for the phanerozoic, Geophys. Res. Lett., 22, 231-234, 1995.

Korenaga, J., A comprehensive analysis of marine magnetic anomalies, *J. Geophys. Res., 100*, 365-378, 1995.

Lancelot, Y., R.L. Larson, and Shipboard Scientific Party, Proc. of the Ocean Drilling Program, Initial Repts, vol. 129, Ocean Drilling Program, College Station, TX, 1990.

Larson, R.L., And C.G. Chase, Late Mesozoic evolution of the western Pacific Ocean, Geol. Soc. Am. Bull., 83, 3627-3644, 1972.

Larson, R.L., and W.C. Pitman III, Worldwide correlation of Mesozoic magnetic anomalies and its implications, Geol. Soc. Am. Bull., 83, 3645-3662, 1972.

Larson, R.L., and T.W.C. Hilde, A revised timescale of magnetic reversals for the Early Cretaceous and Late Jurassic, J. Geophys. Res., 80, 2586-2594, 1975.

Larson, R.L., M.B. Steiner, E. Erba, and Y. Lancelot, Paleolatitudes and tectonic reconstructions of the oldest portion of the Pacific plate: A comparative study, Proc. Ocean Drilling Program, Scientific Results, 129, 615-631, 1992.

Larson, R.L., H. Schouten, M.A. Tivey, and ODP Leg 185 Shipboard Scientific Party, Multiple reversals and/or intensity fluctuations in the Jurassic magnetic quiet zone (JQZ) measured by downhole logging in ODP Hole 801C, EOS Trans. AGU, (Fall Meeting), 80:46, F526, 1999.

Leg 185 Shipboard Scientific Party, Izu-Mariana Margin, Proc. of the Ocean Drilling Program, Initial Reports, vol. 185, Ocean Drilling Program, College Station, TX, in press.

McFadden, P.L. and R.T. Merrill, Lower mantle convection and geomagnetism, J. Geophys. Res., 89, 3354-3362, 1984.

Merrill, R.T. and P.L. McFadden, Paleomagnetism and the nature of the geodynamo, Science, 248, 345-352, 1990.

Merrill, R. T., M. W. McElhinny, and P.L. McFadden, The Magnetic Field of the Earth: Paleomagnetism, the core and the deep mantle, 531 pp., Academic, San Diego, Calif., 1998.

Merrill, R.T., and P.L. McFadden, Geomagnetic Polarity Transitions, Rev. of Geophysics, 37, 201-226, 1999.

Nakanishi, M., K. Tamaki, and K. Kobayashi, Mesozoic magnetic anomaly lineations and seafloor spreading history of the northwestern Pacific, J. Geophys. Res., 94, 15,437-15,462, 1989.

Nakanishi, M., K. Tamaki, and K. Kobayashi, Magnetic anomaly lineations from late Jurassic to Early Cretaceous in the west central Pacific Ocean, Geophys. J. Int., 109, 701-719, 1992.

Ogg, J.G., Magnetic polarity time scale of the Phanerozoic, in Rock Physics and Phase Relations: A Handbook of Physical Constants, AGU Ref. Shelf., vol. 3, edited by T.J. Ahrens, pp. 240-270, AGU, Washington, D.C., 1995.

Ogg, J.G., and J. Gutowski, Oxfordian magnetic polarity time scale, in Proceedings of the 4th International Congress on Jurassic Stratigraphy and Geology, Geo. Res. Forum vols. 1-2, edited by A.C. Riccardi, pp. 406-414, Trans-Tec Publ., Ltd, Zurich Switzerland, 1996.

Opdyke, N.D., and J.E. Channell, Magnetic Stratigraphy, pp. 346, Academic Press, San Diego, Calif., 1996.

Parker, R. L., and S. P. Huestis, The inversion of magnetic anomalies in the presence of topography, J. Geophys. Res., 79, 1587-1593, 1974.

Perrin, M. M. Prevot, and E.A. Mankinen, Low intensity of the geomagnetic field in early Jurassic time, J. Geophys. Res., 96, 14,197-14,210, 1991.

Prevot, M., M.E. Derder, M.O. McWilliams, and J. Thompson, Intensity of the Earth's magnetic field: Evidence for a Mesozoic dipole low, Earth Planet. Sci. Lett., 97, 129-139, 1990.

Rutten, K. Two-dimensionality of magnetic anomalies over Iceland and Reykjanes Ridge, Mar. Geophys. Res., 2, 243-263, 1975.

Roest, W.R. J.J. Danobetia, J. Verhoef, and B.J. Collette, Magnetic anomalies in the Canary Basin and the Mesozoic evolution of the central North Atlantic, Mar. Geophys. Res., 14, 1-24, 1992.

Sager, W.W., C.J. Weiss, M.A. Tivey, and H.P. Johnson, Geomagnetic polarity reversal model of deep-tow profiles from the Pacific Jurassic Quiet Zone, J. Geophys. Res., 103, 5269-5286, 1998.

Schneider, D.A., and G.A. Mello, A high resolution marine sedimentary record of geomagnetic intensity during the Brunhes Chron, Earth Planet. Sci. Lett., 144, 297-314, 1996.

Smith, W.H.F., and D.T. Sandwell, Global seafloor topography from satellite altimetry and ship depth soundings, Science, 277, 1956-1962, 1997.

Steiner, M.B., J.G. Ogg, G. Melendez, and L. Sequeiros, Jurassic magnetostratigraphy, 2. Middle-Late Oxfordian of Aguilon, Iberian cordillera, northern Spain, Earth Planet. Sci. Lett., 76, 151-166, 1985.

Steiner, M.B. and J.G. Ogg, Early and Middle Jurassic magnetic polarity time scale, in 2nd International Symposium on Jurassic Stratigraphy, vol. 2, edited by R.B. Rocha and A.F. Soares, pp. 1097-1111, Cent. De Estratigrafia e Paleobiol. da Univ. Nova de Lisboa, Lisbon, 1988.

Steiner, M.B. and B.P. Wallick, Jurassic to Paleocene paleolatitudes of the Pacific plate derived from the paleomagnetism of the sedimentary sequences at sites 800, 801, and 802, Proc. Ocean Drilling Program, Scientific Results, 129, 431-446, 1992.

Steiner, and Leg 185 Scientific Party, Finally! Origin(s) of the Jurassic Quiet Zone (JQZ), EOS Trans. AGU, 80:46, F507, 1999.

Tarduno, J.A., W.V. Sliter,L. Kroenke, M. Leckie, H. Mayer, J.J. Mahoney, R. Musgrave, M. Storey,and E.L. Winterer, Rapid formation of Ontong java Plateau by Aptian mantle plume volcanism, Science, 254, 399-403, 1991.

Talwani, M., and J.R. Heirtzler, Computation of magnetic anomalies caused by two-dimensional structures of arbitrary shape, in Computers in the Mineral industries, edited by G.A. Parks, pp. 464-480, Stanford Univ. Press, Stanford, Calif., 1964.

Tanaka, T. and J. Korenaga, Enhancement of magnetic field imaging by wavenumber-domain assimilation of vector data, EOS Trans. AGU, 79, F229, 1998.

Thomson, D.J., Spectrum estimation and harmonic analysis, Proc. IEEE, 70, 1055-1096, 1982.

Triantafyllou, M.S., and F.S. Hover, Cable dynamics for tethered underwater vehicles, MIT Sea Grant College Program, 90-4, Mass. Inst. of Technol., Cambridge, MA, 1990.

Vogt, P.R., and A.M. Einwich, Magnetic anomalies and seafloor spreading in the western north Atlantic and a revised calibration of the Keathley (M) geomagnetic reversal chronology, in Deep Sea Drilling Project, Initial Reports, 43, 857-876, 1979.

Vogt, P.R., Magnetic anomalies and crustal magnetization, in The Western North Atlantic Region, edited by P.R. Vogt and B.E. Tucholke, Decade of North American Geology Series, vol. M, pp. 229-256, Geol. Soc. Am., Boulder, CO, 1986.

Wallick, B.P. and M.B. Steiner, Paleomagnetic and rock magnetic properties of Jurassic Quiet Zone basalts, Hole 801C, Proc. Ocean Drilling Program, Scientific Results, 129, 455-470, 1992.

Table 1. Transponder Locations

ID#	X (m)	Y (m)	UTM X (meters)	UTM Y (meters)	Latitude	Longitude	Dept h	Freq. (hz)	Type (status)
A	20283.0	15200.3	221272.88	2059062.74	18° 36.24014' N	156° 21.52176' E	5475.0	10.5	Release "F" Recovered
B	15863.6	19248.1	216915.62	2063178.30	18° 38.43446' N	156° 19.01132' E	5486.4	10.75	Release "H" Did not return
C	19996.4	23626.7	221110.84	2067497.78	18° 40.80812' N	156° 21.35896' E	5489.0	10.25	Release "G" Recovered
D	24261.3	19521.7	225312.48	2063328.18	18° 38.58278' N	156° 23.78164' E	5490.7	10.0	Release "E" Recovered

Table 2. DSL Lowerings

Lowering #	In water	Bottom	Lv Bottom	On Deck	Elapsed time
1	0257 8 Dec	1130 8 Dec	0350 11 Dec	0815 11 Dec	3.23
2	0432 12 Dec	0928 12 Dec	0215 15 Dec	0530 15 Dec	3.04
3	1441 15 Dec	2000 15 Dec	0530 24 Dec	0907 24 Dec	8.77
4	0228 26 Dec	0715 26 Dec	0140 1 Jan	0515 1 Jan	5.97
5	0238 2 Jan	0730 2 Jan	1000 9 Jan	1416 9 Jan	7.48

Table 3. Sea surface magnetometer lines, start and end times in GMT.

Line ID	SOL	EOL	SOL LAT. N	LONG. E	EOL LAT. N	LONG. E
SM-1	1450 6Dec	1915 6Dec	18° 49.500	156° 13.82	18° 31.352	156° 33.421
SM-2	1949 6Dec	2114 6Dec	18° 29.114	156° 31.761	18° 37.668	156° 22.556
SM-3	0130 7Dec	0500 7Dec	18° 27.790	156° 29.095	18° 46.630	156° 08.600
SM-6	1015 11Dec	1436 11Dec	18° 48.259	156° 13.007	18° 29.550	156° 33.073
SM-7	1455 11Dec	1857 11Dec	18° 28.504	156° 31.071	18° 47.474	156° 10.541
SM-8	1938 11Dec	2356 11Dec	18° 44.414	156° 67.968	18° 25.7	156° 27.2
SM-9	0130 12Dec	0303 12Dec	18° 33.107	156° 35.665	18° 41.222	156° 26.851
SM-10	1028 24Dec	2145 24Dec	17° 30.019	157° 27.866	18° 27.376	156° 24.991

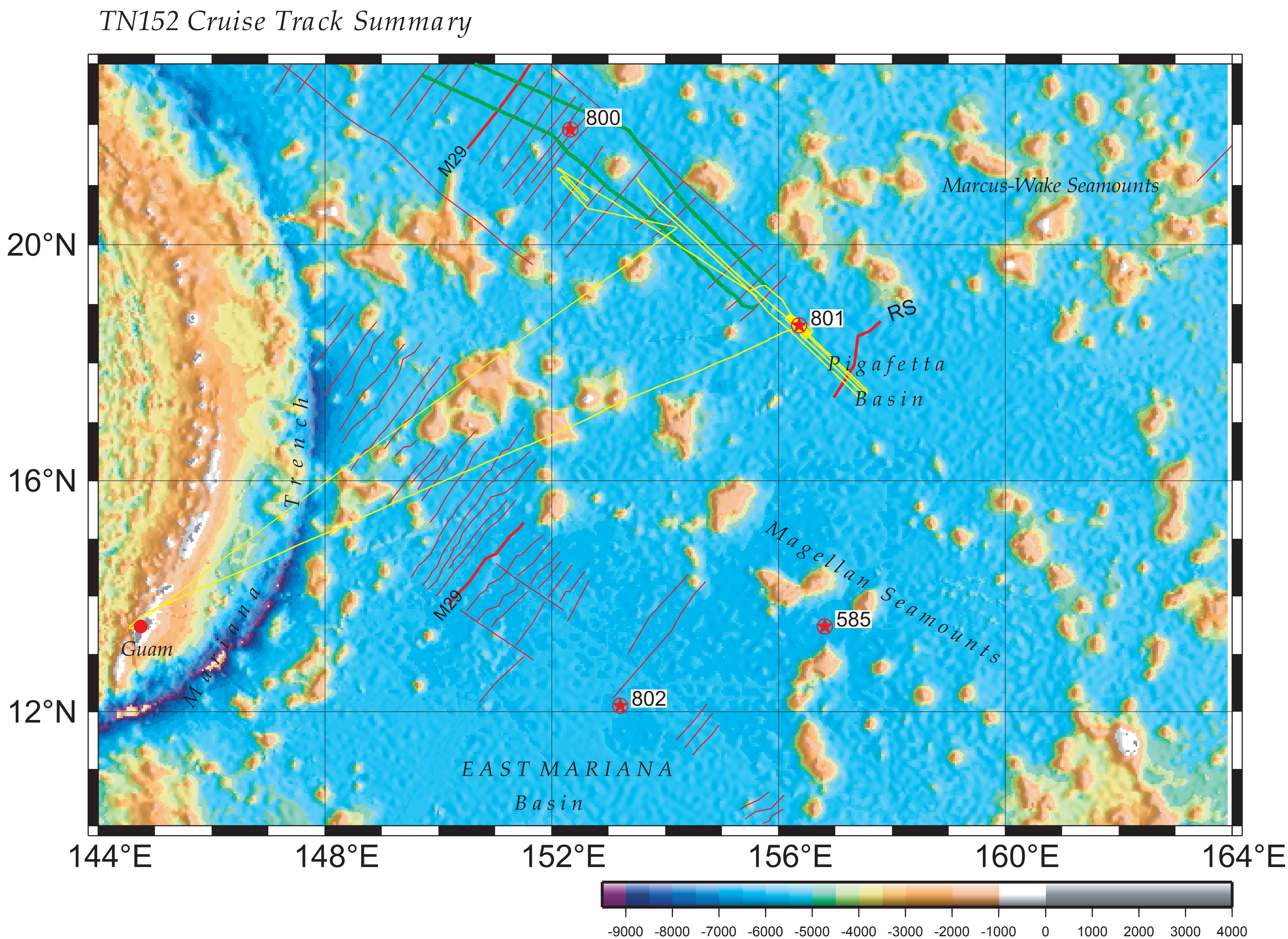


Figure 1. Location map of Pacific Jurassic Quiet Zone study area in the Pigafetta Basin. Bathymetry based on satellite altimetery data of Sandwell. Yellow lines show TN152 ship tracks, Green lines are the 1992 deeptow tracklines. Red lines are magnetic isochrons, RS marks the Rough-Smooth boundary.

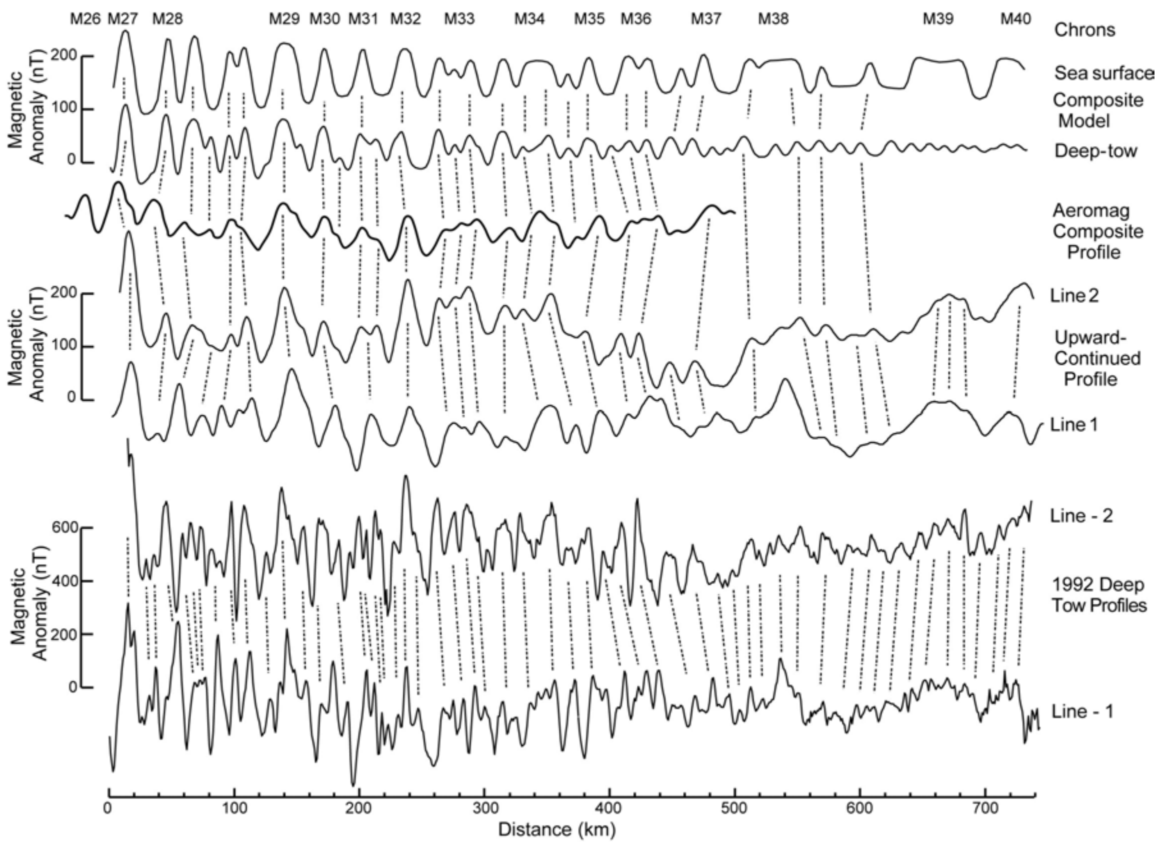


Figure 2. Plot of 1992 deeptow data showing correlations of deeptow, upward continued and composite sea surface model profiles. Chron identifications are shown at the top of the plot (Figure after Sager et al., 1998).

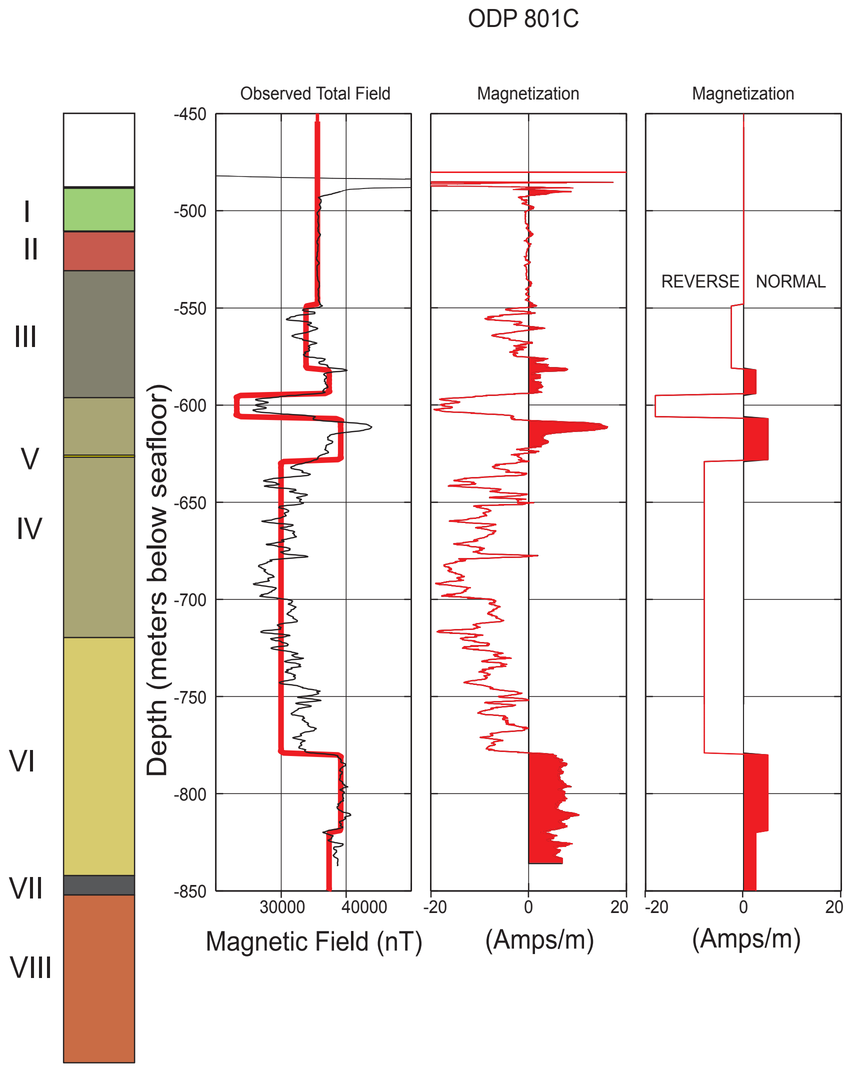


Figure 3a. Figure shows downhole magnetic log results and interpretation of ODP Hole 801C. Far left panel shows the defined geologic units: I Alkaline basement, II Si-Fe rich hydrothermal layer, III Thick lava flows of Jurassic age, IV Jurassic pillows with inter-pillow sediments, V A thin hydrothermal layer, VI Massive Jurassic age lavas, VII Tectonic breccia (Fault), and VIII Thin Jurassic flows and pillows. Next panel shows downhole total magnetic field (black line), with a simple predicted field (red line) based on the magnetization model shown on the far right. The center panel shows an inversion of the total field assuming a constant inclination of 23 degrees. Note the multiple polarities downhole. Data courtesy of Larson et al., [1999].

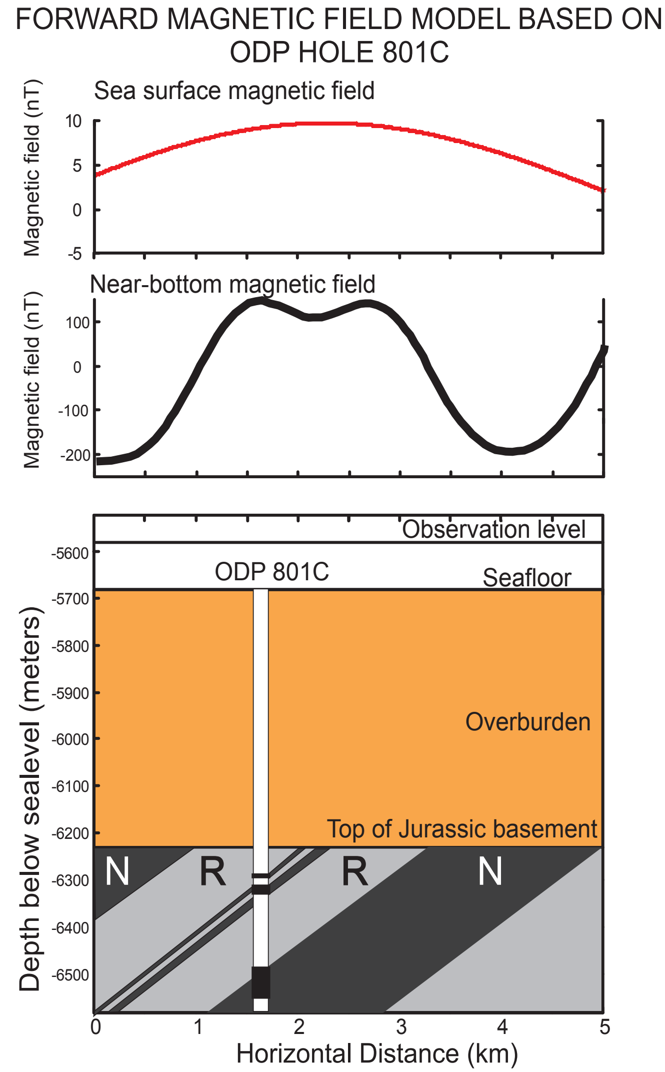


Figure 3b. Forward model based on downhole magnetic logging showing the possible crustal magnetization geometry and the field response that would be measured over the hole location by a deeptow sensor (middle panel) and sea surface sensor (top panel).

Figure 4. Photograph of the DSL-120A sidescan sonar tow vehicle, port side prior to its first launch. Yellow cable to right is magnetometer tow cable. Fiber-optic umbilical is to the left.

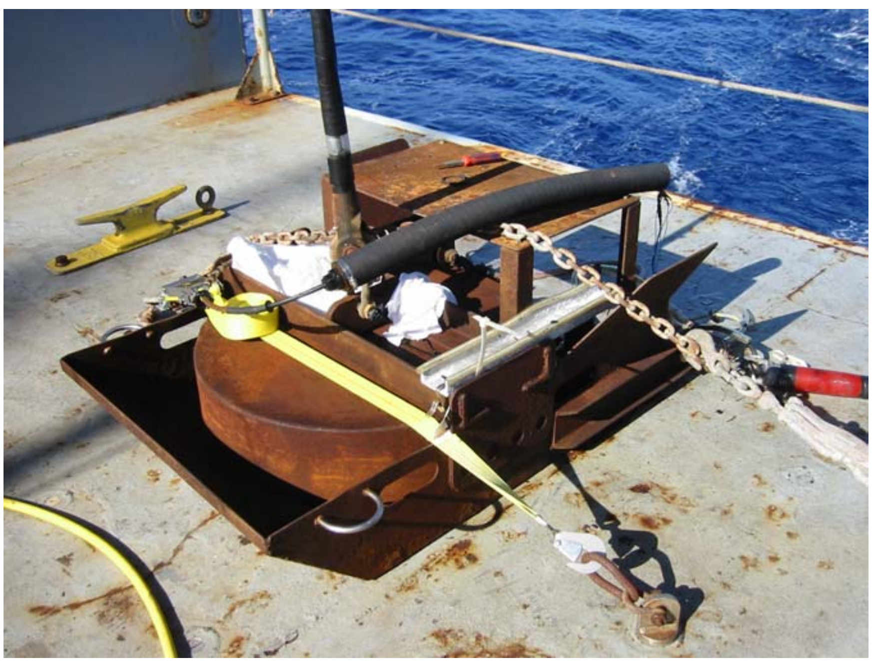


Figure 5. Photograph of the clump weight showing the improvised junction of the fiber-optic cable and neutrally buoyant tow umbilical for DSL-120A.

Figure 6. Photograph showing the HMR2300 vector magnetometer mounted to the starboard wing of the sidescan vehicle.

Figure 7. Photograph showing the starboard side of the DSL-120A sidescan vehicle with the KORDI Overhauser magnetometer (orange housing in front slightly disassembled). The HMR2300 vector magnetometer is located on the wing. See Fig. 6.

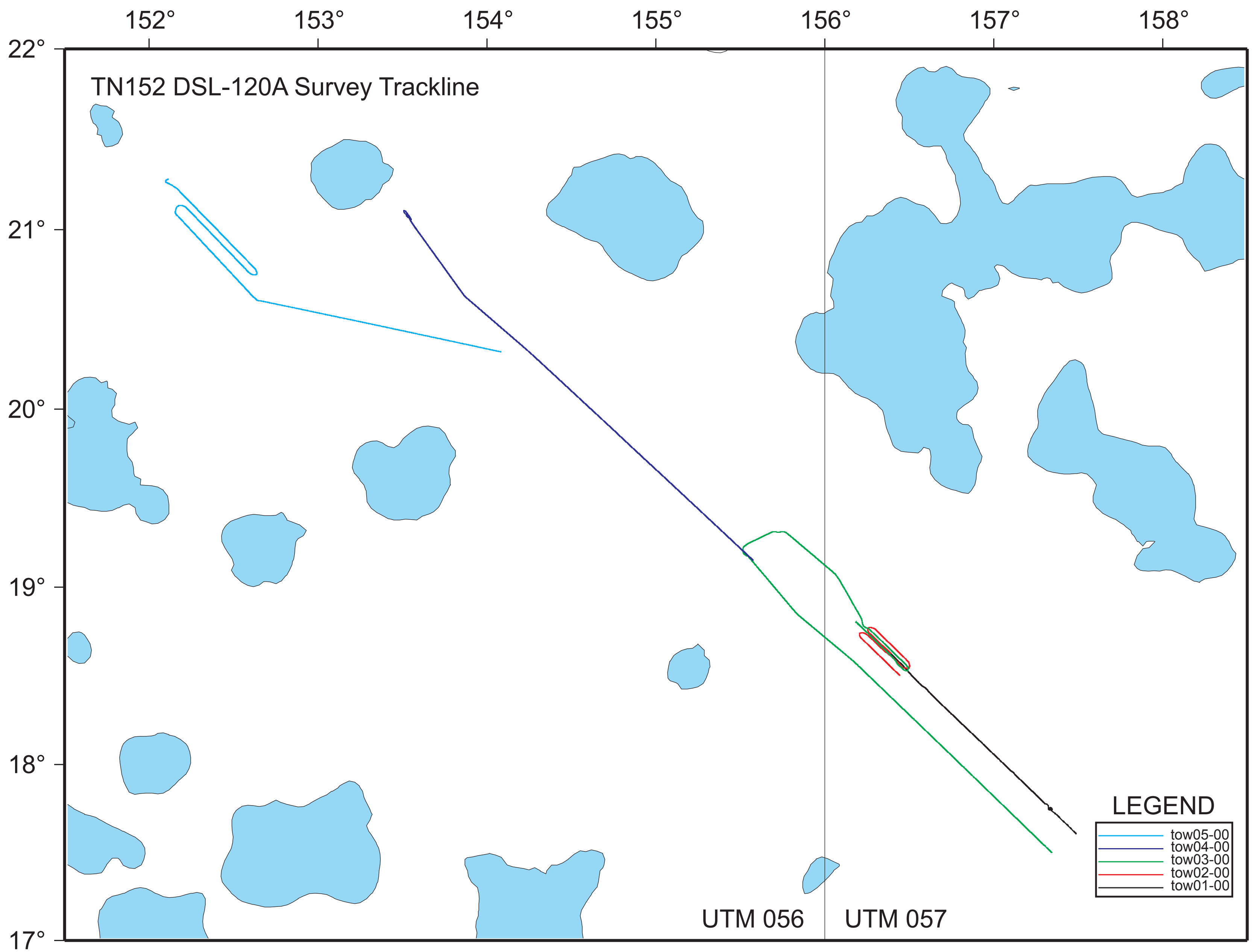


Figure 8. DSL-120A trackline map showing the location of the five near-bottom sidescan and magnetic tows completed during cruise TN152 to the Pigafetta Basin in the western Pacific Ocean. Shaded areas represent seafloor shallower than 4500 meters water depth.

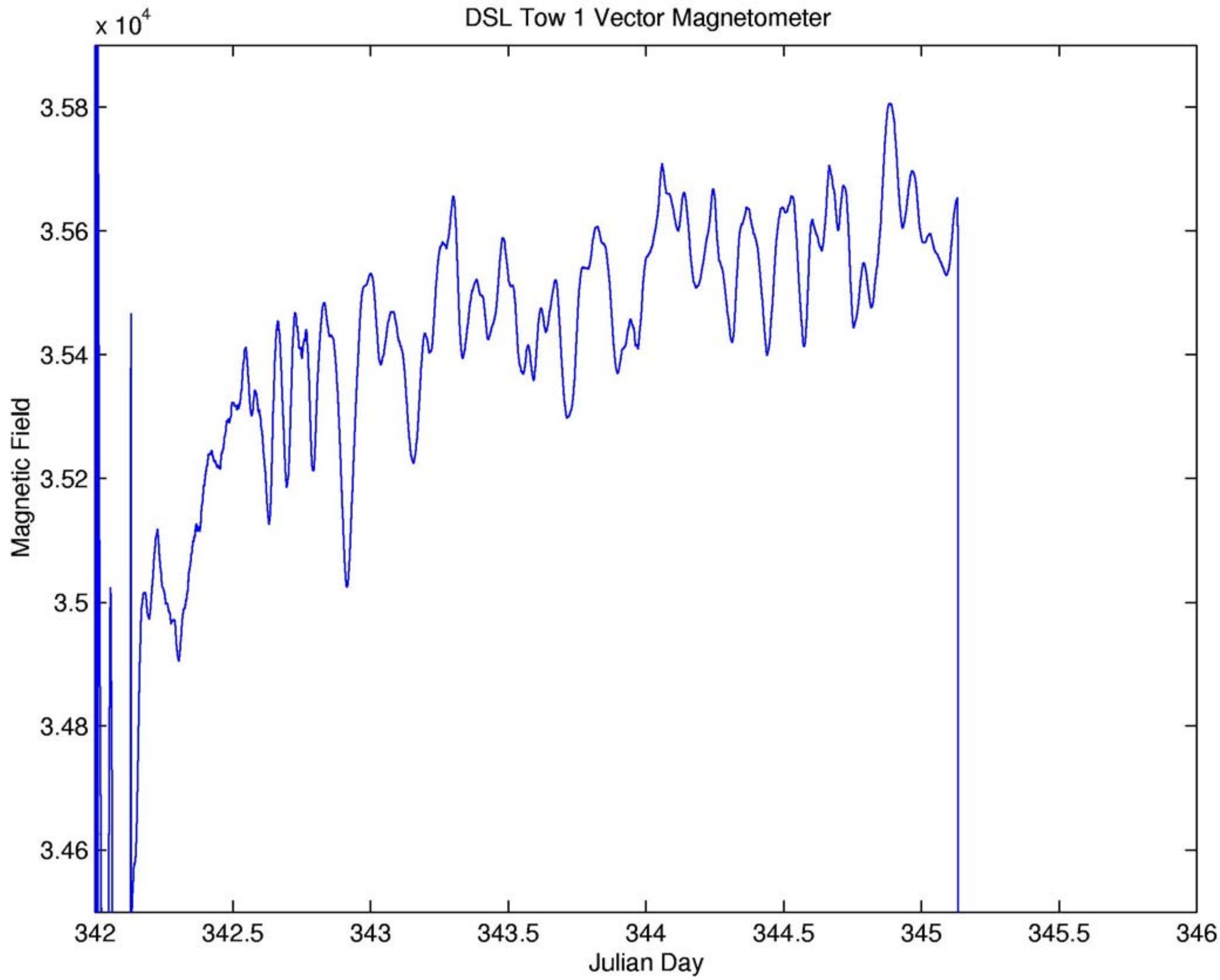


Figure 9. Plot of calibrated HMR2300 vector magnetometer total magnetic field data for DSL-Tow01

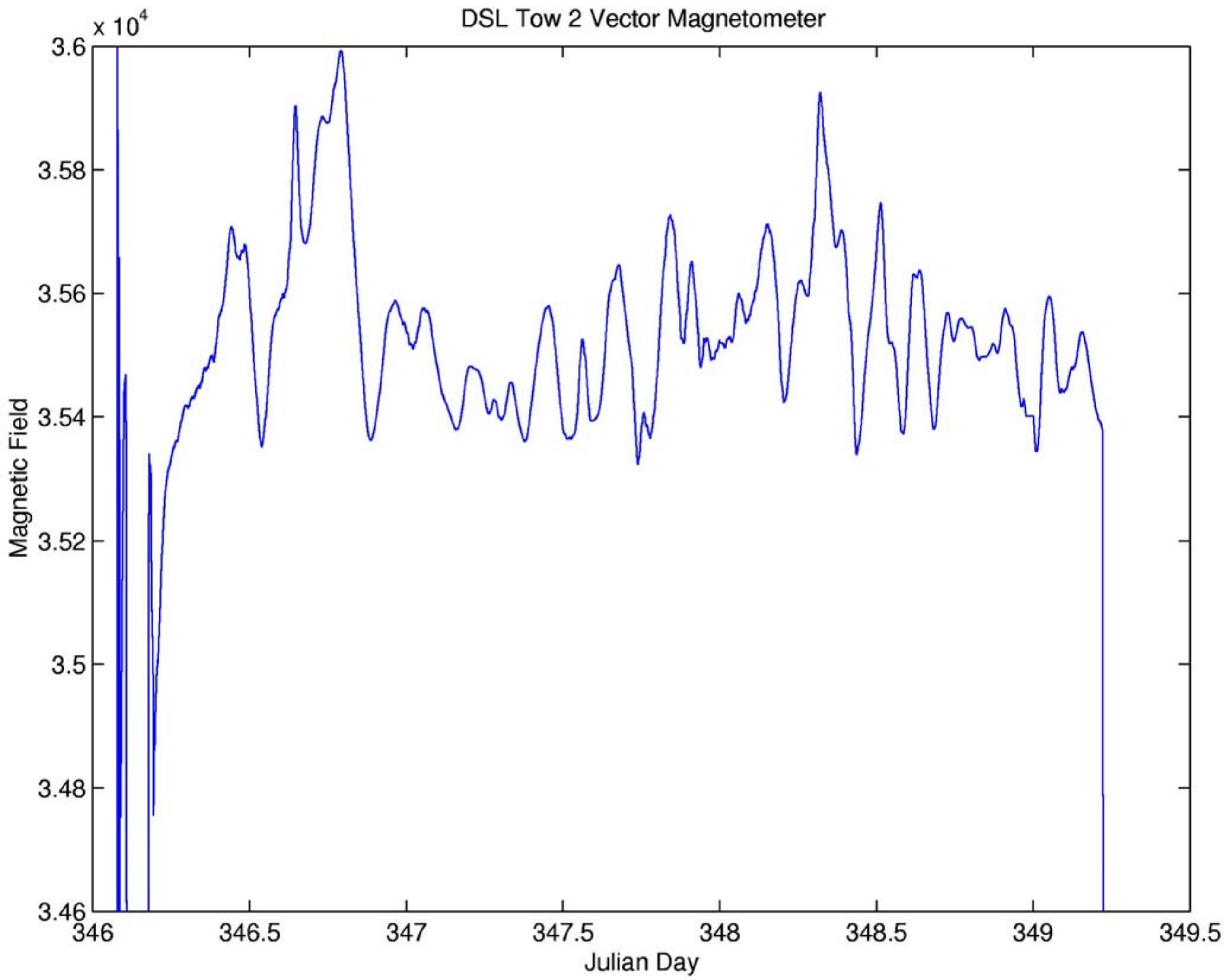


Figure 10. Plot of calibrated HMR2300 vector magnetometer total magnetic field data for DSL-Tow02

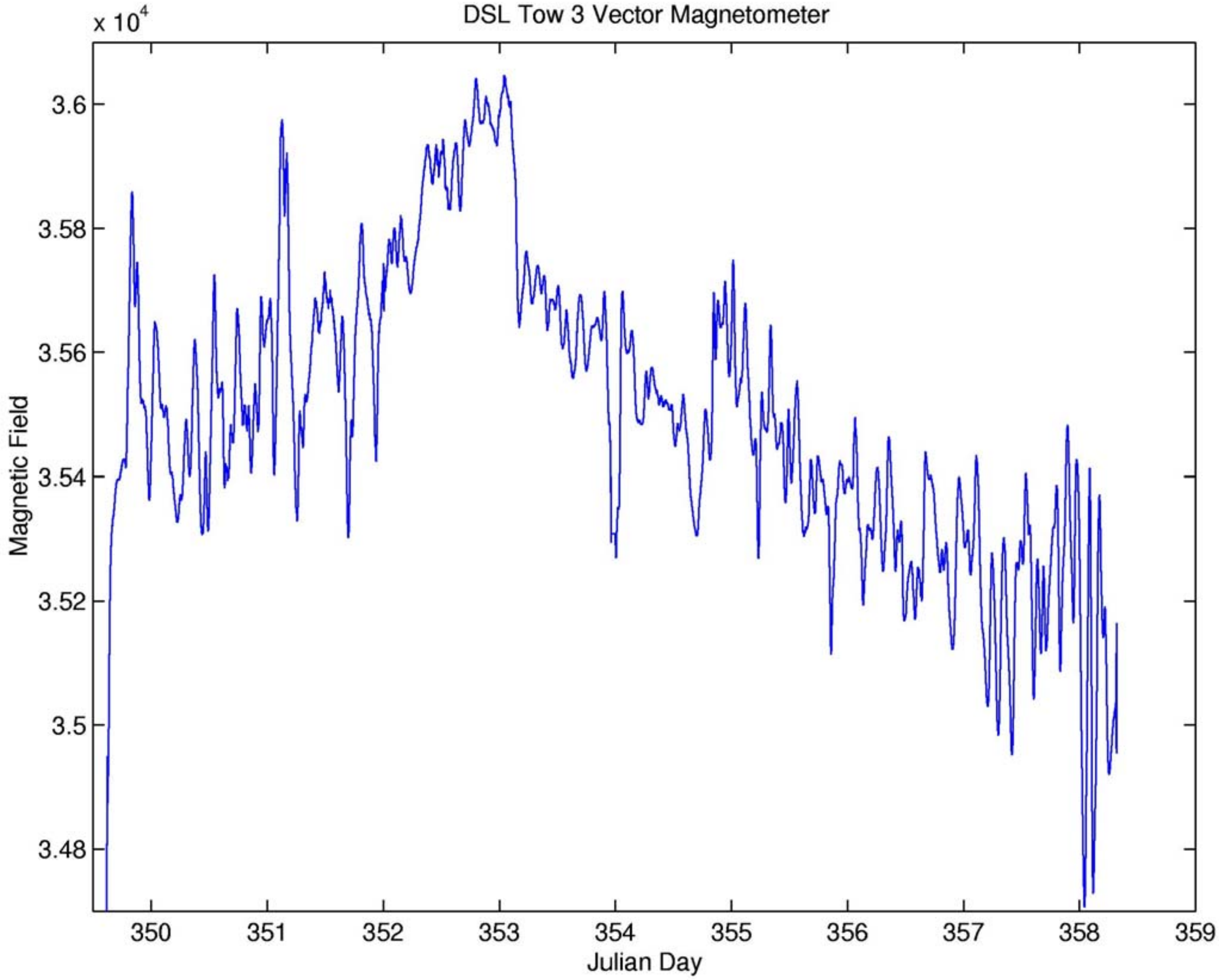


Figure 11. Plot of calibrated HMR2300 vector magnetometer total magnetic field data for DSL-Tow03

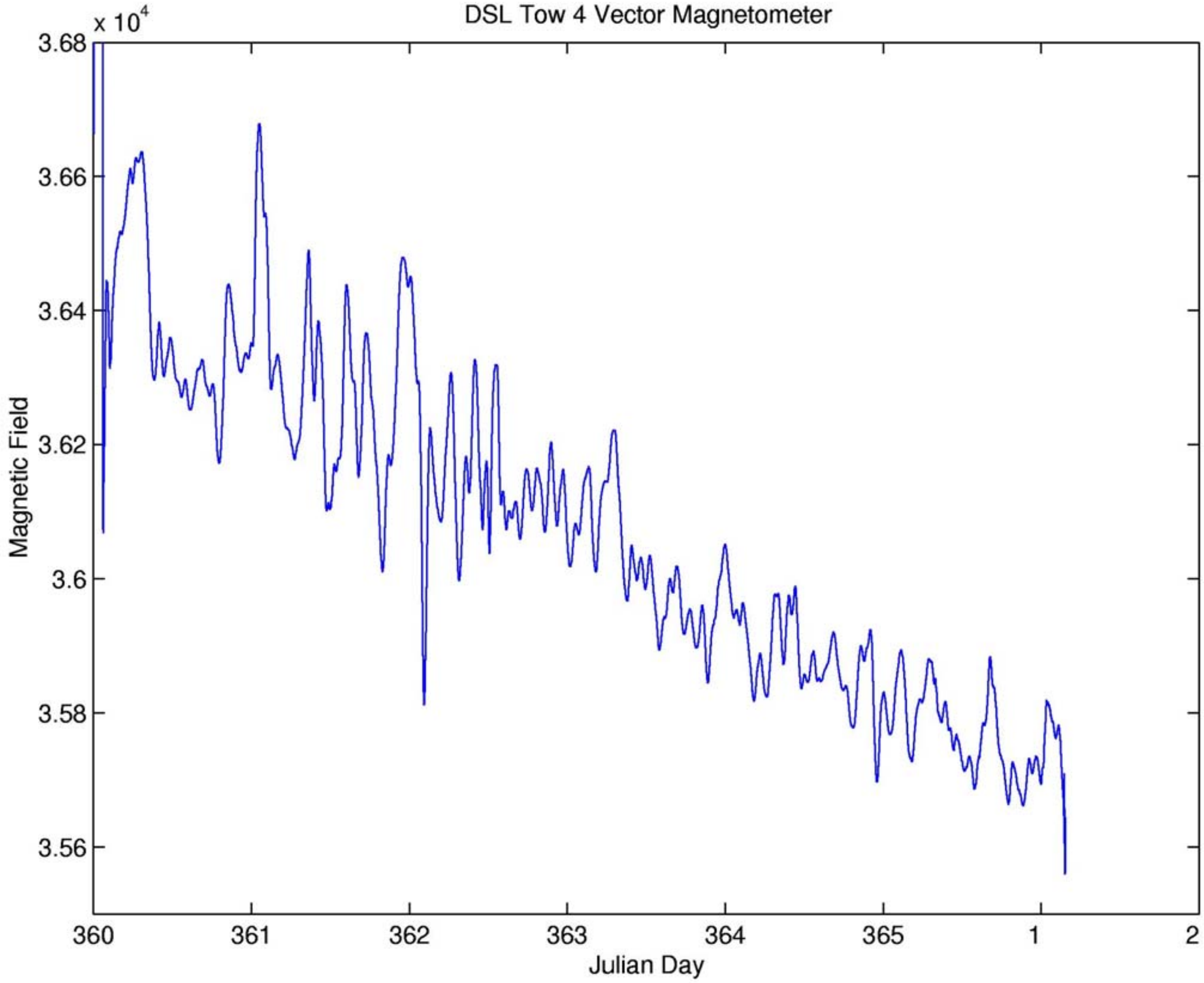


Figure 12. Plot of calibrated HMR2300 vector magnetometer total magnetic field data for DSL-Tow04

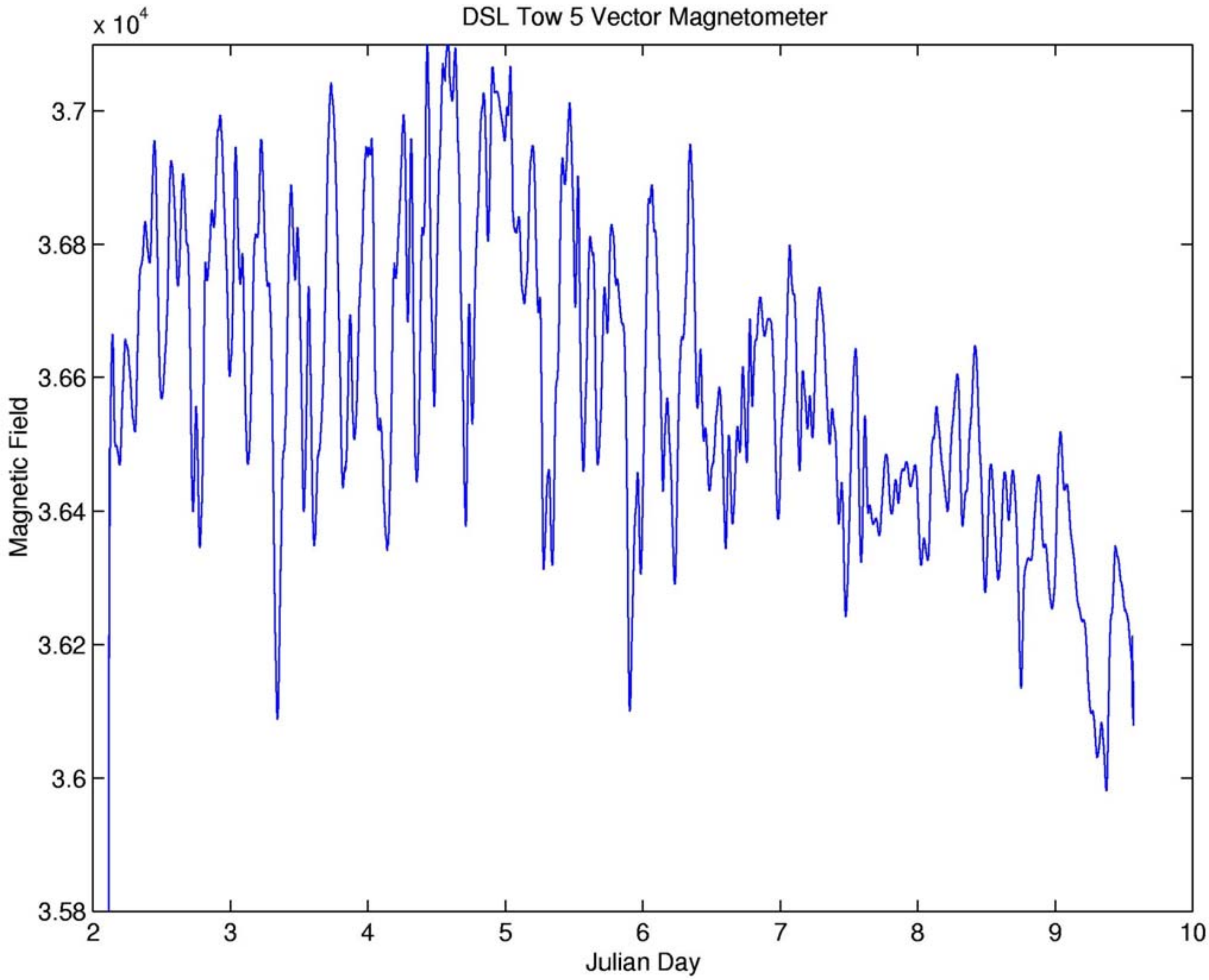


Figure 13. Plot of calibrated HMR2300 vector magnetometer total magnetic field data for DSL-Tow05

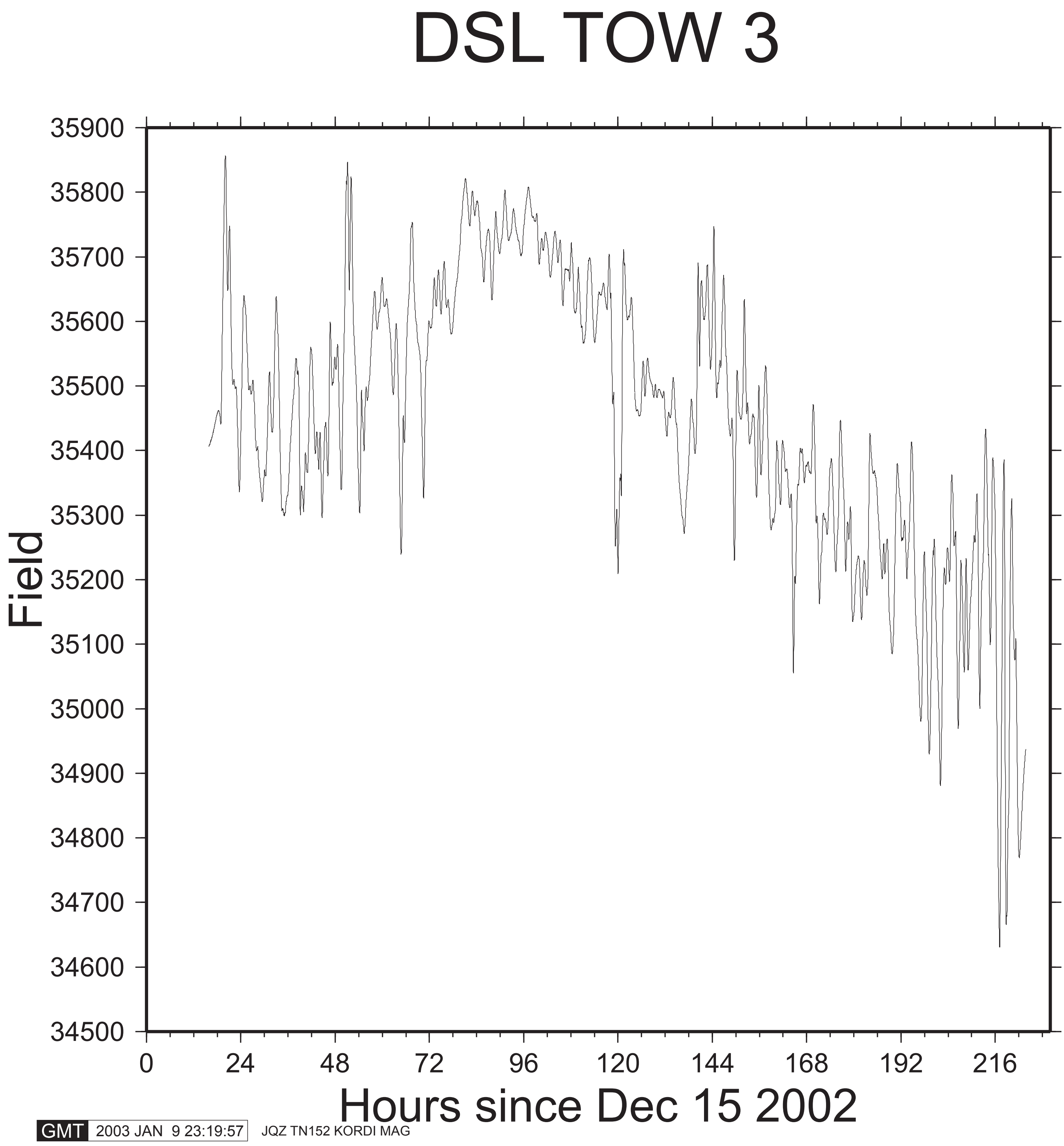


Figure 14. Plot of raw KORDI magnetometer data for DSL-Tow03

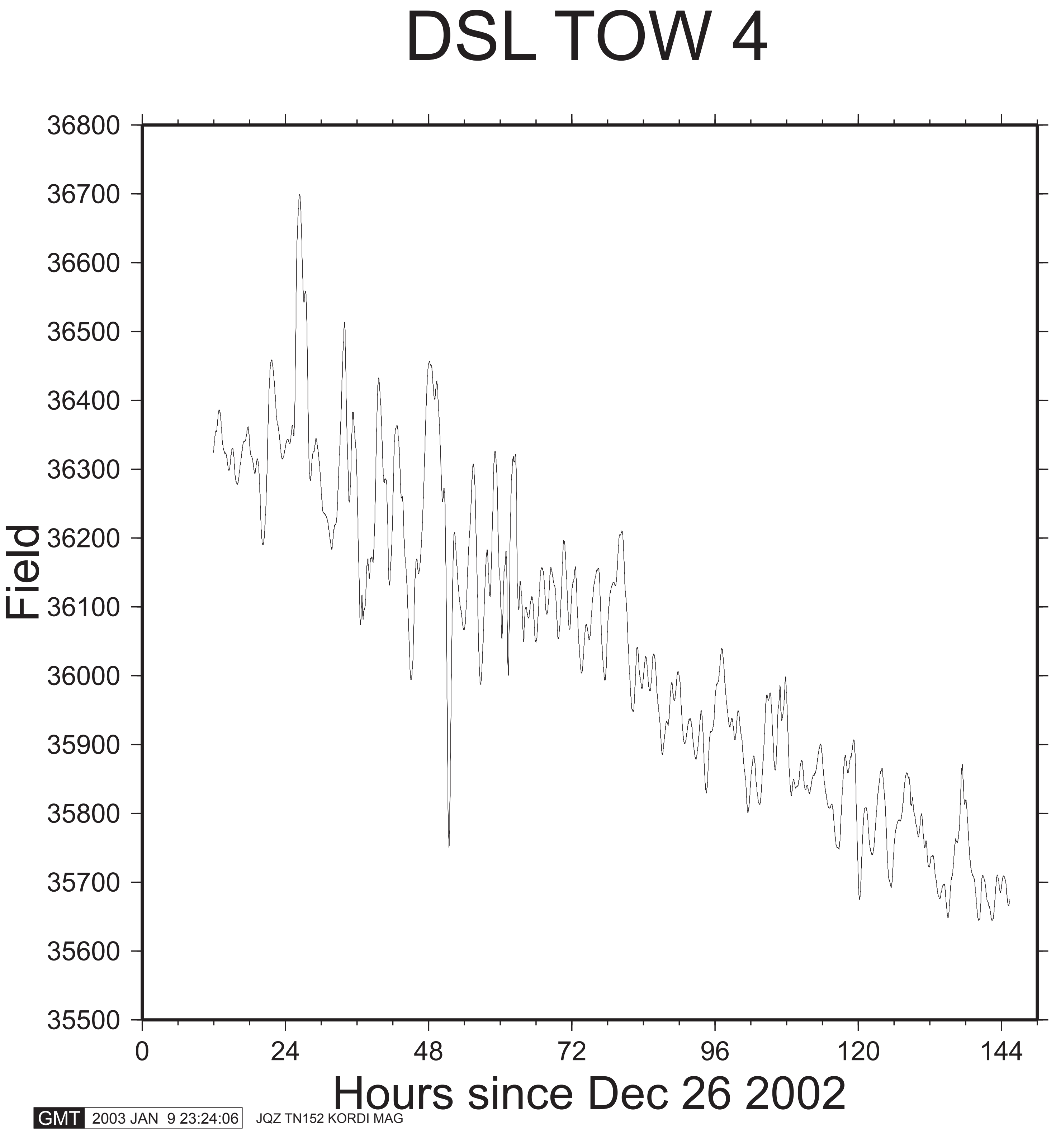


Figure 15. Plot of raw KORDI magnetometer data for DSL-Tow04

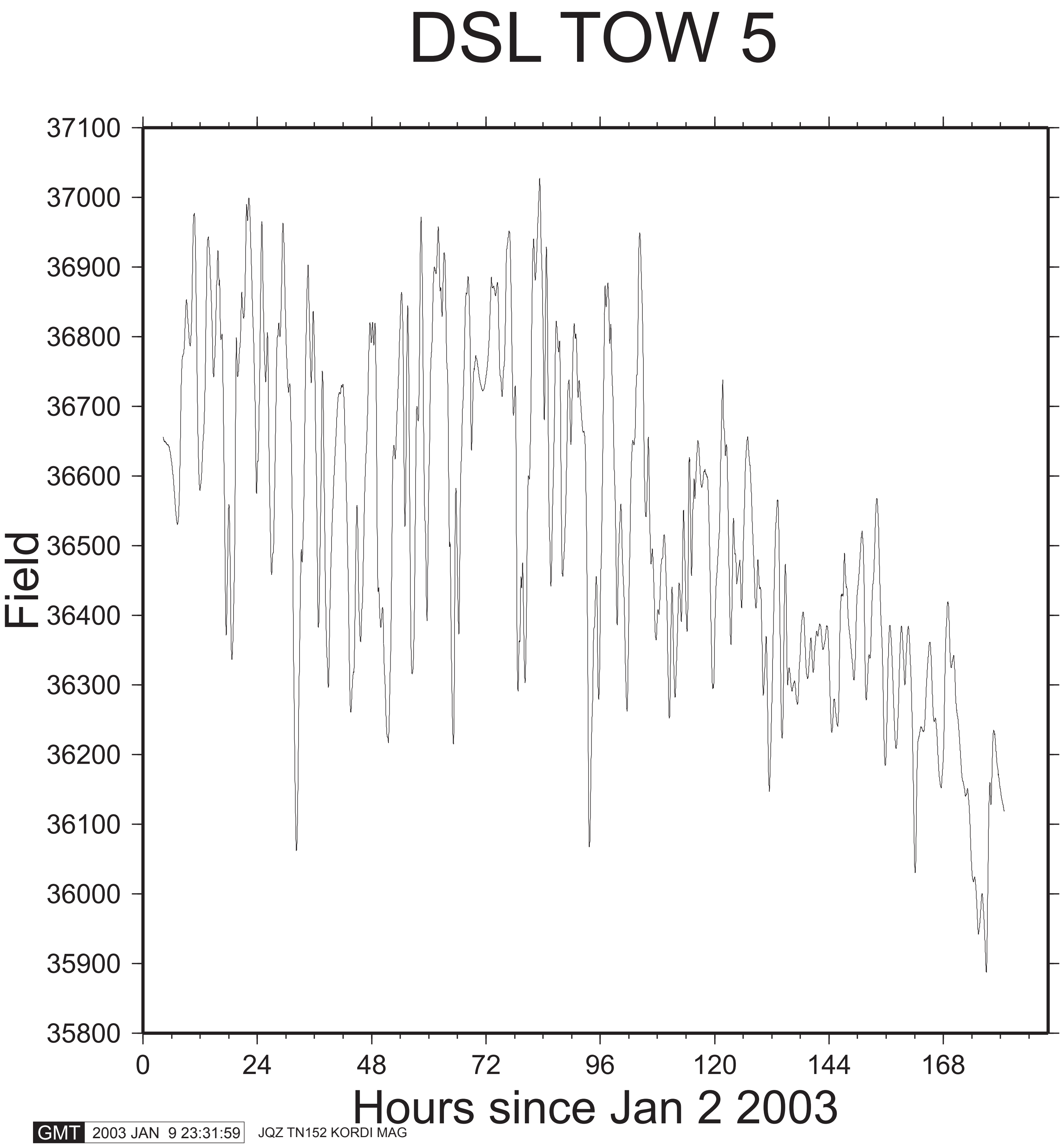


Figure 16. Plot of raw KORDI magnetometer data for DSL-Tow05

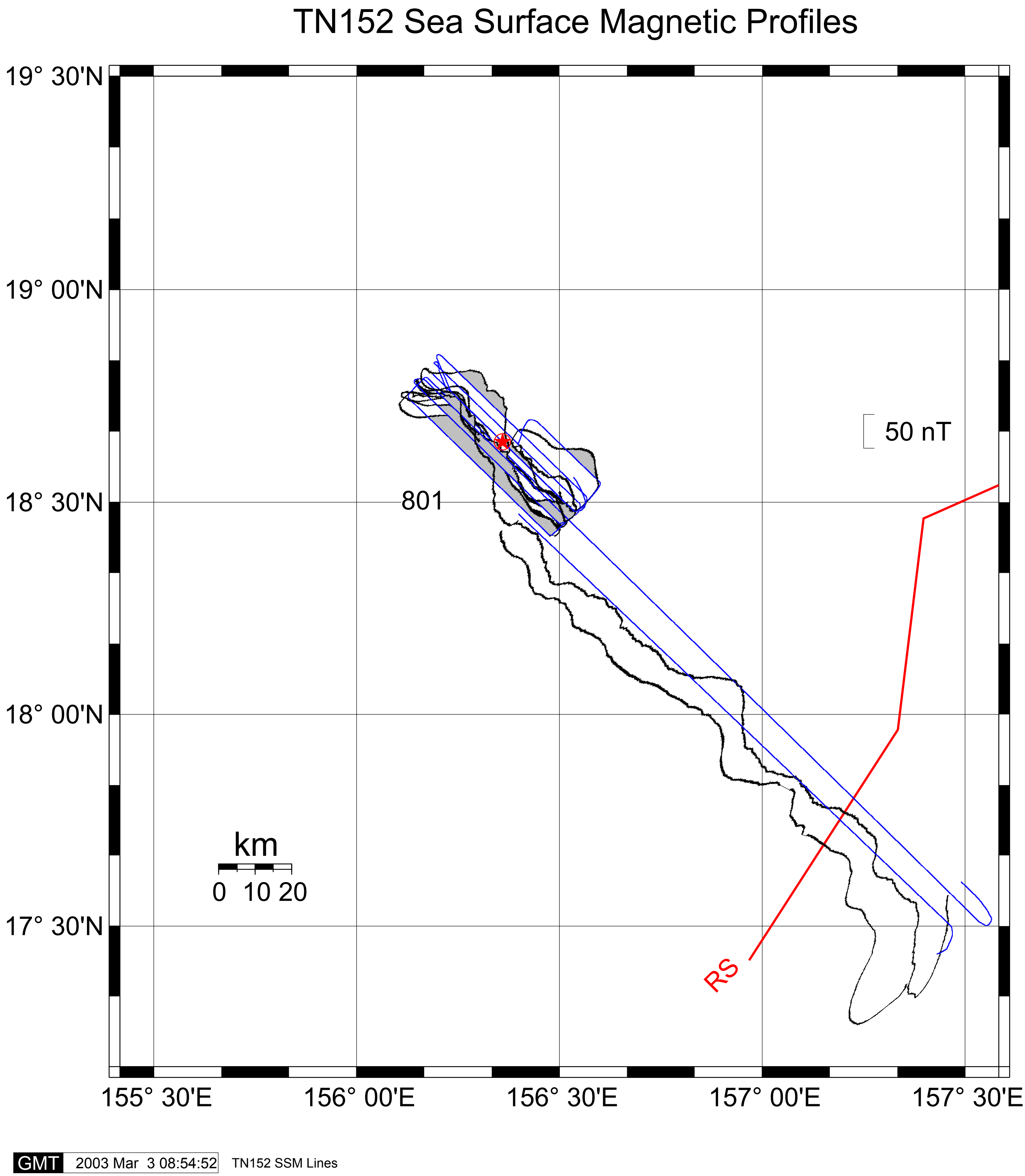


Figure 17. Sea surface magnetic anomalies projected along track showing coverage of profiles from 801C study site to Rough-Smooth (RS) boundary.

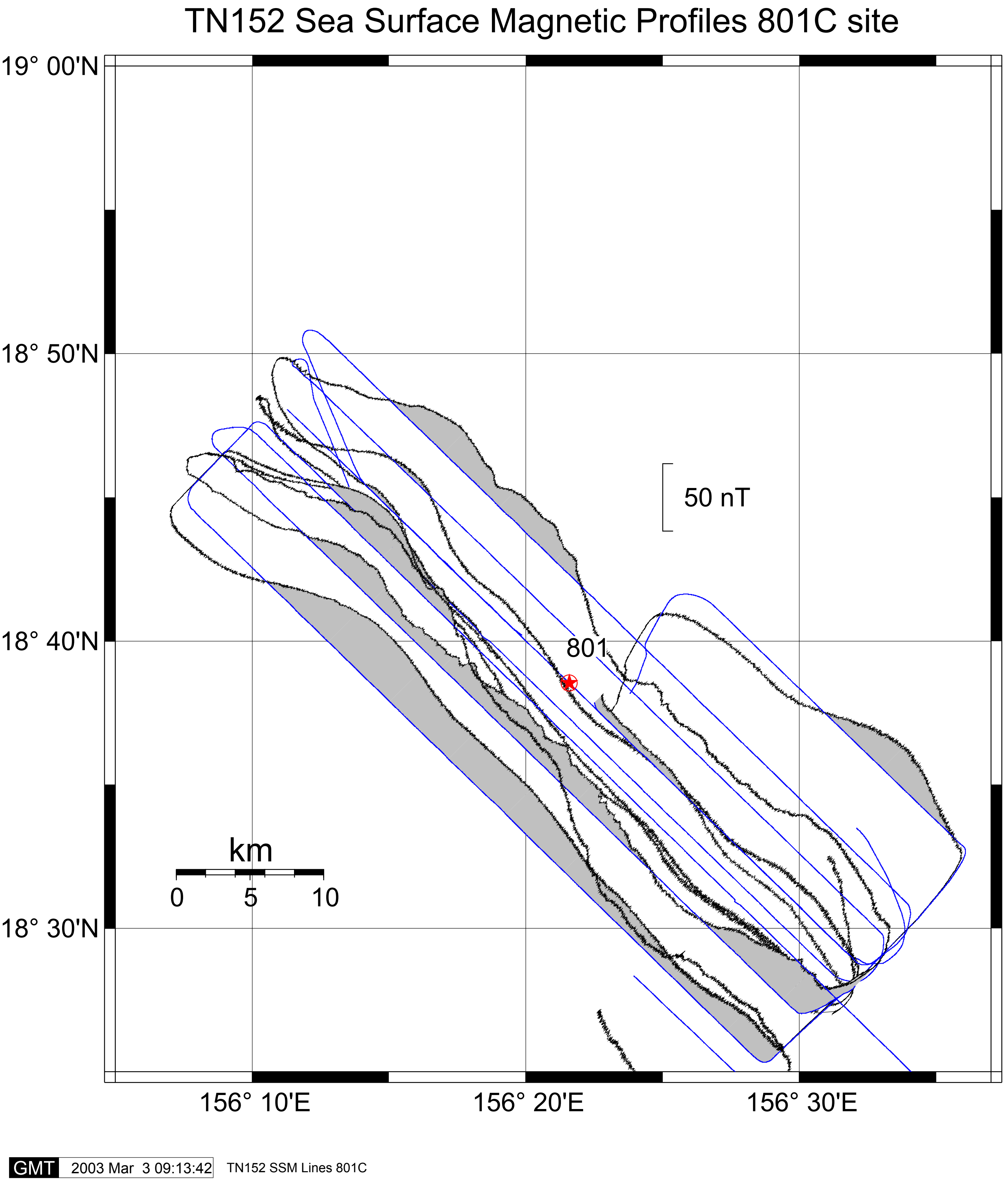


Figure 18. Detailed plot of 801C study area showing sea surface magnetic anomalies projected along track.

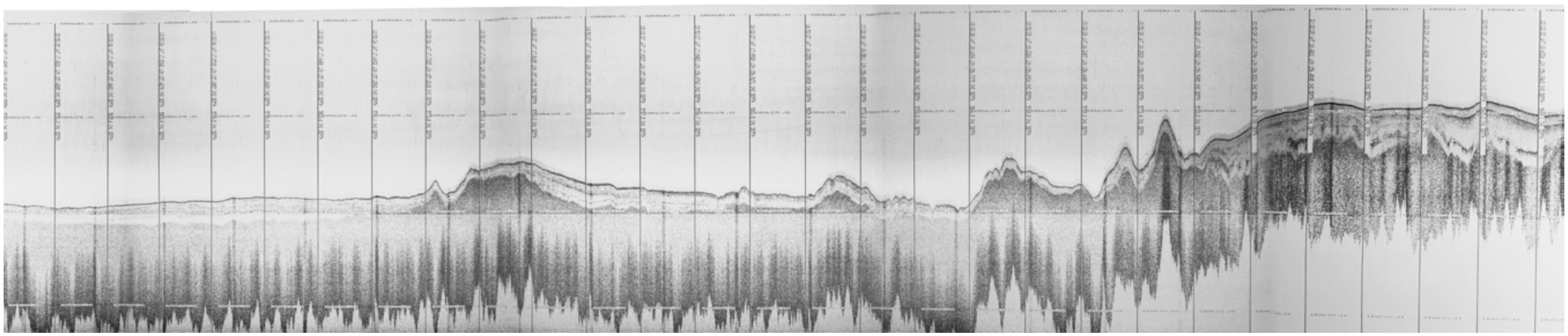


Figure 19a. Composite 3.5 khz sub-bottom profile ranging from left at the Rough-Smooth boundary to Hole 801C to the right.

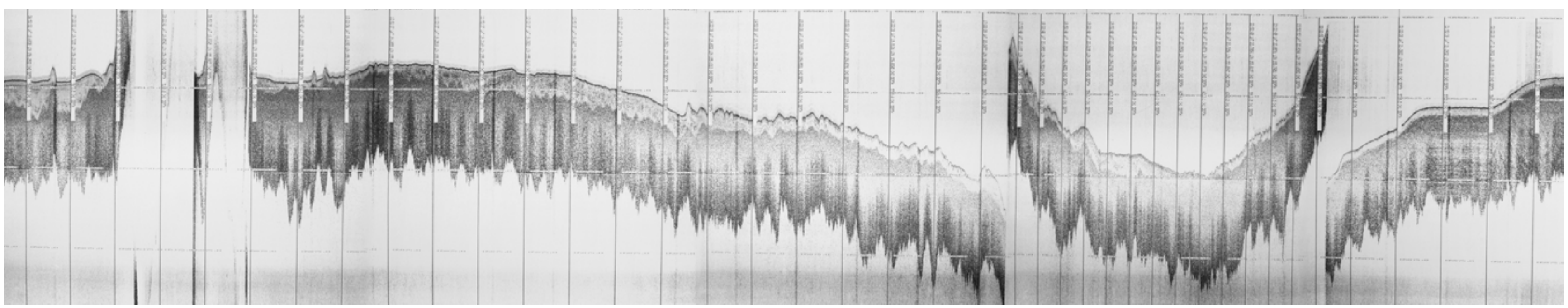


Figure 19b. Composite 3.5 khz sub-bottom profile north of 801C: plot starts from the left at 801C location and goes north to the southern flank of Golden Dragon Seamount. Note the offset in depth in the deep basin that reaches greater than 6200 meters depth.

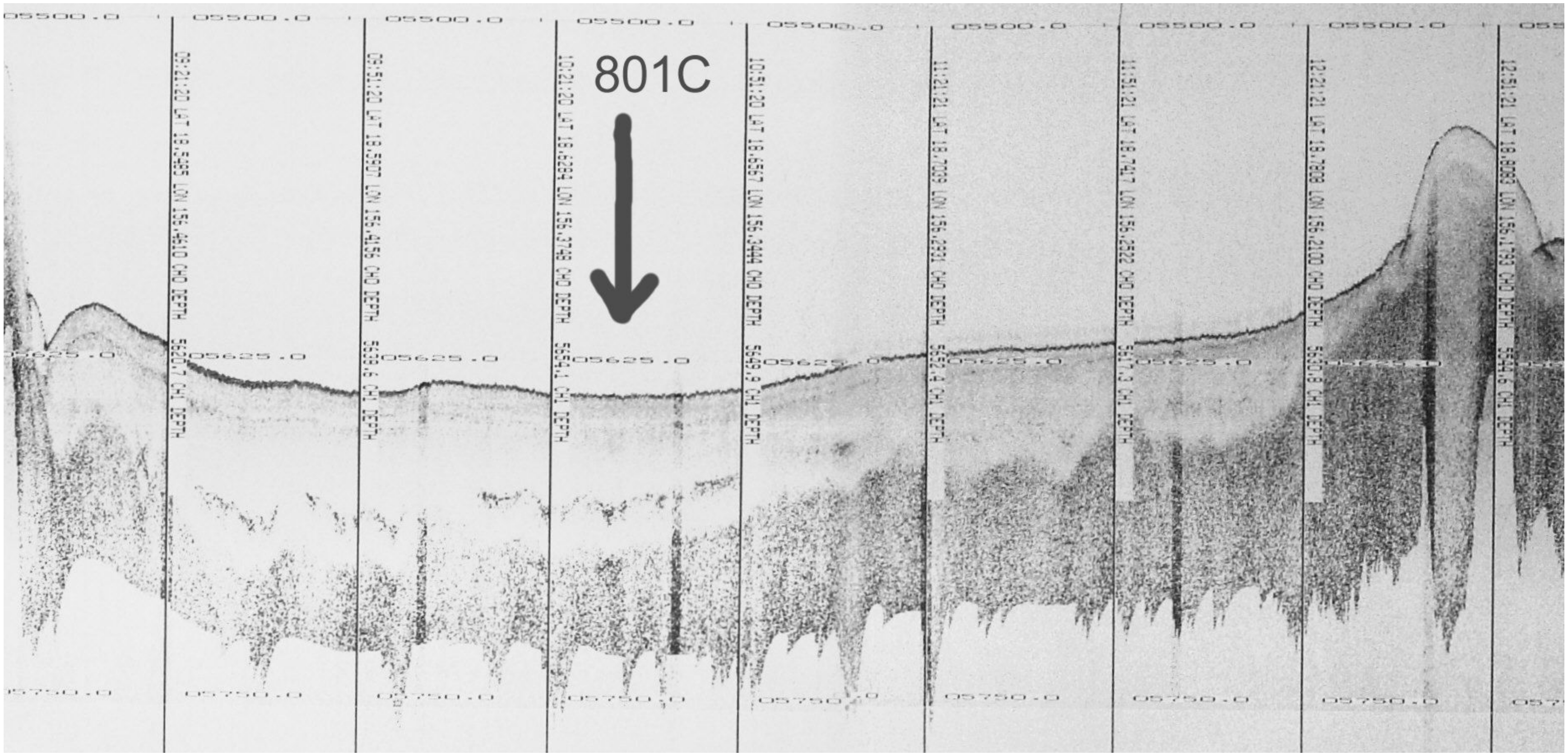


Figure 20. Composite plot of 3.5 khz sub-bottom profile of Hole 801C area ranging from south (left) to north (right).

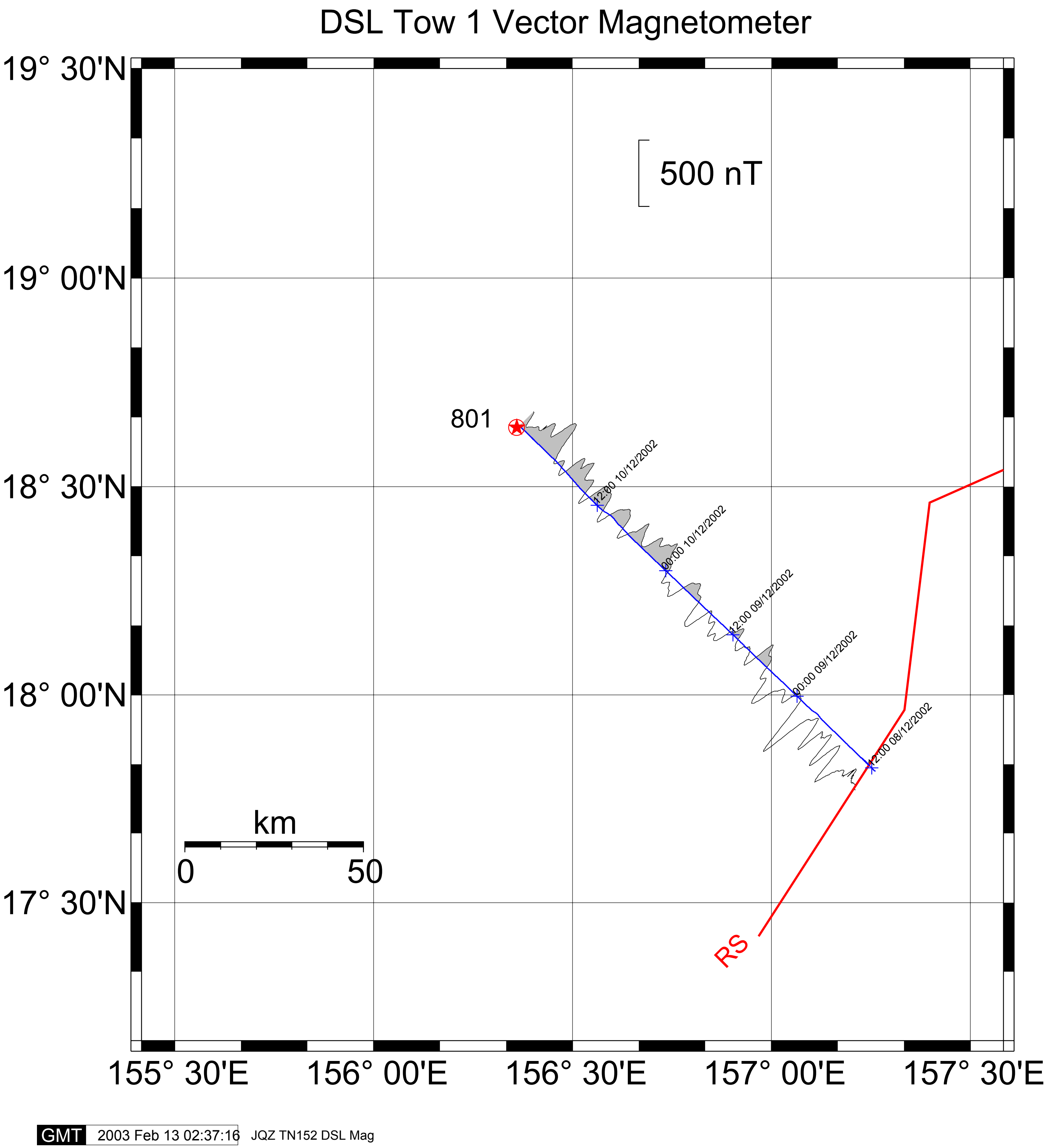


Figure 21. Plot of DSL-Tow01 showing projected profiles of the HMR2300 vector magnetometer total magnetic field from the Rough-Smooth boundary to 801C site.

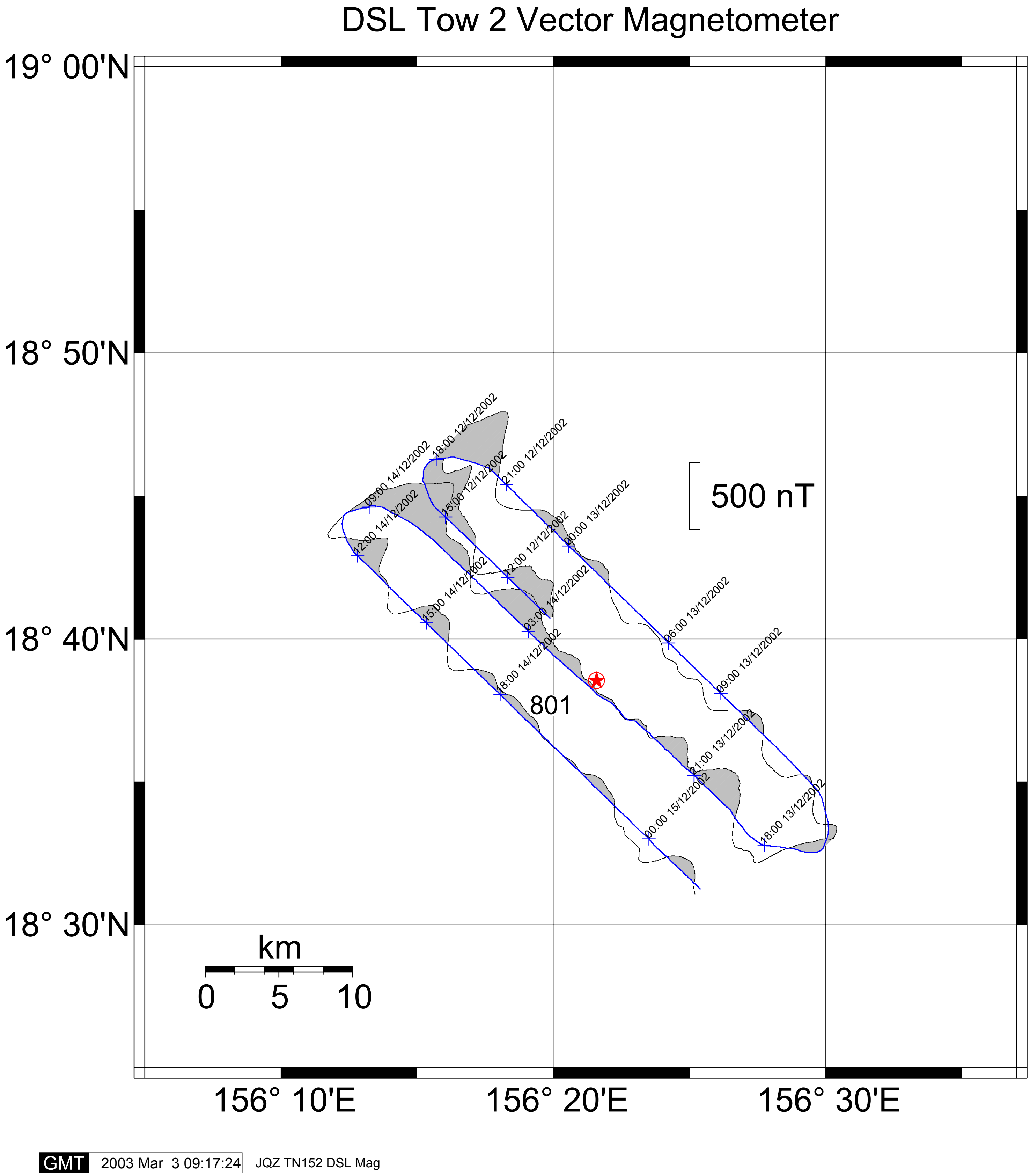


Figure 22. Plot of DSL-Tow02 showing projected profiles of the HMR2300 vector magnetometer total magnetic field over the 801C area.

DSL Tow 3 Vector Magnetometer

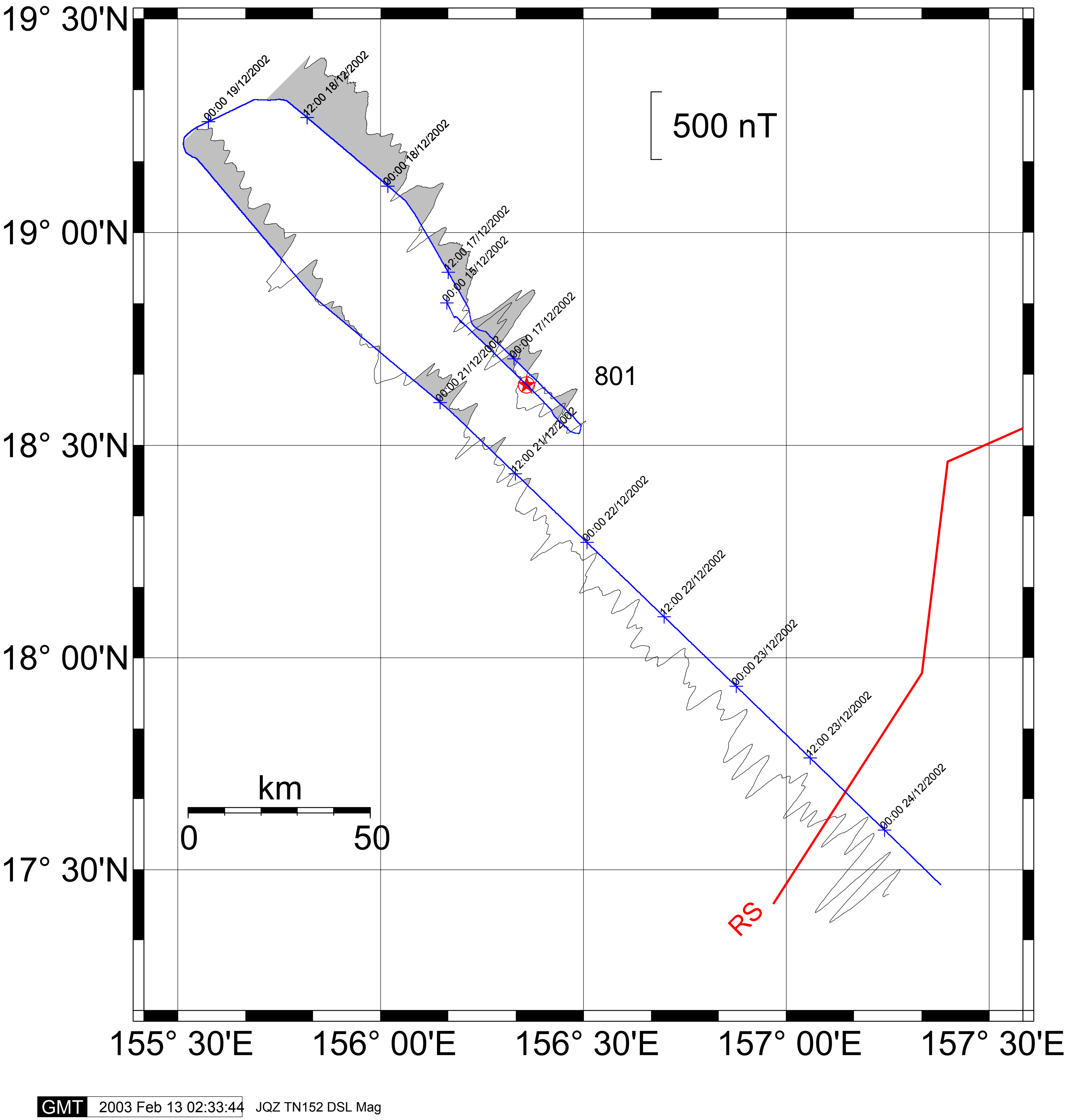


Figure 23. Plot of DSL-Tow03 showing projected profiles of the HMR2300 vector magnetometer total magnetic field over the 801C area.

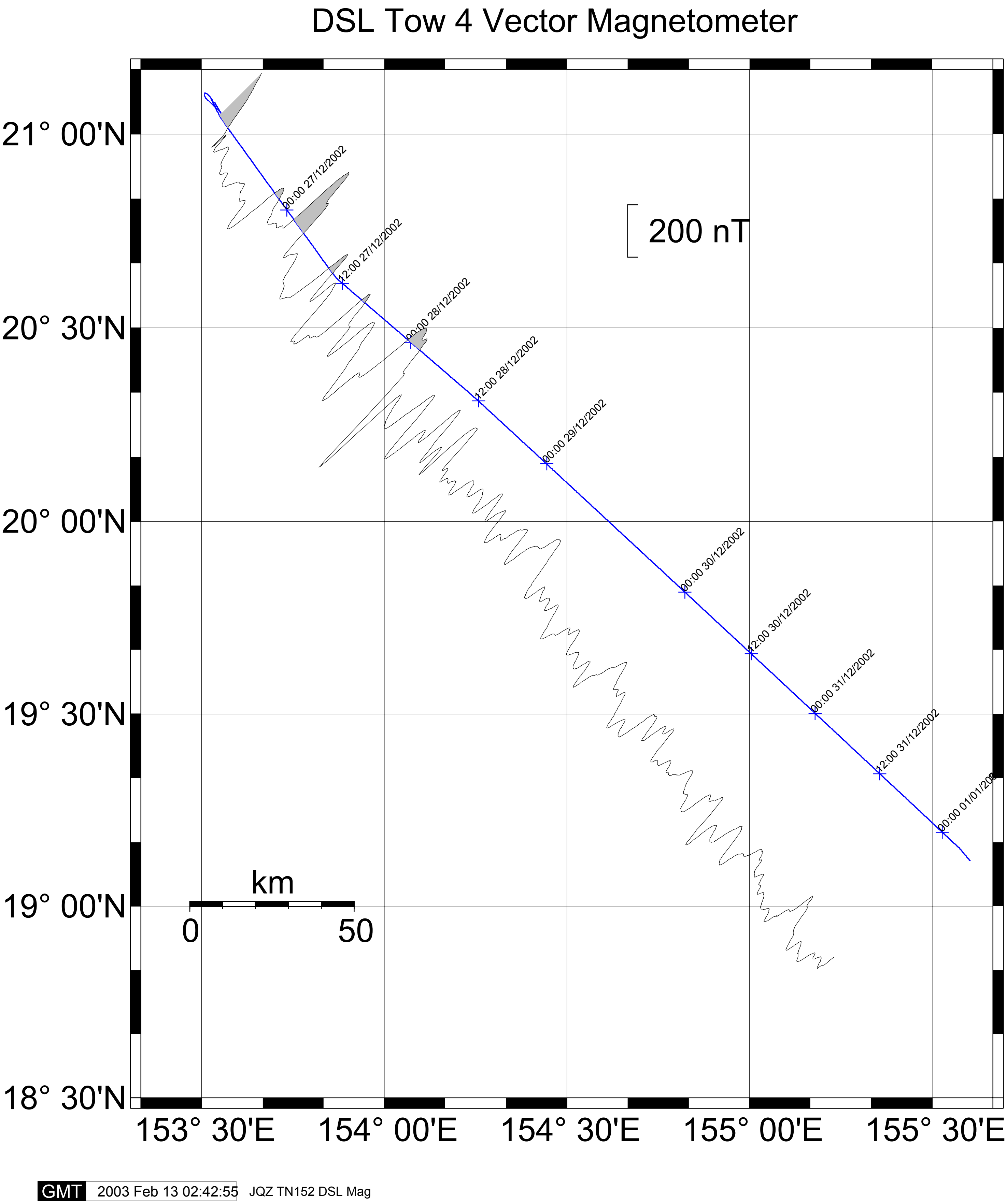


Figure 24. Plot of DSL-Tow04 showing projected profiles of the HMR2300 vector magnetometer total magnetic field.

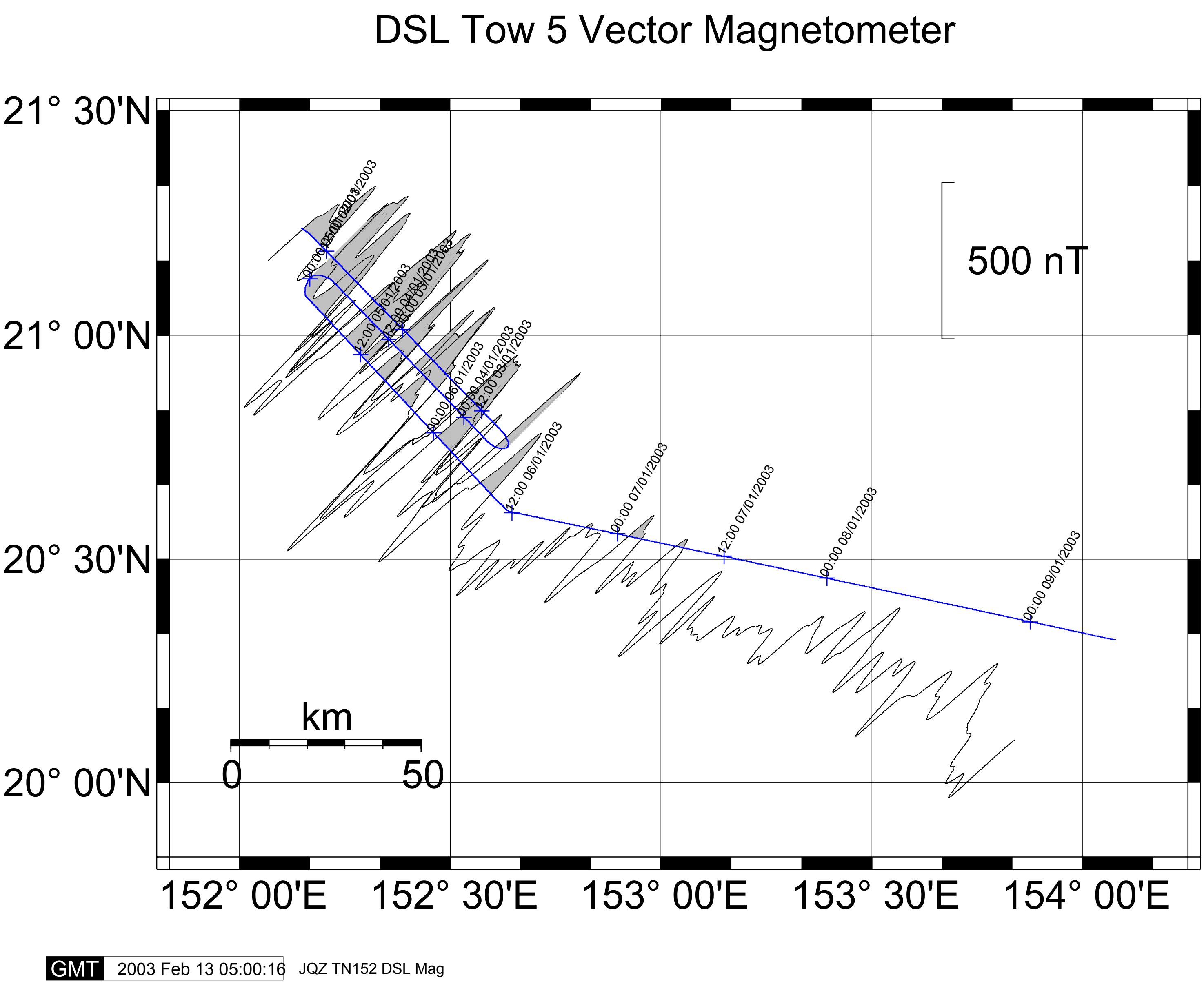


Figure 25. Plot of entire DSL-Tow05 showing projected profiles of the HMR2300 vector magnetometer total magnetic field over the M34 sequence.

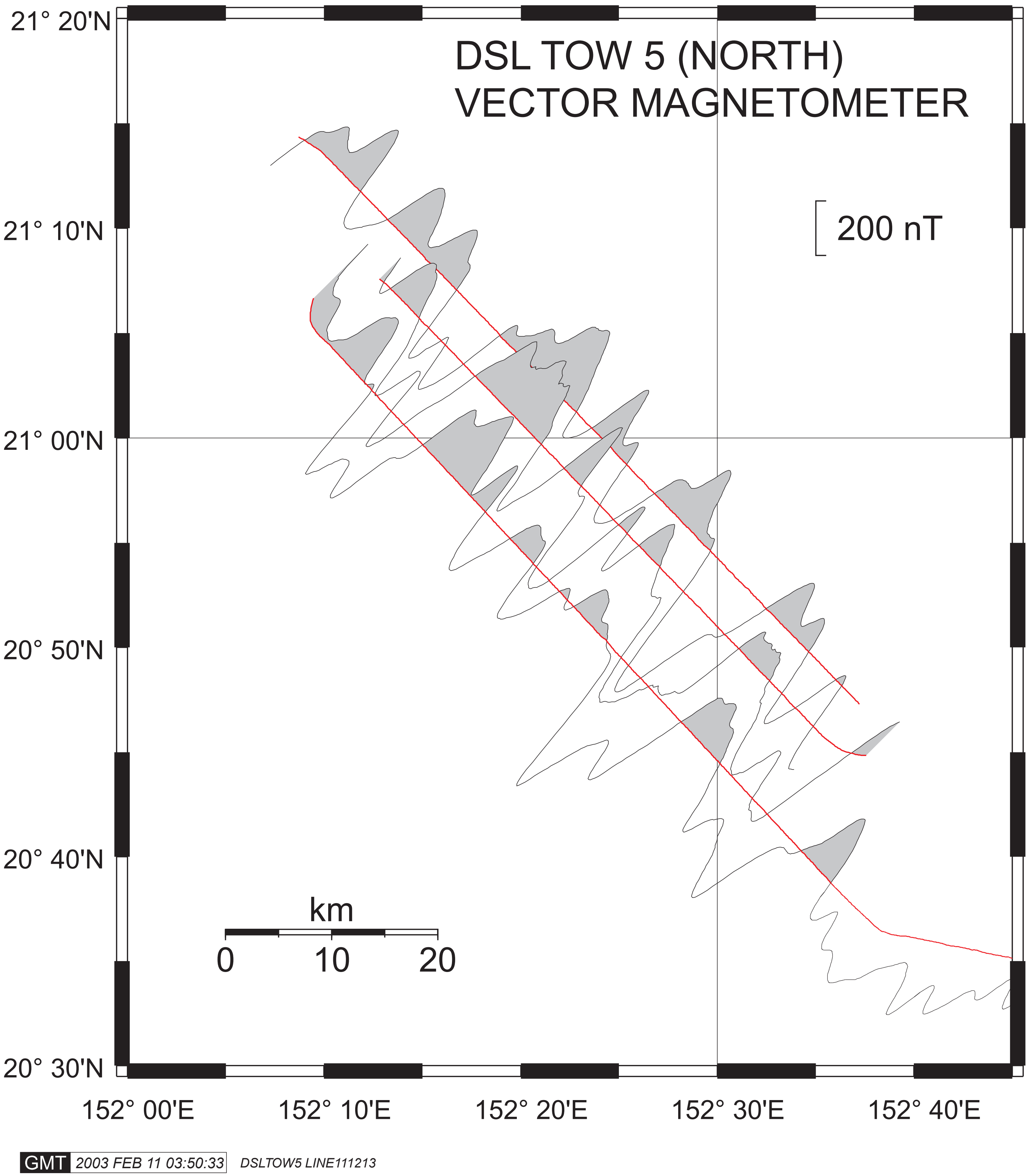


Figure 26. Detailed plot of DSL-Tow05 showing projected profiles of the HMR2300 vector magnetometer total magnetic field over the M34 sequence.

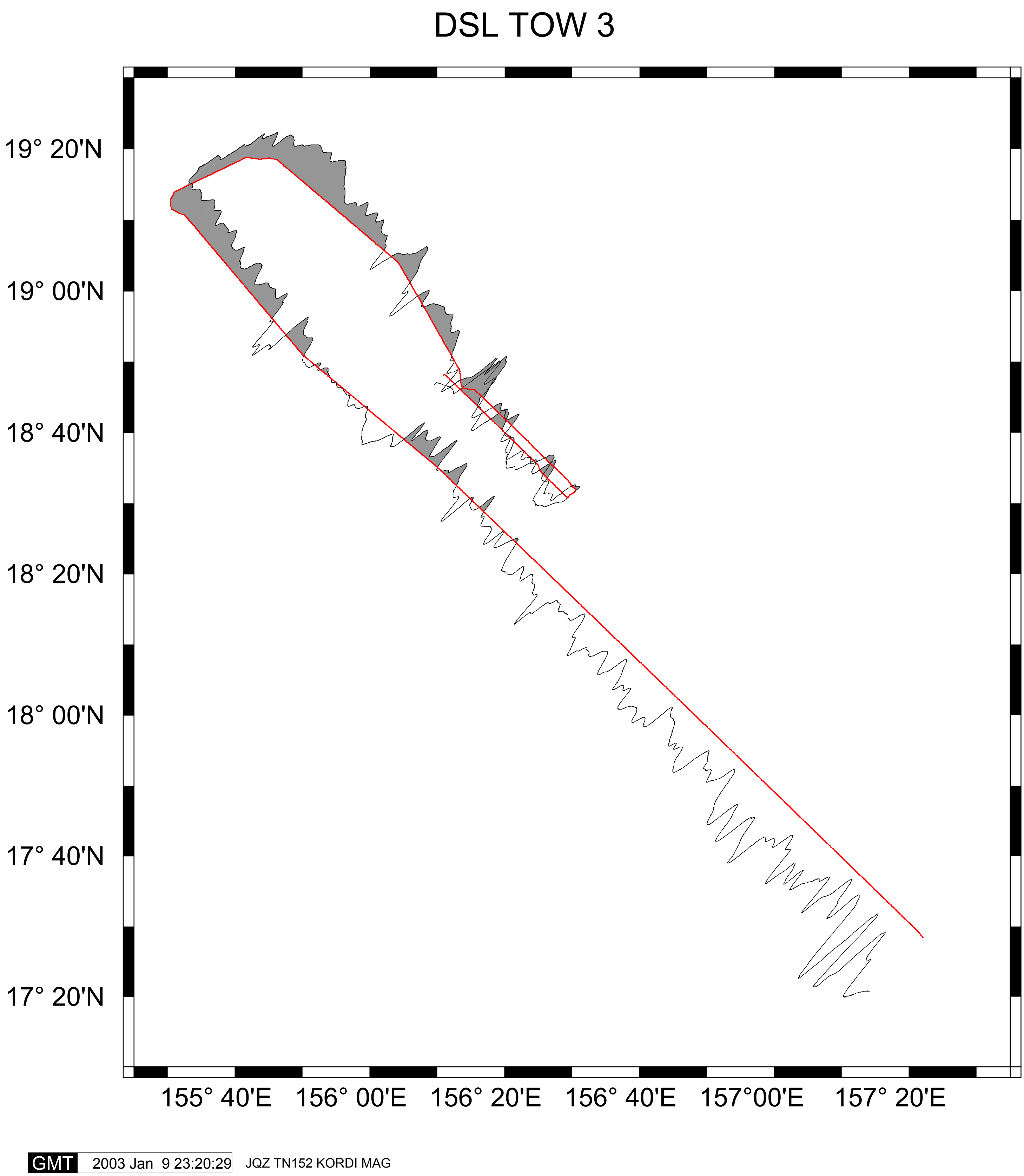


Figure 27. Plot of DSL-Tow03 showing projected profiles of the KORDI total magnetic field over the 801 area.

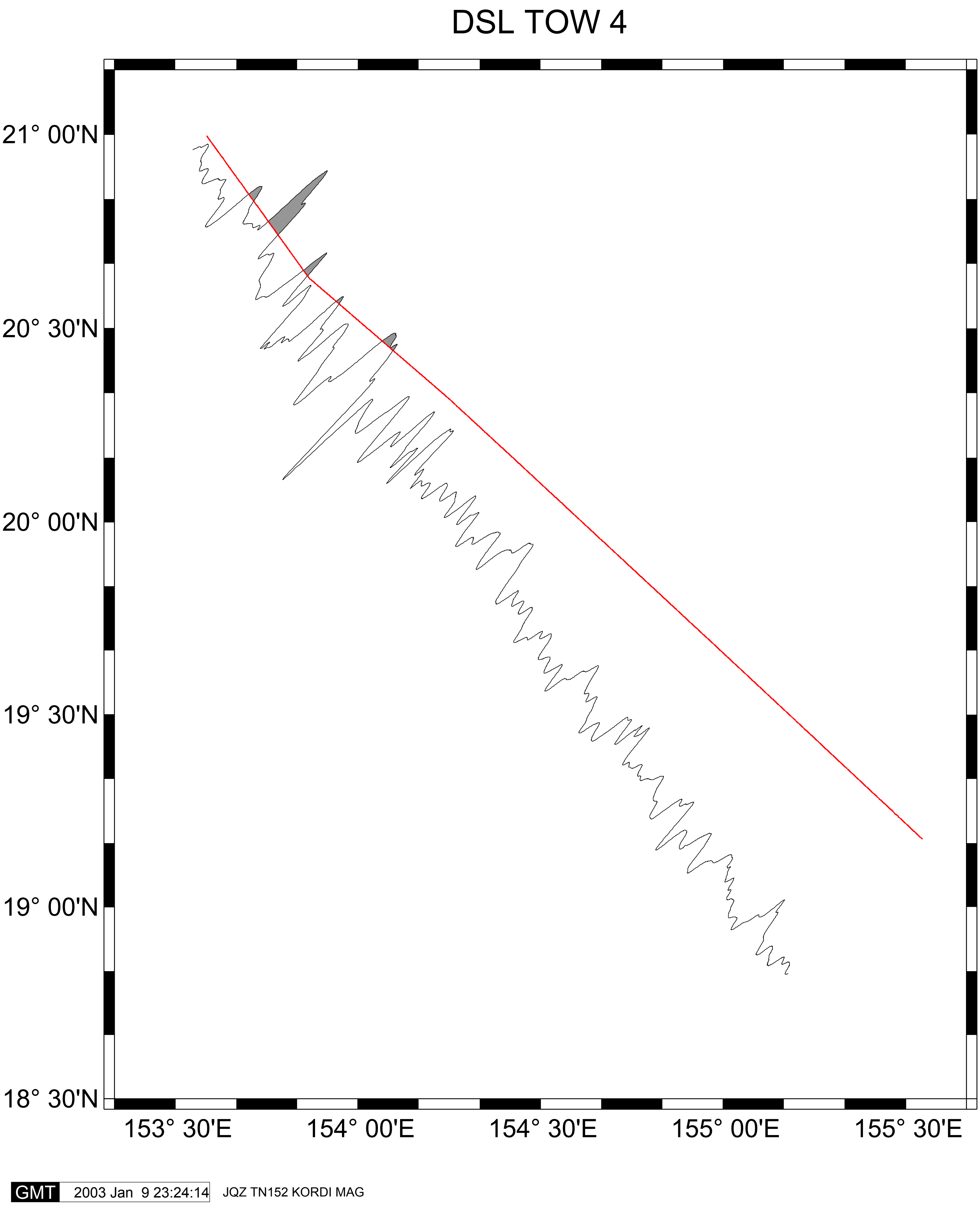


Figure 28. Plot of DSL-Tow04 showing projected profiles of the KORDI total magnetic field. Southward gradient is due to uncorrected effect of IGRF.

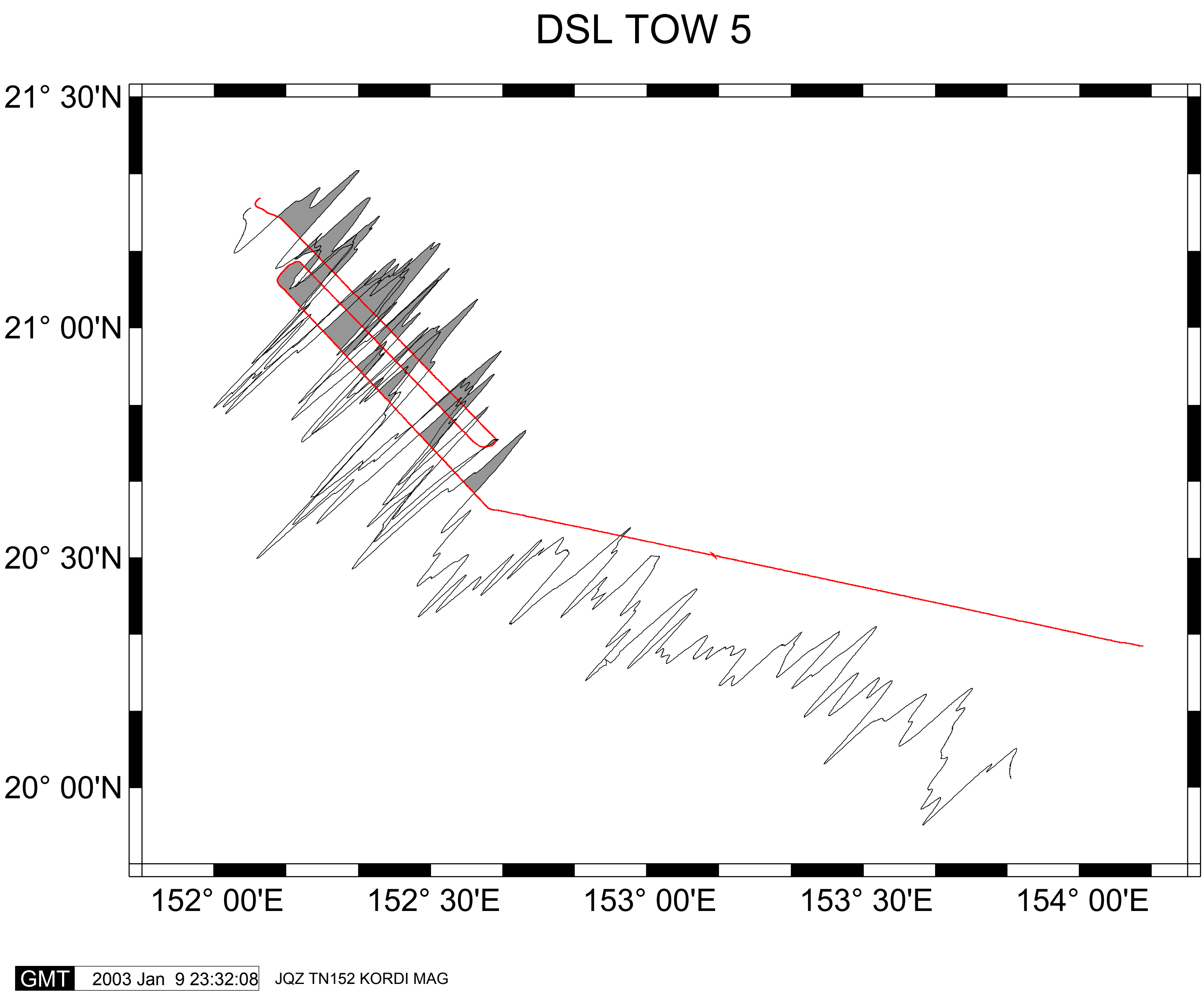


Figure 29. Plot of entire DSL-Tow05 showing projected profiles of the KORDI total magnetic field.

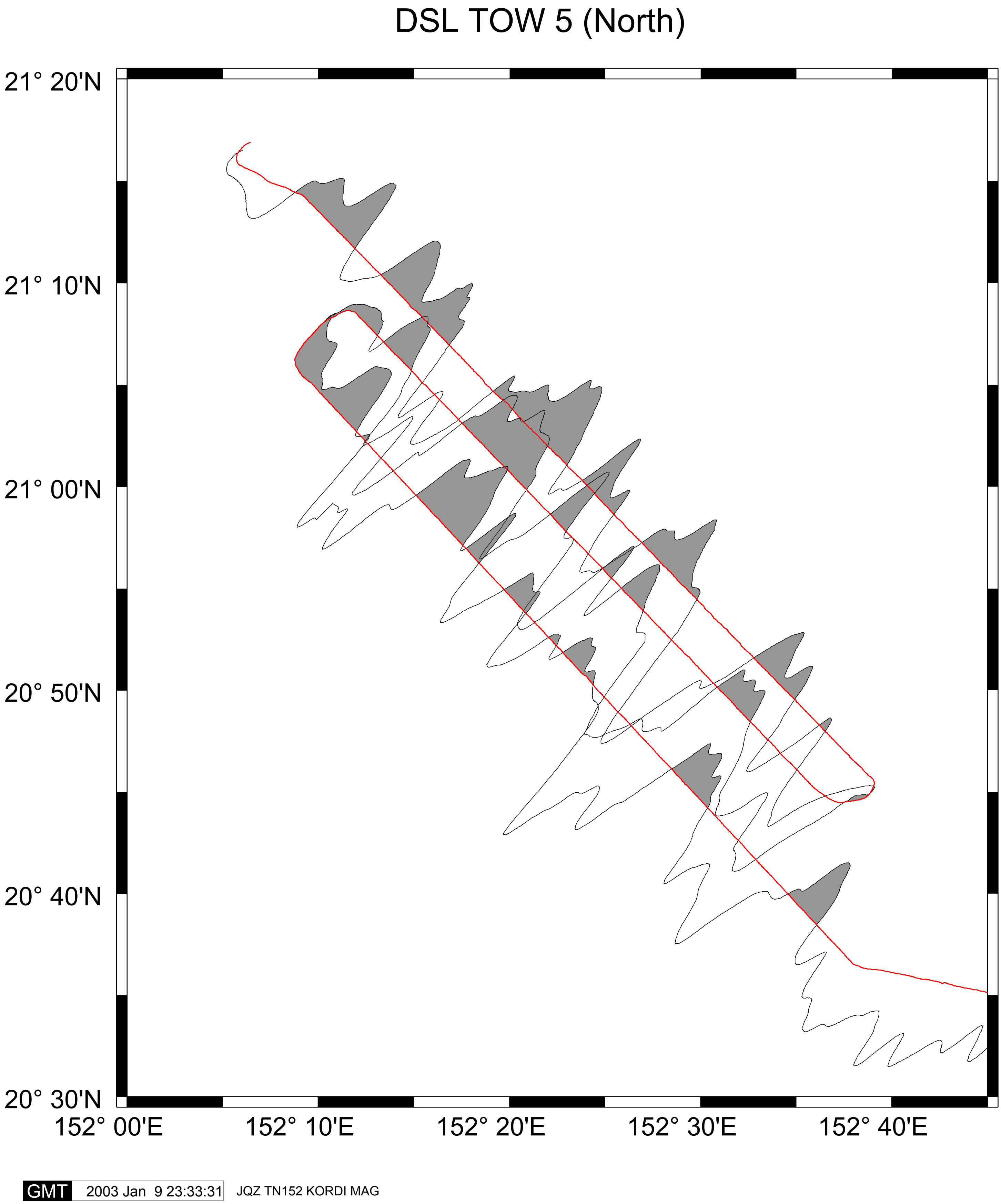


Figure 30. Detailed plot of DSL-Tow05 showing projected profiles of the KORDI total magnetic field over the M34 sequence.

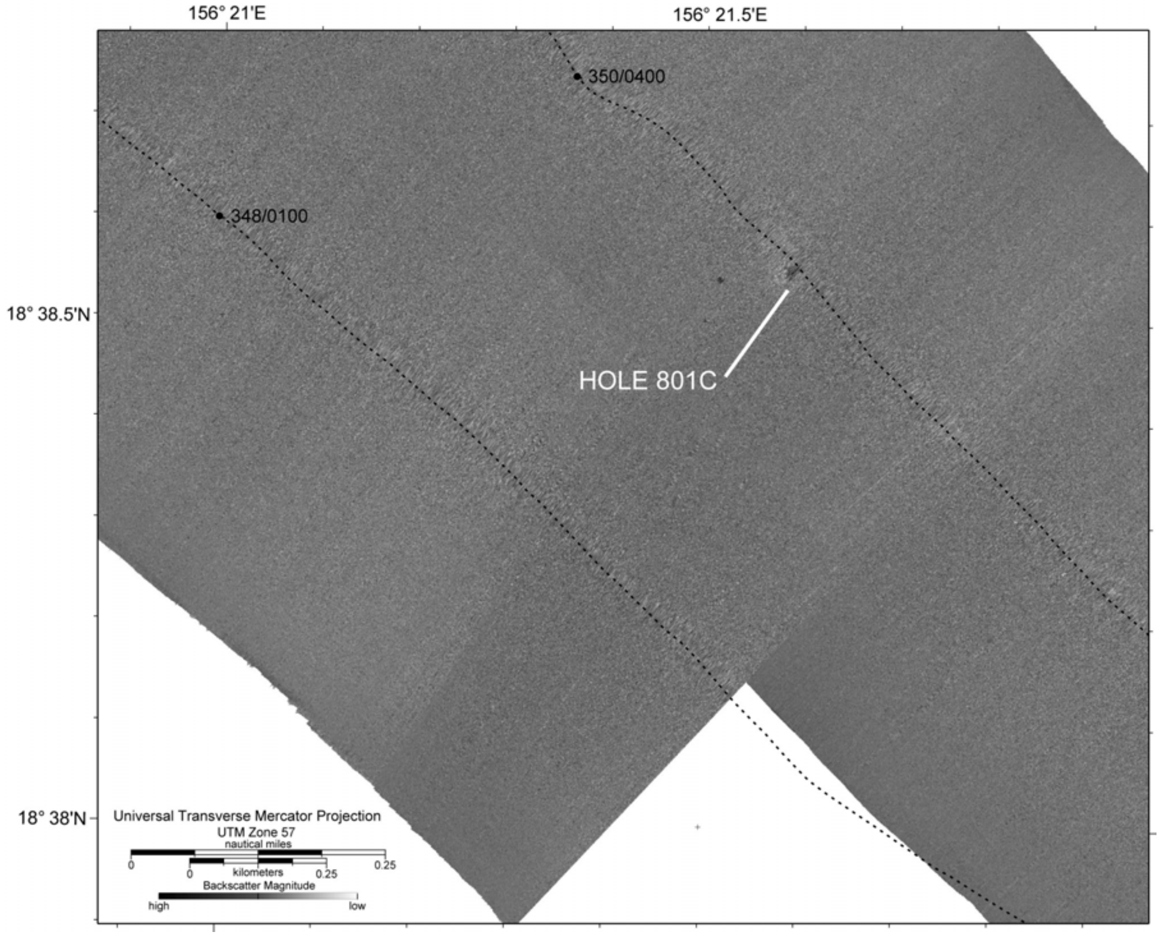


Figure 31. DSL-120A sidescan sonar from the immediate area around ODP Hole 801C showing the reflection from the hole guidebase in an otherwise monotonic backscatter area. This monotonic backscatter was typical of a large percentage of the seafloor in this area.

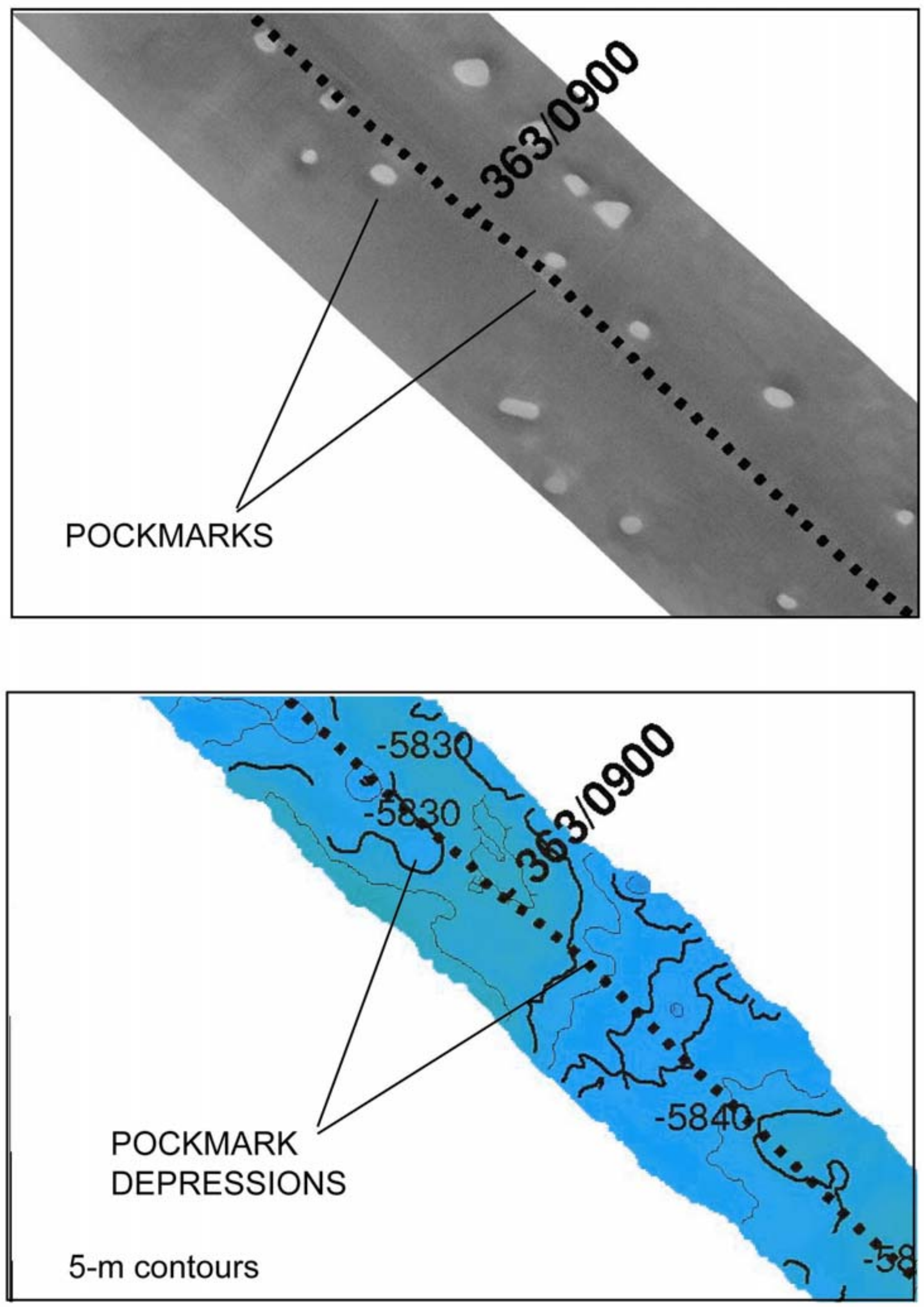


Figure 32. DSL-120A sidescan sonar example of "pock-mark" terrain. Top image shows the backscatter with the ~100 m circular low backscatter features in an otherwise unremarkable terrain. The bottom figure is phase bathymetry map showing the pock-marks are indeed depressions about 5 meters deep. The origin of these features remains undetermined.

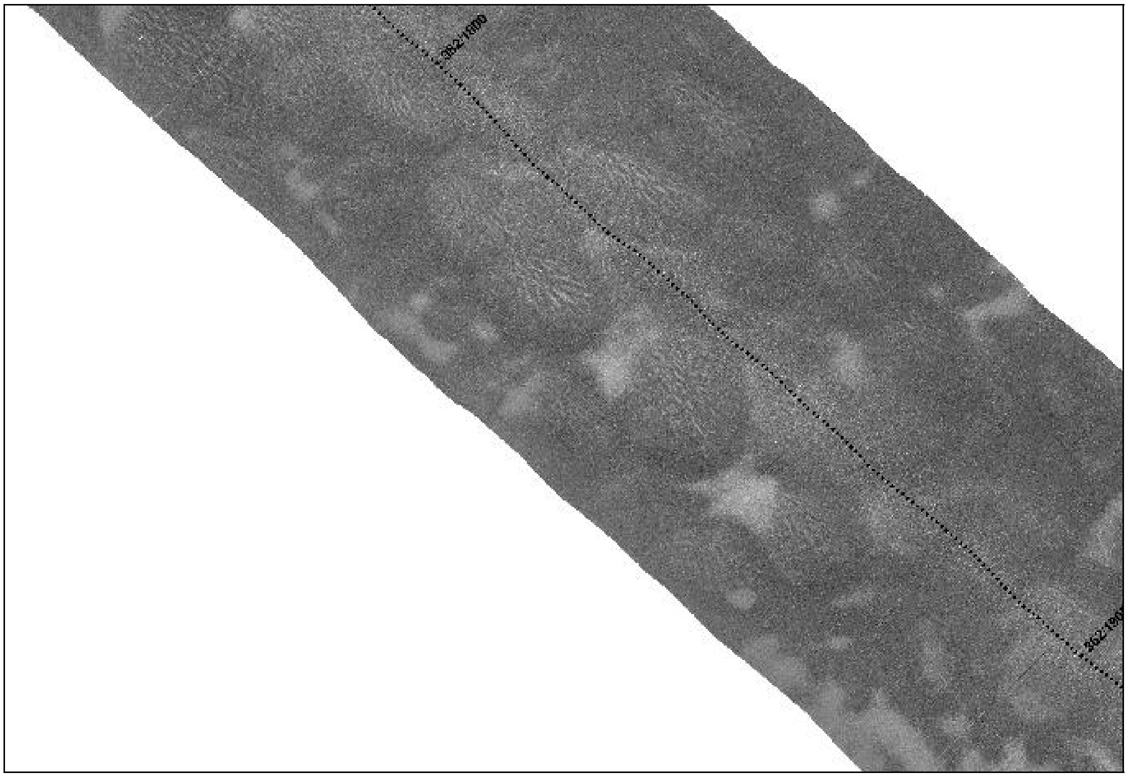


Figure 33. DSL-120A sidescan backscatter plot of the "mound and ripple" terrain found just north of the "pock-mark" terrain. Note the variegated texture of the backscatter and the small ripple features found on top of the mound-like hummocks. The mounds are on the order of a few hundred meters in diameter and slightly elongate. For scale the width of the backscatter swath is approximately 1200 meters.

APPENDIX-1

Daily Operations Summary

Dates and times are GMT
Julian days in parenthesis

1 December (335)
Departed Apra harbor, Guam, at 2300 (0900 local). Circled around NW side of island and headed toward Site 801 in Pigafetta Basin.

2 December (336)
Entire day spent in transit, 9.9-11.1 kt.

3 December (337)
Entire day spent in transit, 9.6-11.5 kt. Passed over summit of large guyot at approximately 2200.

4 December (338)
Entire day spent in transit, 6.5-9.1 kt. Reduced speed owing to large waves.

5 December (339)
Transit continued until 1200 upon arrival at Site 801. Made CTD cast from 1202-1300. Began deploying transponder net at 1524. Four transponders dropped, ending at 1810. Began transponder fix circles at 2-3 kt.

6 December (340)
Continued fixing transponder locations, ending at 1144. Tropical storm located to SE was a potential threat to move toward area; consequently, could not deploy DSL-120. Began sea surface magnetometer lines at 1217 with speed 6.7 kt. First line, toward NW (315°) along center line of survey from Site 801, ended at 1434. Line SM1 to SE (130°) run from 1450 to 1915. Line SM2 (NW, 320°) run begun at 1949 and ended at 2114. Magnetometer retrieved and ship headed to DSL-120 deployment point. Arrived at launch point approximately 2317. Rough sea and typhoon threat abort deployment.

7 December (341)
Deployed magnetometer at 0015 and headed NW on line SM-3 at course of 315°. Typhoon threat forced decision to run a sea surface line back SE to the rough/smooth boundary. Began Line 7, course 130°, speed 6-6.5 kt, at 0530. Line continued through rest of day.

8 December (342)
Retrieved magnetometer at end of line at 0000 and turned to launch DSL-120 on line 30 km to NE. Arrived at launch point at 0215. DSL-120 in water at 0257. Reached 500 m wire out at 0347 and began magnetometer calibration circle, which ended at 0609. Began paying out more wire at 0717. Max wire out, 7450 m, at 1500. Ran line at 1.1 kt average. Deep-tow magnetics line, heading NW, continued to end of day.

9 December (343)
Deep-tow magnetometer line continued all day at 1.1 kt, headed NW.

10 December (344)
Deep-tow magnetometer line continued all day at 1.1 kt, headed NW.

11 December (345)
Deep-tow magnetometer line continued at 1.1 kt, headed NW. The regional line hooked up with DT Line 5 in the Site 801 survey. Currents pushed the ship east during the regional line, making it easier to connect with DT Line 5 rather than DT Line 4 (center line over Site 801). A telemetry failure occurred at 0330 and the DSL-120 was reeled in, reaching the deck at 0812. Inspection found that 3î of water in junction box, some crushing of syntactic foam, and problem with connector at clump-weight, the latter apparently causing the telemetry failure. In addition, oil had forced its way from the junction box, through the tow cable of the Marine Magnetics magnetometer, and into the magnetometer itself. The magnetometer was disconnected and repairs were begun, with an estimate of 24 hours for completion. While repairs were underway, the ship ran surface magnetic lines. Line SM6 was begun at 0910 and completed at 1430. Line SM7 ran from 1455 to 1857, whereas Line SM8 was conducted between 1938 and 2356. Lines SM6 and SM8 were run to the SE (130°) whereas Line SM7 was run to the NW (310°).

12 December (346)
Line SM-9 was commenced at 0130, going NW (310°) at 7.3 kt. At 0305, the ship broke off the line, about mid-way through, to head to a DSL-120 launch point, situated on DT Line 5 about 4 nm SE of the point where telemetry was lost. DSL-120 was launched at 0432 and on bottom at 0928, five hours later. DT Line 5 was resumed, heading NW at 1.1 kt. Line DT5 was finished at 1427 and the ship turned NE to pick up Line DT7, the northernmost line in the Site 801 survey. During the turn, approximately 500 m of wire was brought in, so that the wire out was less than the water depth. The ship was on Line DT7 at 1818 and wire was payed out, with the DSL-120 reaching the desired tow depth at 1853. The turn took 4 hours. The ship continued down Line DT7 to the SE for the rest of the day.

13 December (347)
Line DT7 was continued for much of the day. Some confusion about which monitor to watch led to the ship going slower than expected, making only 0.7 kt for much of the line. Apparently the ship was also heading into the wind and current. Line DT7 was finished at 1225 and the ship turned SW to go to Line DT4. The ship was on line with the DSL-120 at towing depth at 1800. The ship made excellent speed going with the current at 1.7 kt, but this speed eventually proved to be too fast and the DSL-120 would not stay down. Speed was reduced to 1.3-1.5 kt. At 2108 the ship entered a swifter current and was pushed off line to the west. The current direction and wire angle were such that the ship could not hold the line and we moved west to the next line over, DT3, at 2200.

14 December (348)

Finished Line DT3 at 0730. Turned to SW to begin Line DT1, the southernmost line in the Site 801 survey. Line DT1 began at 1125 and the ship was on that line for the remainder of the day.

15 December (349)
The ship began the day near the south end of Line DT1, pulling the fish clear of the end at 0200. The DSL-120 was hauled in for inspection, arrived on deck at 00530, and remained on deck for several hours. In the meantime, the ship ran surface magnetic lines. Line SM2 beginning at 0845, heading NW, and ended at 1230. The DSL-120 and overhauser magnetometer were deployed at 1441. Line DT4 was commenced at 2000, headed SE at 1.2 kt. At day's end, the ship was in the first miles of the line.

16 December (350)
Line DT4 continued until 0630, when the ship reached the point at which it was previously necessary to move from Line DT4 to DT3. At 0630, the ship crossed over to switch lines, from DT4 to DT3, in order to complete the missing part of the latter. Line DT3 was finished at 0930 and the ship turned NE toward Line DT6. The DSL-120 was on line at 1445, headed NW. With the wind and current behind, the ship made rapid progress, at 1.5-2.0 kts, but eventually there were problems keeping the deep-tow fish near the bottom.

17 December (351)
At 0300, Line DT6 and the Site 801 survey were completed. This last mini-survey line was extended N to connect with the north line of the two 1992 JQZ deep-tow survey. It was necessary to steer a dog-leg line to go around a small seamount. This line was designated DT8N.

18 December (352)
Line DT8N continued until 1238, when the ship turned SW to go to Line DT9. The passage from one line to the other took the rest of the day.

19 December (353)
At 0128, the ship turned SE onto Line DT9. This line would extend to the rough-smooth boundary. The ship remained on line all day. The line crossed the extension of a small seamount from 2030 through 0200 on December 20. The minimum depth crossed was 4624 m.

20 December (354)
All day was spent headed SE on Line DT9.

21 December (355)
All day was spent headed SE on Line DT9.

22 December (356)
All day was spent headed SE on Line DT9.

23 December (357)
All day was spent headed SE on Line DT9.

24 December (358)
End of line DT9 reached at 0515; began hauling in DSL-120. Deep-tow fish on deck at 0907. Deployed sea surface magnetometer at 0930 and began surface magnetic line SM10 at 1028, heading NW back to Site 801 area. The magnetometer was recovered at 2215 to begin recovering transponders.

25 December (359)
Transponder A was on deck at 0112 and transponder D, at 0147. There was no response from transponder B, so a search was conducted for several hours. At 0405, the ship headed to the transponder C location and picked it up at 0521. The ship returned to the transponder B location to try communicating with it again. Again there was no response from the balky transponder. A search continued until near sunset. At 0610, the search was given up and the ship began transit to the north end of deep-tow line DT10, which would stretch from near Golden Dragon Seamount southward to link up with the Site 801 deep-tow lines. The transit was conducted at 12 kt, so no surface magetic data were collected.

26 December (360)
The ship was still in transit at the beginning of the day, reaching the launch point at 0200. The DSL-120 was in the water at 0228 and reached bottom at 0706. Line DT10 was run heading southeast, into the wind. This line would require many days to complete.

27 December (361)
All day was spent headed SE, running line DT10.

28 December (362)
All day was spent headed SE, running line DT10.

29 December (363)
All day was spent headed SE, running line DT10.

30 December (364)
All day was spent headed SE, running line DT10.

31 December (365)
All day was spent headed SE, running line DT10.

1 January (001)
The south end of Line DT10 was reached at 0128 and the DSL-120 was on deck at 0515. The ship began transiting north, to the northwest end of DT line 11.

2 January (002)

The ship reached the DSL-120 launch point at the northwest end of Line 11 at 0200. Line 11 is the northernmost of three lines run over M34-M36. The DSL-120 was at its cruising altitude of 100 m above the seafloor at 0730 as the ship headed SE on Line 11 at 1.2 kts. The remainder of the day was spent on Line 11.

3 January (003)
By 1330, the DSL-120 had reached he end of Line 11. The DSL-120 was raised by 1200 m as the ship turned southward to the next line. The deep-tow was lowered and reached its towing altitude at 1855 as the ship headed NW on Line 12.

4 January (004)
The end of Line 12 was reached at 1949, the deep-tow raised by 900 m, and the ship turned SW to Line 13. The day expired with the ship still in transit between lines.

5 January (005)
The DSL-120 reached its 100 m towing altitude on Line 13, headed SE, at 0115. The entire day was spent running this line.

6 January (006)
The Thompson turned onto the second segment of Line 13 at0940. This bend marked the end of the part of the line that repeats Lines 11 and 12, and the beginning of a regional line run oblique to the anomalies. The ship would spend the rest of the operational time on this line.

7 January (007)
The Thompson continued Line 13, headed ESE, at 1.2 kt.

8 January (008)
Line 13 continued all day.

9 January (009)
The end of available deep-tow time was reached at 0947. The DSL-120 was pulled in and on deck at 1415. After securing the DSL-120 and clump weight, the ship turned and headed to Guam at nominal speed of 12.5 kts (max speed 13.3 kts).

10 January (010)
Transit to Guam.

11 January (011)
Transit to Guam.

12 January (012)
Arrived at the entrance to the harbor at 0800 and docked at 0900, ending cruise TTN152.

DSL-120 Operations

R/V *Thompson* TN152, December 2002

HMRG Operations Log

Revision	Author	Purpose of Revision
02 DEC 2002	Bruce Appelgate	precruise TN152
06 JAN 2003	Bruce Appelgate	post-TN152 revisions

HMRG Operations Log

SURVEY INFORMATION

Client:	US National Science Foundation
Principal Investigator:	Maurice Tivey, Woods Hole Oceanographic Institution
Purpose:	Deep tow magnetics, DSL-120 sidescan and bathymetry survey of the Jurassic Quiet Zone, Pigafetta Basin, NW Pacific Ocean
Vessel:	R/V *Thomas G. Thompson*

PERSONNEL

Ship's crew

Master:	Glenn Gomes
1st Mate:	Adam Parsons
2nd Mate:	Tom Drake
3rd Mate:	Jason Stephens
Marine Tech:	Rob Hagg
Marine Tech:	Tony Burke
AB:	Tim Younker
AB:	Frank Spetla
AB:	Jack Greenberg
AB:	Tony Monocandilos
AB:	Charlie Leahey
AB:	Tammy Giezentanner
Chief Engineer:	Charlie Ormiston
1st Engineer:	Mike Merrill
2nd Engineer:	Rich Leonard
3rd Engineer:	Mike Wojciechowski
Oiler:	Mark Johnson
Oiler:	Robert Maldonado
Oiler:	Russell Rowley
Wiper:	Issac Larson
Chief Steward:	Dax Maupin
2nd Cook:	Yvonne Morril

Mess Attendant: Mike Durnan

Scientific Party

Chief Scientist:	Maurice Tivey	WHOI G&G
Co-Chief Scientist:	William Sager	Texas A&M University
Co-Chief Scientist:	Sang-Mook Lee	KORDI
Student:	Amy Lamarche	Texas A&M University
Student:	Andriy Mishonov	Texas A&M University
Student:	Giorgio de la Torre Morales	Texas A&M University
Student:	Michael Murphy	U. North Carolina
Student:	Masako Tominaga	Texas A&M University
Student:	Clare Williams	WHOI / MIT

DSl-120 Team

Expedition Leader:	Bruce Appelgate	U. Hawaii / HMRG
DSL120 Engineer:	Bob Waters	WHOI - DSOG
DSL120 Technician:	Gary Austin	SIO / DSOG
DSL120 Technician:	Jack Dellibovi	WHOI / DSOG
DSL120 Technician:	Marlene Messina	WHOI / DSOG
HMRG Party Chief:	Akel Sterling	U. Hawaii / HMRG
HMRG Sonar Tech:	Jennifer Morgan	University of Leeds / HMRG

Mobilization Team (Honolulu)

Bruce Appelgate	U. Hawaii / HMRG
Akel Sterling	U. Hawaii / HMRG
Mark Rognstad	U. Hawaii / HMRG
Bob Waters	WHOI / DSOG
Roger Davis	U. Hawaii / HMRG

Mobilization Team (Guam)

Bruce Appelgate	U. Hawaii / HMRG
Akel Sterling	U. Hawaii / HMRG
Mark Rognstad	U. Hawaii / HMRG
Bob Waters	WHOI / DSOG

SUMMARY OF SURVEY EVENTS

Times expressed in Universal Time

Local	UT	HST
333/1900	333/0900	332/2300

Event	Time	Comment
Mobilize Guam Navy Pier		27 NOV - 02 DEC (local Guam)
Depart Guam	335/2300	02 Dec 0900 (local Guam)
Tow 01 Deploy	342/0400	DSL Lowering 120A-022

Tow 01 On Bottom	342/1123	alt=100 w/o=6879 WD=5581
Halt metadata ACQ	343/2358	install new code
Restart metadata ACQ	343/2358	Depth now logged correctly
Tow 01 Off Bottom	345/0320	Telemetry failure
Tow 01 On Deck	345/0800	Recovered fish, no problem
Tow 02 Deploy	346/0400	DSL Lowering 120A-023
Tow 02 On Bottom	346/0928	alt=100
Tow 02 Off Bottom	349/0200	Time for regular maintenance
Tow 02 On Deck	349/0600	
Tow 03 Deploy	349/1430	DSL Lowering 120A-024
Tow 03 On Bottom	349/1855	alt=100
Tow 03 Off Bottom	358/0510	
Tow 03 On deck	358/0905	
Tow 04 Deploy	360/0220	DSL Lowering 120A-025
Tow 04 On Bottom	360/0648	
Tow 04 End of Data	001/0147	Running noise tests
Tow 04 Off Bottom	001/0212	
Tow 04 On Deck	001/0510	Transit to northern area
Tow 05 Deploy	002/0230	DSL Lowering 120A-026
Tow 05 On Bottom	002/0730	
Tow 05 Off Bottom	009/0949	
Tow 05 On Deck	009/1300	Go home

DSL120 LOWERING STATISTICS

Tow 01

bottom time:	63:57 hr:sec	2.66 days
line distance:	153,966 meters	(hours * 1.3 knots * 1852 m/nm)
sidescan coverage:	184,759,200 sq meters 184.8 sq km	(distance * 1200 m swath width)
bathymetry coverage:	92,379,600 sq meters 92.4 sq km	(distance * 600 m swath width)
pings:	287,775 pings	(time * 1.25/sec)

Tow 02

bottom time:	64:32 hr:min	2.69 days
line distance:	155,362 meters	(hours * 1.3 knots * 1852 m/nm)
sidescan coverage:	186,434,400 sq meters 186.4 sq km	(distance * 1200 m swath width)
bathymetry coverage:	93,217,200 sq meters 93.2 sq km	(distance * 600 m swath width)
pings:	290,400 pings	(time * 1.25/sec)

Tow 03

bottom time:	202:15 hr:min	8.43 days

line distance:	486,937 meters	(hours * 1.3 knots * 1852 m/nm)
sidescan coverage:	584,324,400 sq meters 584.3 sq km	(distance * 1200 m swath width)
bathymetry coverage:	262,162,200 sq meters 262.2 sq km	(distance * 600 m swath width)
pings:	910,125 pings	(time * 1.25/sec)

Tow 04

bottom time:	138:59 hr:min	5.79 days
line distance:	334,616 meters	(hours * 1.3 knots * 1852 m/nm)
sidescan coverage:	401,539,200 sq meters 401.5 sq km	(distance * 1200 m swath width)
bathymetry coverage:	200,769,600 sq meters 200.8 sq km	(distance * 600 m swath width)
pings:	625,425 pings	(time * 1.25/sec)

Tow 05

bottom time:	175:19 hr:min	7.30 days
line distance:	422,092 meters	(hours * 1.3 knots * 1852 m/nm)
sidescan coverage:	506,510,400 sq meters 506.5 sq km	(distance * 1200 m swath width)
bathymetry coverage:	253,255,200 sq meters 253.2 sq km	(distance * 600 m swath width)
pings:	788,925 pings	(time * 1.25/sec)

Totals

bottom time:	645:02 hr:min	26.9 days
line distance:	1,552,982 meters	(hours * 1.3 knots * 1852 m/nm)
sidescan coverage:	1,863,578,400 sq meters 1,863.6 sq km	(distance * 1200 m swath width)
bathymetry coverage:	931,789,200 sq meters 931.8 sq km	(distance * 600 m swath width)
pings:	2,902,650 pings	(time * 1.25/sec)
bathymetry soundings:	217,698,750 soundings	
sidescan samples:	3,483,180,000 samples	
raw sonar data:	323.11 Gb	
processed sonar data:	46.44 Gb	
towfish attitude data:	27.30 Gb	
ship navigation data:	206.73 Mb	
other metadata:	828.88 Mb	

SUMMARY OF DELIVERED PRODUCTS

Product	HMRG	DSL	Tivey	Sager	Lee
Raw data tapes	X	X			

Processed data tapes	X	X	X		
CD of charts	X	X	X	X	X

DSL120 SETTINGS

Transmit Settings used on this survey:

Tow Number	DSL Lowering	From	To	Wave Form	Ping Rate	Power
Tow 01	120A-022	342/1123	345/0320	122/122-192	800ms	Full
Tow 02	120A-023	346/0928	349/0200	122/122-192	800ms	Full
Tow 03	120A-024	349/1855	358/0510	122/122-192	800ms	Full
Tow 04	120A-025	360/0648	001/0147	122/122-192	800ms	Full
Tow 05	120A-026	002/0730	009/0949	122/122-192	800ms	Full

Note: The only transmit waveforms available for use were 122kHz with a 192-cycle pulse, or 122kHz with a 48-cycle pulse. We always opted for the longer pulse because the longer pulse yields better signal:noise in the phase measurements (hence better bathymetry).

NAVIGATION

Ship navigation was by C&C Technologies C-NAV World D-GPS. A fantastic commercial differential system.

DSL120 navigation was by layback, calculated using acoustic range from ship to the fish. The offsets between the *Thompson's* through-hull transducer pole, GPS antenna, and stern tow point were taken into account.

Layback navigation was checked against long-baseline acoustic navigation in the southern survey area. Ship-to-fish horizontal distances were essentially identical using the two methods, although layback nav can't account for towfish variations in the cross-track direction. However, our survey tracklines were straight, so the layback method worked fine.

Acoustic range data was logged in real time on the DSL120 processing computer `malolo` via a serial cable from the Benthos 455 unit. These data were combined with towfish depth data logged in real time by the DSL-120's pressure transducer, and layback offsets were calculated at 1Hz using the HMRG scripts `hordis` and `layback-shiplag.awk`

BREAKDOWN OF HMRG CREW DUTIES

Akel:	sonar QA/QC
Bruce:	bottom detect and initial processing
Jennie:	bottom detect and initial processing
Bob:	engineering, lead navigator, and navigation watch
Marlene:	navigation watch
Jack:	navigation watch
Gary:	winch operations and winch watch
Amy:	winch watch

Clare: winch watch
Gorgio: winch watch
Masako: winch watch
Mike: winch watch

MOBILIZATION

JD331 - Wed 27 November 2002

Local time is GMT+10

Arrive Guam 6:30 PM.

Mark picks up Bruce Akel and Jennie at airport and drives us to hotels.

Inconvenient Ship Berthing:
Mark relates frustrating day: ship is at Navy pier and due to security on the base he was not able to get in all day. Ship's agent sets up a shuttle service for the remainder of the in-port, which is the only way we can get on or leave the base.

Depart Holiday Plaza Hotel: 0730 1130 1330 2300
Depart TG Thompson: : 0900 1200 1700 0000

JD332 - Thu 28 November 2002

Local time is GMT+10

Thanksgiving Day.

Bruce and Akel started setting up computer directories and environments.
Mark working on sonar electronics.
Bob working on making all the bits talk to each other.
Gary working on winch.

JD333 - Fri 29 November 2002

Local time is GMT+10

Winch control cable still not delivered to Guam, so we had to come up with new plan for the lab winch control. Gary moved the HPU as far forward as possible, and we arranged to put the winch controls farther aft in the computer lab (DSL acquisition stuff is set up in computer lab).

Mark continues working on sonar electronics. All three DSP boards are giving clean (very low noise) data. But two of the boards have the 72-ish degree phase shift, and one doesn't. Mark doesn't know why yet.

Bruce set up data directories, processing environment, and user accounts.

Akel worked on DSL data logging using Jon Howland's scripts.

Captain tells us that Jennie can't sail with her existing visa. We make plans with the agent to go to immigration at 7:30am tomorrow to attempt to clear this up.

Captain delays departure date until Sunday December 01. Not sure why.

JD334 - Sat 30 November

Local time is GMT+10

Jennie Morgan visa problem

Drove to immigration office at the commercial port and met with INS Agent Lacy. He told us that Jennie needs a special waiver that he was not willing to give, and told us we could either sail with her aboard and hope INS grants a waiver when we arrive, or we could appeal to the Honolulu office. If no waiver is given, Jennie would have to stay aboard until the next foreign port, which is scheduled to be Vietnam about 2 weeks after our cruise ends.

Maurice suggests flying today to Saipan and getting a visa there, but there's no consulate in Saipan that can do that. He then suggests Jennie fly to Tokyo today and get a visa there. Jennie and Bruce phone the consulate there, but its closed until Monday.

Bruce phones the Honolulu District Office (its Friday there) and speaks with the superintendent of the entire district (includes Guam), Mr. Radcliffe. He agrees that the visa waiver rules are confusing, and states that its his job to enforce the laws but also to help out in cases like this where honest mistakes have been made. He says that he will instruct Guam INS to issue Jennie "parole" upon her return, which will allow her to disembark in Guam and get on a plane and go home, with no penalty assessed to RV THOMPSON or the captain. Bruce asks if Mr. Radcliffe can fax a statement to this affect to the ship's agent, and Mr. Radcliffe agrees. We think we've won.

But read on...

LETTER TO CAPT GOMES AND DAN SCHWARTZ
To: captain@indian.thompson.ocean.washington.edu
CC: mtivey@thompson.ocean.washington.edu

Hi Glenn (and Dan),

RE Jennifer Morgan's visa
30 November 2002

This is a synopsis of today's events, which have led to US Immigration agreeing to allow Jennie to embark aboard THOMPSON and return to Guam without incurring penalties to the vessel or Ms Morgan.

Quick review of the problem: When Jennie was planning for this trip months ago, we were told that UK citizens could enter the US under the visa waiver program, which allows multiple entries into the country. Jennie cleared immigration in Los Angeles en route to Guam under the visa waiver program. Upon embarking aboard THOMPSON we were informed by Guam immigration that research vessels are not signatory to the visa waiver program, and that Jennie would not be allowed to disembark the vessel in Guam under this program. At this point we began querying immigration officials in order to solve this problem.

1. This morning (8am) we spoke to a Guam immigration inspector (Mr. Lacy) at the commercial seaport, who told us that we needed to contact the US Immigration District Office in Honolulu for a definitive resolution to her problem.

2. We then spoke by phone (11am) with Mr. Donald Radcliffe, who is District Director of the Honolulu District Office. Mr. Radcliffe agreed that indeed the rules are difficult to understand in the case for UK residents and the visa waiver program, and that in this case he would grant Jennie "parole" upon returning to Guam aboard THOMPSON, as long as her intention was to return to the UK after disembarking. This means that Jennie will be allowed to transit through Guam upon arrival, with no penalty to the THOMPSON. Jennie is booked on a flight out of Guam on 7PM, 13 January.

3. Captain Gomes requested written confirmation of Mr. Radcliffe's agreement, and Mr. Radcliffe indicated he would send a confirming fax to the ship's agent.

4. After several hours had passed without receiving the fax, the ship's agent phoned the Guam immigration office and spoke with Officer Sofie (4pm), who said that it is not their policy to issue written confirmation in cases such as this, and that the Guam immigration office had a verbal agreement with the Honolulu District Office to grant Jennie's parole upon her return.

5. We then (4:30pm) contacted Mr. Al Harrell, who is another supervisor for Guam immigration. Mr. Harrell reiterated Mr. Radcliffe's instructions that Jennie would be granted parole upon her return, but also that it is not their policy to issue written statements to the Captain. He again affirmed that he and Mr. Harrell had a verbal agreement and commitment to allow Jennie's transit through Guam after the cruise. Mr. Harrell also made the point that, since we are bringing Jennie's situation to their attention PRIOR to our leaving, that they are able to make this offer of parole. Had we requested this after leaving Guam, they indicated that they would probably not give permission.

6. At 1800 today, the third mate again spoke with Mr. Harrell requesting a fax to confirm that Jennie would be admitted back into Guam. Mr. Harrell restated his position, that the verbal agreement between the Honolulu District Office, the Guam Office, and the ship would be enough to allow Jennie to disembark the vessel in Guam.

JD335 - Sun 01 December 2002

Local time is GMT+10

Ship is scheduled to depart at 1000. Still no fax from Guam INS. Captain Gomes contacts Dan Schwartz at UW for guidance, and their position is firm, they will not sail without written confirmation from INS.

Bruce calls Guam INS to ask again for a fax. Inspector ??? on duty is of course familiar with Jennie's case (everybody in Guam is by now), and says that she has seen the document that states INS's intention to grant Jennie parole, but it hasn't been faxed because it hasn't been signed by the Guam chief inspector. He'll be in Monday morning and can fax it then.

Despite this encouraging word, Captain Gomes says he won't sail until we get the written confirmation. Maurice postpones our departure til tomorrow to wait for the fax, with the understanding from the captain that once the fax comes we can leave. The captain agrees.

UNDERWAY LOG

JD336 - Mon 02 December 2002

Winds NNE 10-20 knots, seas 3-6 feet

Depart Guam

Shoved off from pier with Jennie aboard at 0900 local. Heaved-to in the lee of the point outside the harbor and waited until we heard from the agent that Jennie's Special Dispensation had been faxed to him. Headed for the high seas 1000 local.

JD337 - Tue 03 December 2002

Winds NNE 25-30 knots, seas 10-12 feet

In transit.

Bob and Jack tested transponders and set them up for deployment.

All DSL acquisition gear ready to go, except that during a bench test today we noted that lat, lon, pitch, roll and heading data are not being recorded in the sonar TTS files. Bruce tested to make sure its not a problem with the display sonar, and its not. This is an item that Jon Howland tested the week before we left for Guam, and it worked. I wrote Jon and Roger about the problem this evening.

Gary still fixing things on the towfish and clump.

Ship has slowed to 6 knots.

JD338 - Wed 04 December 2002

Winds NNE 25-30 knots, seas 10-12 feet
High weather conditions posted for weather decks.

In transit.

Today Jon Howland sent out instructions on how to get the DSL topside machine to correctly broadcast the attitude and navigation data to the HMRG sonar acquisition machine. Akel implemented and tested, and it worked.

Gary built a new junction box on the clump weight to replace the original, broken one.

Jennie completed Sonar School today.

Ship has slowed to 4 to 7 knots, delaying our ETA.

JD339 - Thu 05 December 2002

Winds NNE 25-35 knots, seas 10-14 feet
High weather conditions posted for weather decks.

In transit.

0400 GMT Deck operations meeting. Captain, chief mate, Maurice, Sang Mook, Will, Bruce, Bob, Gary, and Akel in attendance. Agreed:

1. General cutoff for ops is 25 knots wind, 8-10 foot seas unless we hear otherwise from Andy Bowen (Bruce has asked what the max conditions are).
2. First DSL120 deployment will be in daylight
3. If 120 needs to be retrieved right after deployment and we can't, then Maurice may choose to run long lines first, which don't require 120 data. The 120 has to be deployed in order to collect deep tow mag data because the electronics are inside the 120.
4. A tropical depression is forming to SE of us, will be a couple hundred miles SW of us in 3 days. This may cause winds to back down in our area.

0600 GMT We conducted a test of the dynamic positioning in this rough weather. Successfully handed off control from bridge to computer lab, and successfully drove the ship at 1 knot along a variety of courses, including our main survey direction.

JD340 - Fri 06 December 2002

Winds NNE 15-25 knots, seas 6-10 feet

Arrive on station

deployed transducers

...and surveyed them in.

Started racetrack of surface magnetometer lines, plan is to launch tomorrow morning 8AM.

JD341 - Sat 07 December 2002

Winds SEE 20-35 knots, seas 10-14 feet

Abort launch

Bruce, Bob, Gary, Maurice and Capt Gomes meet on deck while ship holds station. We decide its too rough to launch, and Maurice plans more surface magnetometer lines.

PM: weather abates enough to give it a try, but the Capt. came down with a weather fax showing that the hurricane Pongsona to the S of us is recurving north, and he decided that we need to run away soon. We discussed putting the fish in to test its trim with the maggie streaming aft and do a mag calibration circle, but decided that the risk involved bringing it back aboard in marginal conditions outweighed the gain. So we'll finish a couple sfc magnetics lines here and then head SE until it passes (~1 day?).

JD342 - Sun 08 December 2002

Winds ESE 20 knots, seas 6-8 feet
High weather conditions posted for weather decks.

Launch Tow 01

Hurricane Pongsona heading to NW and weather is amenable, so we decided to launch.

AM: tested sonar, and noticed system noise that wasn't there during 04 Dec tests. Two kinds of noise:
A) ~3 hi-amplitude pings followed by ~12 lo-amp pings;
B) homogenous, continuous hi-amplitude across all pings.

Tried:
1. Re-downloaded code for doppler, and that eliminated some crosstrack noise.
2. Tried changing the voltage on the power supply, and that changed the noise.
3. Removed rack from pressure case and re-seated the boards and wiggled the connections. Everything seemed OK inside, but some of the noise went away when we powered back on. But system is still sensitive to voltage, and both kinds of noise above are still evident.

Maurice indicates he wants to get the magnetometer down. The only troubleshooting avenue left is to remove the rack from the fish, bring it inside and run it into the dummy load and poke around. We decide that the noise is low enough now to launch and see how it looks when it gets to the bottom.

Gary: Deck boss
Bob: lab engineer
Bruce: radio guy / tether handler
Akel: tether handler
Captain: tag line handler
AB: tag line handler
Tim (AB): crane
AB: deck winch

Magnetometer negatively buoyant
During deployment we discover that the maggie is about 30 pounds negative, when we'd been told that it was neutral. Dang, always test this stuff for yourself!

Maggie rotated the aft end of the fish down, plus made the overall fish negative.

Magnetometer calibration
Did a calibration circle for KORDI magweight with 500 m wire out.

Got on line and took DP control from bridge. After a couple hours, Capt. Gomes decided to take control back to the bridge because DP was overloading the bow thruster. Our line is ~315, winds are 30 knots from 132, so the ship has a major crab angle on, resulting in a severe wire angle. Gary's concerned about the wire rubbing the edge of the sheave, so he'll keep an eye on it.

SBSRD depth display in along-track (upper-right window) is NEGATIVE, which is wrong and puts the towfish up in the air. Akel wrote Andy and RBD about it.

Octans data being logged incorrectly
Akel also discovered that Octans attitude data are being logged incorrectly, and he's trying to fix.

KORDI magnetometer fails
KORDI MAGGIE FAILS: 342/1045

ON BOTTOM: 342/1123 w/o 6879 WD 5581

Waveform: 122/122/192
Power: Full
Rate: 800 ms

Report to WHOI:
08 December 2002
AM:

1. *The typhoon went NW and weather calmed down*
2. *Maurice decided to deploy at our present location (SE of originally planned deployment spot).*

PM:

1. *Launched DSL120 successfully, although when we deployed the towed magnetometer we discovered that it is about 30 pounds negatively buoyant, and hangs straight down. We decided to launch anyway and see how the system trimmed when towed.*
2. *With DSL120 at the surface, the buoyancy of the towfish appeared to be balanced by the weight of the towed maggie, making the whole package (fish + maggie) approximately neutrally buoyant.*
3. *Descended to 500 m w/o and drove a 2-km dia circle to calibrate magnetometer.*
4. *DSL120 trim is 6 degrees bow-up. When wire is paid out, pitch oscillates over a 60-degree range. Decided to go down.*
5. *At 342/1045Z the KORDI towed magnetometer failed. It appears to be on, and there's no short. We're still collecting mag data from the DSL120 maggie, and Maurice decided to continue.*
6. *Reached the bottom 342/1123Z (depth 5780m) and began towing at 100 m altitude. Sidescan data are of good quality, with a swath width of ~1180 meters. Bathymetry data are also very good, with a swath width of 500 meters (we're making good contours at 5% of altitude, which is about what you expect from phase-difference systems).*
7. *Doppler is on and working.*
8. *Towed without incident to present (343/0450Z).*

Initial analysis of the phase data indicate that the swath width is limited to ~600 meters because, on a plot of phase vs. time for a given ping, the slope of the measured phase-difference goes to 0 at about -0.5 radians. At an altitude of 100 meters, this corresponds to a time of about 0.38 seconds, a slant range of 285m, a horizontal distance of 267m, and a geometric angle of 70 degrees. I think this limit is a function of the sonar hardware (xducer row spacing and frequency) and not signal:noise, and it looks to me as if DSL120 is a 140-degree bathymetry system as currently configured.

End WHOI report

JD343 - Mon 09 December 2002

Winds SW 10-15 knots, seas 4-6 feet

Surveying.

Octans data logging problem fixed

Jon sent out code changes to fix the sign convention of depth values that the DSL topside system is sending to HMRG. Akel recompiled and installed the new software and it worked! The installation required a brief gap in the metadata:

23:58:29 stopped metadata acquisition
23:58:52 restarted to fix the depth problem

NOTE: Towfish depth was incorrectly logged as NEGATIVE from 342/1100 to 343/2358. Btyp acoustic attributes need to have min/max depths of -6000/-4000. After processing in btyp you need to strip out the fish depths, change their sign, and replace them in the processed data files. See loop in $DOC/realtime/btyp_gen to see how this was done.

JD344 - Tue 10 December 2002

Winds S 15-20 knots, seas 4-6 feet

New processing attributes
New AA tables
Whole new way of doing bathymetry: the Big Angle Mrtrim Method (BAMM)

Pongsona hits Guam

Guam devastated by Super Typhoon Pongsona. 185 knot winds recorded.

CLEANING CARTRIDGES STAY GONE ....

Today tape drive /dev/st0 on waimea (real time machine) began flashing its "clean me" lights. We went to the cupboard to find the poor drive a cleaning cartridge, and the cupboard was bare.

Akel, Bruce and Tony (marine tech) ALL saw the cleaning cartridges in the science hold on Honolulu, but after searching all over the place we can't find them.

WHO STOLE OUR CLEANING CARTRIDGES? ....

JD345 - Wed 11 December 2002

Winds SSE 5-10 knots, seas 2-4 feet

Telemetry failure

345/0320 TELEMETRY FAILURE -- End of Tow 01

Topside gear all OK, Bob finds no problem with slip ring. Light checks in but it doesn't check out -- problem is downstairs. Recovering...

Recover Tow 01

345/0800 Recovered fish, no problems

JD346 - Thu 12 December 2002

Winds SSE 5-10 knots, seas 3-6 feet

Bob and Gary repaired the fiber/Jbox on clump, and the Jbox on the 120. Removed the tether to the magnetometer.

Gary found long-line fishing gear wound around clump.

Deck test looked OK.

Launch Tow 02

346/0400 - deployed the fish, no problems

Stopped at 50 meters, fish it too buoyant. It's nose-up by 10 degrees.

346/0928 - Altitude 100 meters

Port bathy is flipped, stbd is not. Stopped / restarted acquisition, and it came up with both sides unflipped and OK.

Towfish is ~6 degrees nose down, meaning its too buoyant. Towfish is rolled +0.5 degrees.

Fish is pretty unstable -- getting pitch oscillations from 5 to -30 degrees and heading oscillations of +/- 3 degrees (6 degrees total)

Both instabilities translate into stripe noise, although pitch is way more debilitating.

346/1133	Changed from transponder nav to layback nav, which created a big heading change that slowly readjusts to the true heading. This will have to be edited and fixed.
346/1156	Layback nav kicks in with decent values
346/1354	Time series data record read error in file TN152-2002346-133420 shows pings 0 to 1485 (not the expected 2250) only.
346/1416	Ping flipped on port side bathymetry (starboard OK). Are near the end of the line anyway, so will wait until then to stop and restart acquisition (port bathy dodgy from here).
346/1523	Lost the bottom as fish is brought up ready for turn onto next survey line. No bottom data recorded from here.
346/1800	Changed Raytheon roll
346/1900	Fish on bottom for start of next survey line
346/1906	Ping Flipping suppressed and Phase Inversion enabled in SBSRD bathymetry attributes to produce correct bathymetry. Good sidescan imagery and bathymetry data from this time.
346/2106	Starboard bathymetry ping flipped. Ping Flipping set to automatic in SBSRD, and also in real-time processing for the affected areas.

DP PROBLEM -

At the end of Line 5 (346/1520) there was a ship handling problem
1. Original plan OK'ed by Glenn was to have Bob do the turn in DP
2. Bob, Bruce and Maurice subsequently decided that since data would not be acquired around the turn we should haul wire until w/o < WD and have the bridge take control of the turn. Bob and Bruce discussed this with Jay (3rd mate) on bridge, and agreed that lab control of DP would end when the towfish reached the end of the line, and the ship would hand-steer to the next line.
3. Somehow, at the end of the line, the ship was observed to be thrusting in reverse, and Gary reported seeing a negative wire angle, suggesting the vessel was backing down on the wire. However, Marlene never saw STW lower than 0.3 knots forward, and the UW marine tech on duty (Rob Hagg) observed that none of the actions of the watchstanders contributed to the problems encountered.
4. Potential causes: The bridge attempted to transfer control back to the lab after they'd taken control. Not sure why. When this happened, the reverse thrust could have been caused by A) the DP reference being located behind the ship when DP was handed over, or B) the ship had arrived at the goal. Rob Hagg suggested that the problem was with the ship's DP system, not with the DSL gear or personnel.
5. Fallout: Capt Gomes decides that the inexperience of the new DSL navigators, in combination with the inexperience of his 2 new mates, is too great to safely go into DP. The only way he wants to go into DP is if Bob is on watch in our lab.

JD347 - Fri 13 December 2002

Winds SSE 5-10 knots, seas 3-6 feet

347/1049	Go into layback nav - towfish heading (calculated from towfish nav) are no good (good heading = 135)
347/1157	Towfish headings back to 135deg

Hey! This means that the heading data in TTS files is calculated from navigation, which is not what we want. We want Octans heading.

Phase shift problem begins

347/2347	Port side spontaneously switches flip -> no flip Stbd side remains flipped

JD348 - Sat 14 December 2002

Winds SSE 5-10 knots, seas 3-6 feet

348/0027	Port side spontaneously changes from inverted, un-phase shifted to un-inverted, with phase wrap (good -> bad)	
348/0150	Port side spontaneously changes back (bad -> good)	
348/0027	Port side spontaneously changes good -> bad	X

348/0257	Port side spontaneously changes bad -> worse	X
348/0315	Port side spontaneously changes worse -> bad	X
348/0334	Port side spontaneously changes bad -> good	X
348/0345	Port side spontaneously changes good -> bad	X
348/0410	Port side spontaneously changes bad -> good	X
348/0517	Port side spontaneously changes good -> bad	X
348/0518	Port side spontaneously changes bad -> good	X
348/0541	Port side spontaneously changes good -> bad	X
348/0622	Port side spontaneously changes bad -> worse	X
348/0631	Port side spontaneously changes worse -> bad	X
348/0512	Switched from LBL to layback nav. Headings/positions nogood.	
348/0624	Headings/positions OK.	
348/0622	Port side spontaneously changes flipping/phase shifting state	

Cycled ACQ off/on with no result.
Turned power transmit power from full to 0 to full with no result.
Cycled ACQ off/on with positive result.
348/0631 Port side back to where it was prior to 0622

Spent all day trying to unwrap phase on port side of file TN152-2002347-232606 with NO LUCK. How come we this won't unwrap? See $DOC/04-calibration/AA-tables

Trying to fix phase-shifted pings

1. Port side is not inverted, but has a phase wrap
2. If you set phase unwrap to near nadir shift, turn ping flipping off, and disable ping inversion, then the ping is correctly interpreted, but the current AA table is not appropriate.

PROBLEM

3. Stbd pings here ARE inverted, with NO phase wrap. If you process them with inverting disabled, then the port pings don't process correctly.
4. If ping flipping is set to auto, btyp interprets this as a flipped ping, and inverts it

Look at pings 55-75 in file TN152-2002348-002608

348/1323 Port side spontaneously changes good -> bad
348/1429 Port side spontaneously changes bad -> worse
348/2329 Port side spontaneously changes worse -> bad

JD349 - Sun 15 December 2002

Winds SSE 5-15 knots, seas 4-6 feet

349/0102 Port side spontaneously changes bad -> good

Recover Tow 02

349/0200 - Off bottom, end Tow 02

Re-attach fixed KORDI magnetometer

Bob wants to recover to check the oil in the JBox & get the fish properly trimmed. We'll also reattach the KORDI magnetometer, which has been repaired, and float it using a glass ball streamed ~20 feet aft of the maggie.

New drogue and harness for pitch stability

Gary will make a 4-point harness for the maggie-drogue as per
Mark Rognstad's suggestion to minimize bucking.

Launch Tow 03

349/1430 - DSL redeployed
349/1855 - DSL at ~100m above seafloor, bottom data starts to be recorded.

Phase shift problem continues

Appears to be even worse on this tow, with system switching modes for brief periods (6-20 pings) and then shifting back. During the 0200 hour of JD350 it shifts EVERY PING.

JD350 - Mon 16 December 2002

Winds SSE 5-15 knots, seas 4-6 feet

Bathy files still really suck, the switching between phase modes has become more frequent, and often varies from ping to ping.

ODP Site 801C imaged

on file: TN152-2002350-040751

Today really sucked, because all the files needed microadjusting in btyp due to changing phase / flipping characteristics

JD351 - Tue 17 December 2002

Winds NE 15-25 knots, seas 4-8 feet

Eli Appelgate is 5 years old today. Happy birthday, boy.

Voltage problems a continuing problem

Bruce and Bob diddled the voltage on the topside power supply, and the noise dropped a lot. This improved the phase data, and bathy seemed more consistent after diddling.

The voltage happy place is about 341 or 342 volts.

JD352 - Wed 18 December 2002

Winds NE 5-10 knots, seas 2-4 feet

Today we acquired many pings. Some were good pings, and we were happy. Some pings were bad, and we were sad. We fixed what we were able, and ate, and slept and ran on the treadmill, and it was good.

JD353 - Thu 19 December 2002

Winds NE 5-10 knots, seas 2-4 feet

Surveying...

JD354 - Fri 20 December 2002

Winds NE 15-25 knots, seas 3-5 feet

Surveying...

JD355 - Sat 21 December 2002

Winds NE 15-25 knots, seas 4-6 feet

Surveying...

JD356 - Sun 22 December 2002

Winds knots, seas feet

Surveying...

JD357 - Mon 23 December 2002

Winds knots, seas feet

Surveying...

Fix for tape drive failure

Today the /dev/st0 drive on waimea stopped working. Symptoms are that the thing still accepts tapes, and appears to be writing them for the entire 4-hour duration of the logging period. The tapes, however, are unreadable by other drives, giving an error message:

```
> mt -f /dev/st0 setblk 10240
> tar tvf /dev/st0
  tar: /dev/st0: Cannot read: Input/output error
  tar: At beginning of tape, quitting now
  tar: Error is not recoverable: exiting now
```

So I abandoned drive /dev/st0 on waimea, we'll make the extra tape manually on `malolo`.

The broken tape drive will be repaired after this tow -- it can be fixed by stopping the `ttpl` program, re-running the command `mt setblk 10240`, and restarting `ttpl`.

JD358 - Tue 24 December 2002

Winds 0-5 knots, seas 1-2 feet

Surveying...

Recover Tow 03

Reached end of line: 358/0510
Off bottom: 358/0510
On deck: 358/0905

JD359 - Wed 25 December 2002

Winds 0-5 knots, seas 1-2 feet

In Transit...

NSF winch and sheave problems

PM: Gary works to replace winch gear

JD360 - Thu 26 December 2002

AM: Gary works to replace winch gear
AM: Gary inspects sheave. Says its OK to go.

Notes on 9-second noise

Bob has turned off the doppler's "water ping", which was transmitting once every 10 cycles. Louis thought it's the source of our 9-second "notebook paper" noise. But the noise persists after we turn off the water ping. The noise goes away when we turn off the doppler. The noise gets worse as we turn transmit power down, the noise gets less offensive as we turn power up.

See figure $DOC/01-general/DopplerNoise.jpg

Sonar noise in general

See Bob W's email on this topic -- basically the more the current draw, the noisier the system is. As we turn off instruments, the noise level decreases proportionally to the draw of the instrument.

Problem with ship's DGPS nav

The commercial differential nav system is flaky today, so we've switched over to PCode-1.

Reballast

We moved a couple of pounds of lead aft on each of the P/S sides. Total lead payload is the same. Took photos (Tow04-01-Before folder)

New UTM origin

We're going to be entirely within UTM zone 56 for this tow, so Akel switched the UTM origins on the acquisition ini files.

Launch Tow 04

Deploy: 360/0220 No problems.

New noise related to winch movement?

On the way down this time, we went out at 30 m/min. Pitch excursions ranged 0 - 45 degrees, with heading variation of 5 degrees peak-trough. During this period we saw strong noise signals. We stopped paying out wire and the noise stopped. See figures in $DOC/01-general called WinchOutNoise-01.jpg and WinchOutNoise-02.jpg

On Bottom: 360/0648

Ship navigation back on line

Sang-Mook noticed that his nav was being logged correctly. The commercial GPS is working OK again, so we switched back to that around 360/1050 or so.

Sonar time stamp problem

Jennie noticed that there is an offset in GPS time compared to the time recorded in the ping headers. The ping headers record a time which is precisely 7 minutes faster than actual GPS time (360/1900). By 360/2359, the time difference had increased to 8 minutes and five seconds.

This problem will continue for the rest of the survey. See SonarTimeOffset.doc in $DOC/01-general for a log of time differences between GPS UTC time and sonar time.

JD361 - Fri 27 December 2002

Winds 10-15 knots, seas 3-5 feet

TIME PROBLEMS CONTINUE

Time problem continues. Mark suggested the problem is related to telemetry errors. We looked at the GUI, which is supposed to report errors, but it showed 0. To test if the GUI was working, we disconnected the FO input to the acquisition computer, and found that the GUI does NOT work -- it didn't report any errors when we disconnected the FO cable. But then...

Telemetry problem

... we discovered that when we reattached the FO cable (361/0210 or so), the sonar noise increased dramatically -- it wiped out bathy and made the sidescan way noisier. We tried halting/restarting sonar acquisition on the DSL program, but this had no effect. We tried turning power to the sonar off, restarting sonar and redownloading the sonar waveform/pingrate/power info, but this had no effect -- still noisy. So we disconnected the FO cable again and reattached it, and this time the noise level went back down to where it originally was. Bob then cleaned the FO connection using lens cleaner.

JD362 - Sat 28 December 2002

Winds 5-10 knots, seas 3-5 feet

Surveying...

JD363 - Sun 29 December 2002

Winds 5-10 knots, seas 3-5 feet

Surveying...

JD364 - Mon 30 December 2002

Winds 5-10 knots, seas 3-5 feet

Surveying...

Intellifish (tm) method of layback calculation is resurrected from Bruce's MS thesis, and reincarnated as an awk script used to process DSL120 nav. Works...

JD365 - Tue 31 December 2002

Winds 5-10 knots, seas 3-5 feet

Surveying...

Navigation pau for tows 1 thru 3. Can't do tow 4 until we recover, because we've got to halt the Benthos 455 unit to load the data onto floppies, and in doing so we lose acoustic range data.

After we recover, Bob is going to install a serial line from the 455 to a linux machine so we can capture the serial acoustic data in real time, and all our dreams will come true.

JD001 - Wed 01 January 2003

Winds 10-20 knots, seas 4-6 feet

Surveying...

End Tow 04: 001/0147

Noise tests

Ran some noise tests on the bottom:

01:48:38 Doppler off
01:50:03 Doppler on
01:50:38 Octans off
01:52:10 All systems off except sonar

Note: turning systems off changes the noise characteristics in a way that's consistent with noise being proportional to load. The doppler did not affect the 3-second noise evident in the bathy. However, the 9-second noise goes away when we turn the doppler off.

Tow 04 Off Bottom: 001/0212

Recover Tow 04

Tow 04 On Deck: 001/0510

JD002 - Thu 02 January 2003

Winds 10-20 knots, seas 4-6 feet

Acoustic range data logged via serial line

Bob configures a serial line from the 455 to malolo, and Akel uses one of Jon's acquisition scripts to log the data in real time. This will allow us to calculate layback data in real time, which we can use to merge with the sonar data as part of our regular processing.

Launch Tow 05

Deploy: 0230
On Bottom: 0730

Surveying...

JD003 - Fri 03 January 2003

Winds 10-15 knots, seas 4-6 feet

Surveying...

JD004 - Sat 04 January 2003

Winds 10-15 knots, seas 4-6 feet

Surveying...

JD005 - Sun 05 January 2003

Winds 10-15 knots, seas 4-6 feet

Telemetry problems redux

Today Bob tried cleaning the fiber/power connections on the winch to see if that would fix the problem of the skipped pings (on the theory that the dropped pings result from telemetry problems).

Result: Cleaning the connections did not make the dropped pings go away. Now the sonar data is way noisier than it had been before Bob did his evil deed.

But Then: Bob fixed the problem by removing the fiber from the MUX on the ACQ computer, and replacing it. Magically, the noise went away and the bathy was as good as new.

Test: So we tried degrading the optical signal to see if we could duplicate the heinous noise.

Normal Light Level: -19 dB	Data OK
Bad Light Level: -26 dB	Data STILL OK
Normal Light Level: -19 dB	Data OK

We repeated this a few times, but could not make the data ugly and noisy again.
WHY DOES THIS HAPPEN?

JD006 - Mon 06 January 2003

Winds 10-15 knots, seas 4-6 feet

Surveying...

JD007 - Tue 07 January 2003

Winds 5-10 knots, seas 2-5 feet

Surveying...

JD008 - Wed 08 January 2003

Winds 10-15 knots, seas 4-6 feet

Surveying...

JD009 - Thu 09 January 2003

Winds 10-15 knots, seas 4-6 feet

New sidescan speckle noise

New kind of noise evident in the sidescan data, high-amp speckle noise that occurs periodically. Starts sometime before 0100

Surveying...

009 09 49 00 Off Bottom

Recover Tow 05
009 13 00 00 On Deck

END OF SURVEY

JD010 - Fri 10 January 2003

In transit to Guam

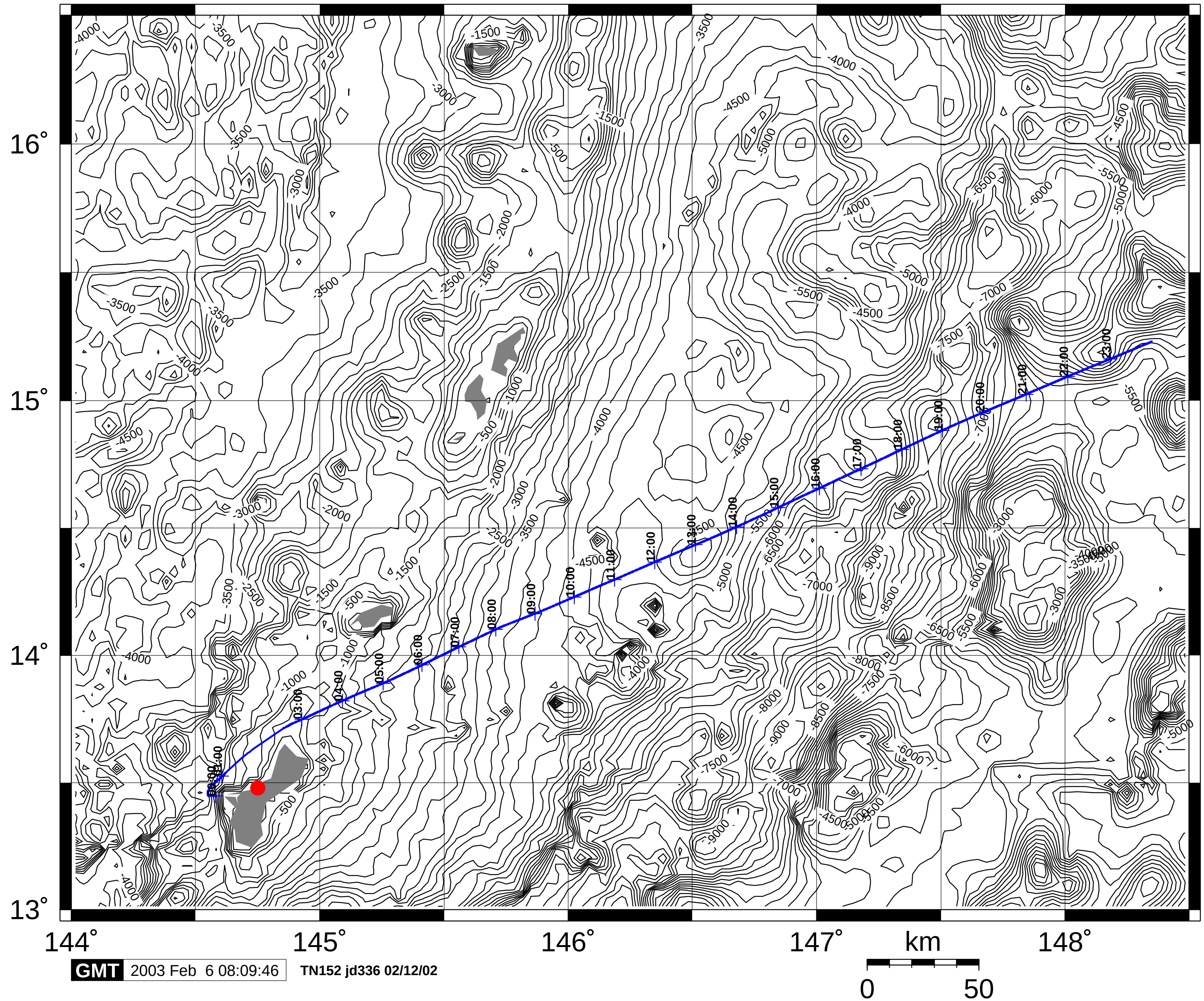
JD011 - Sat 11 January 2003

In transit to Guam

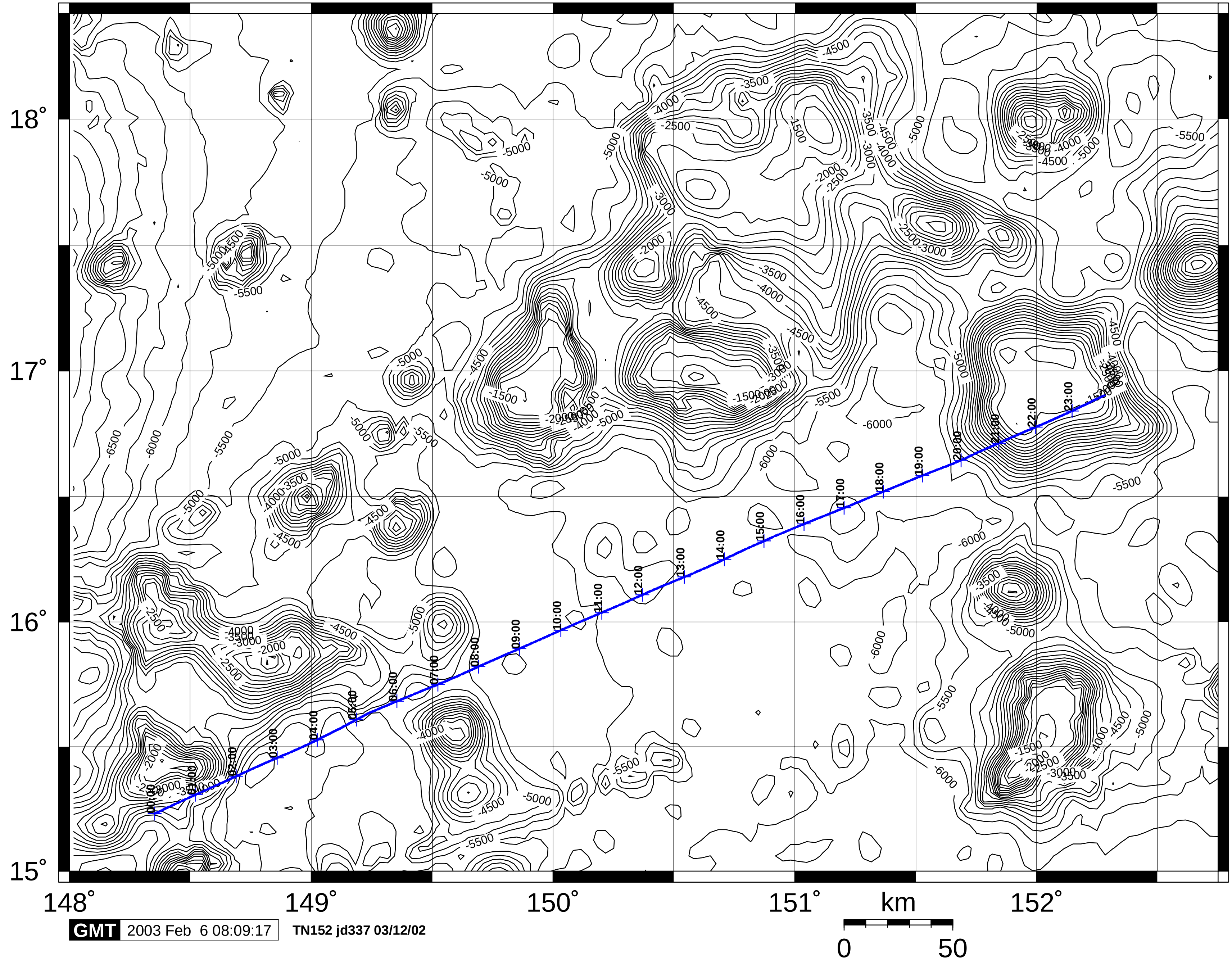
JD012 - Sun 12 January 2003

Arrive Guam AM
Demob - minimal because most gear staying aboard for Fryer survey in March. All required gear off vessel by 5 PM

TTN152 Ship Track Jurassic Quiet Zone

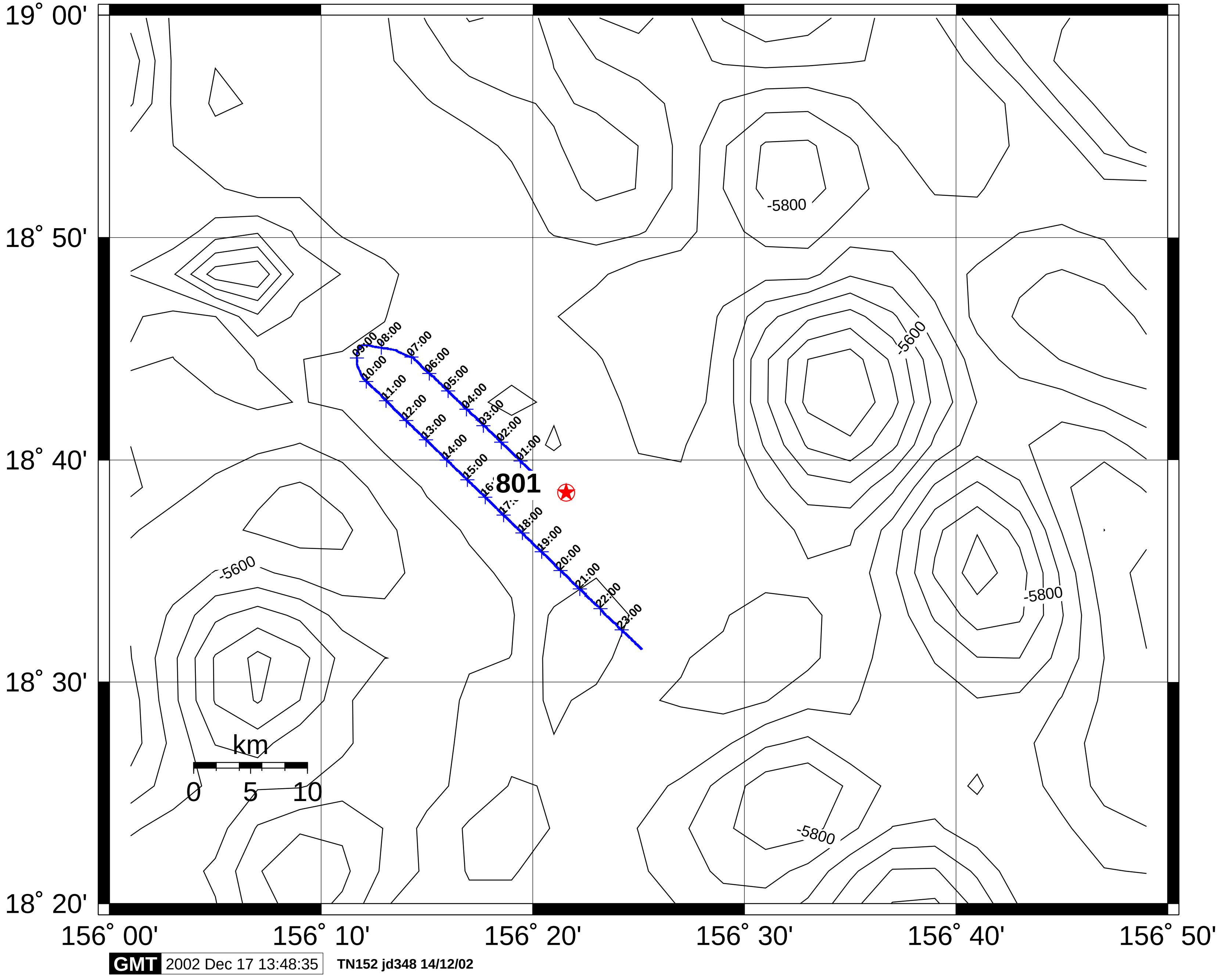


TTN152 Ship Track Jurassic Quiet Zone

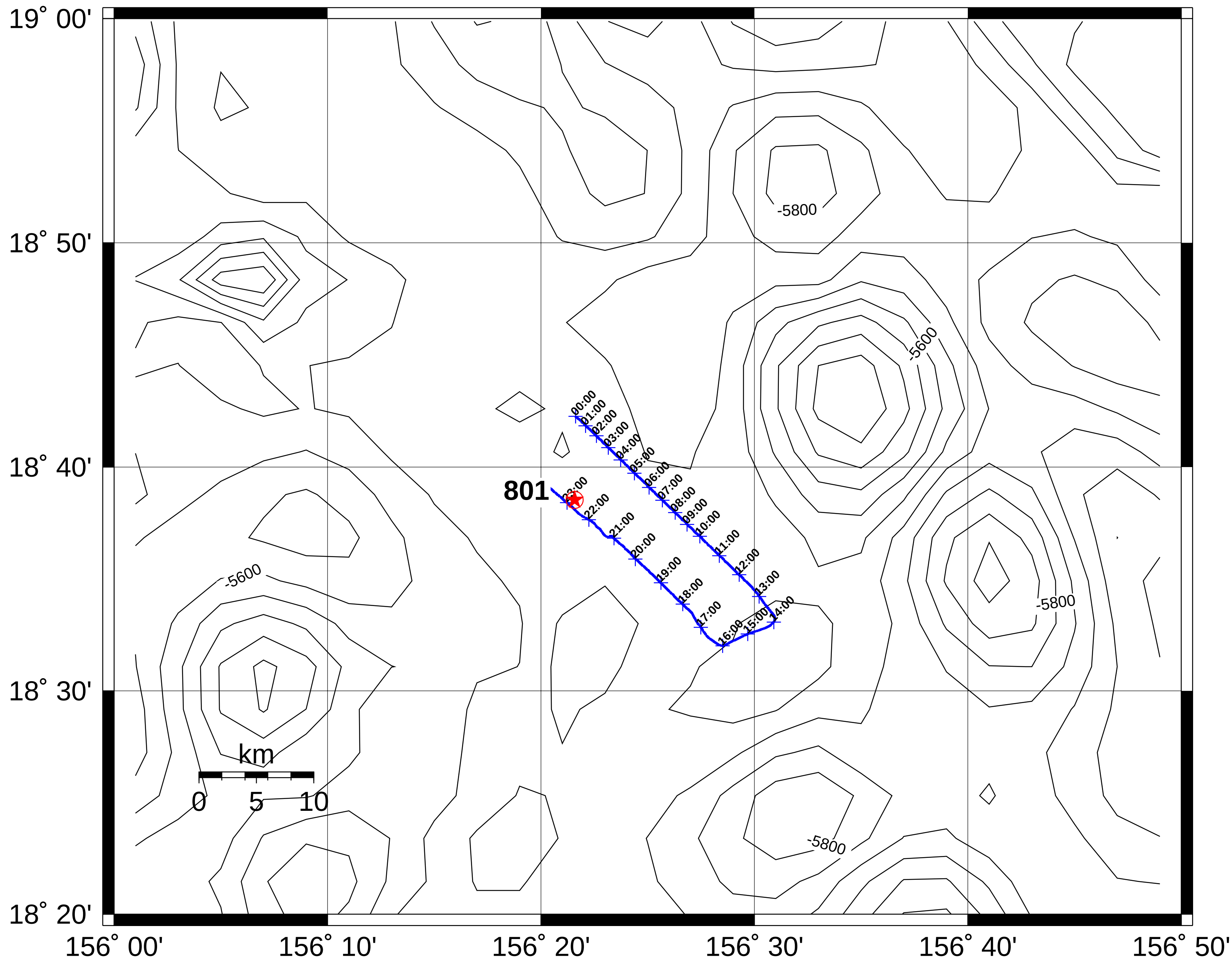


TN152 jd337 03/12/02

TTN152 Ship Track Jurassic Quiet Zone

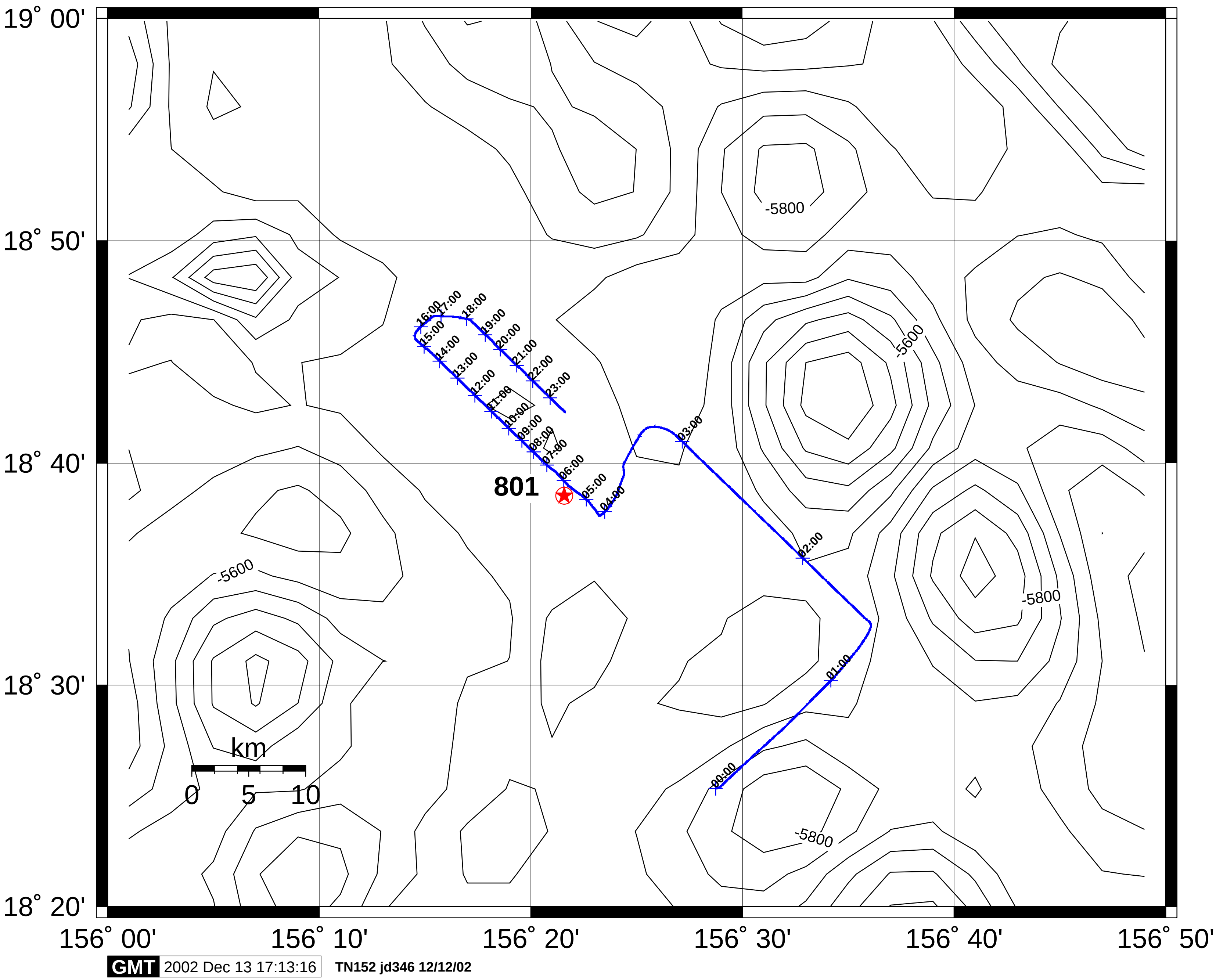


TTN152 Ship Track Jurassic Quiet Zone

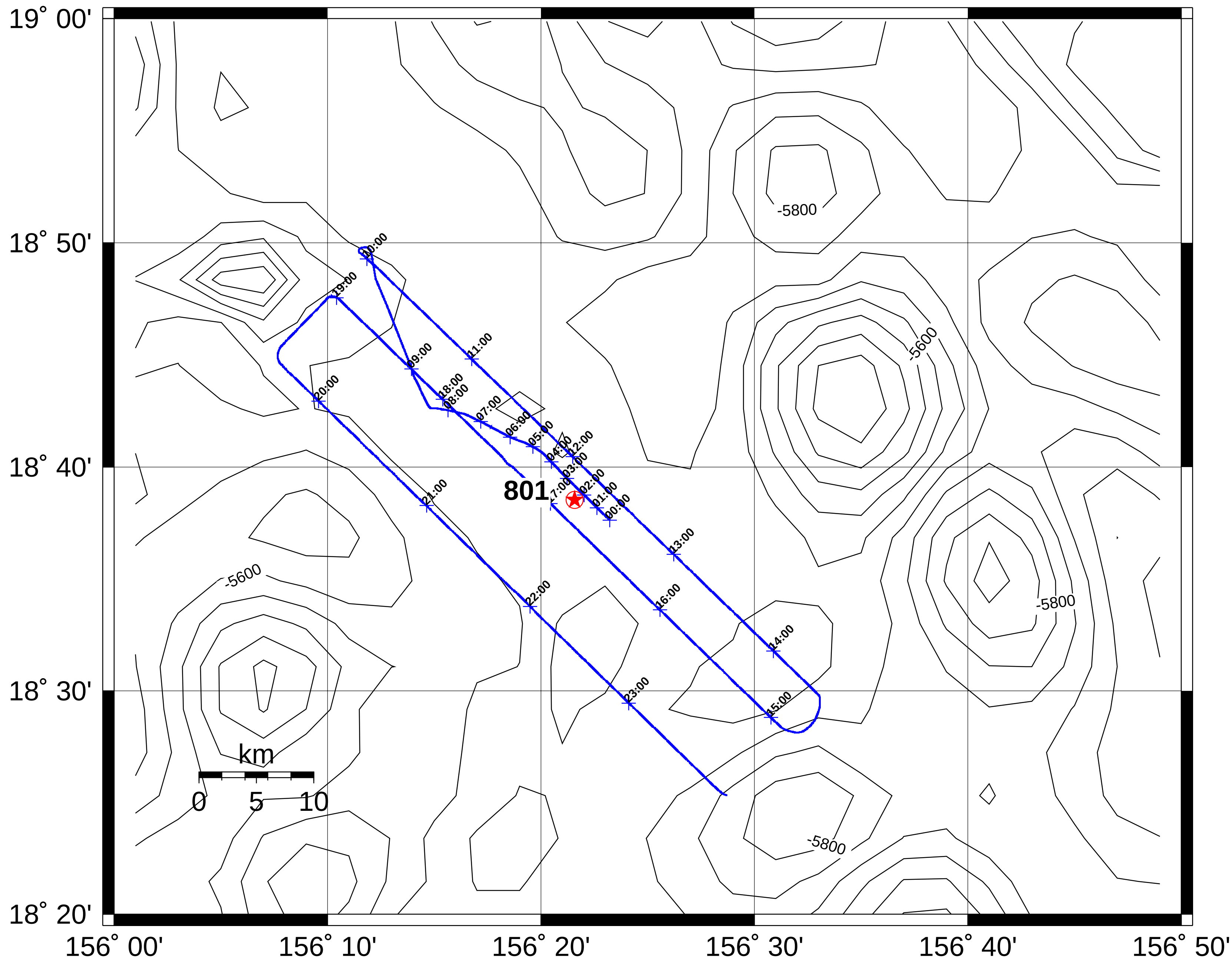


GMT 2002 Dec 13 17:40:19 **TN152 jd347 13/12/02**

TTN152 Ship Track Jurassic Quiet Zone

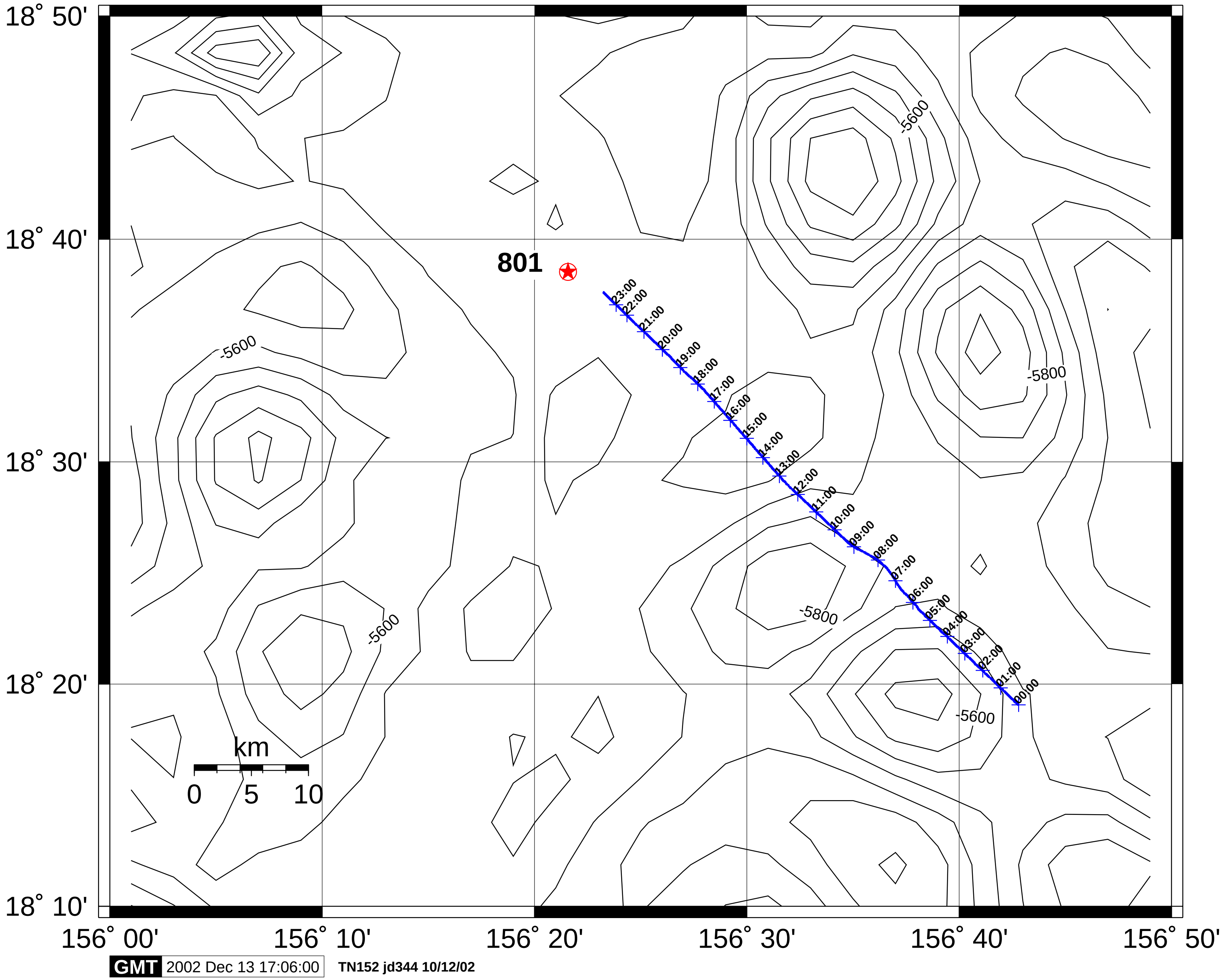


TTN152 Ship Track Jurassic Quiet Zone

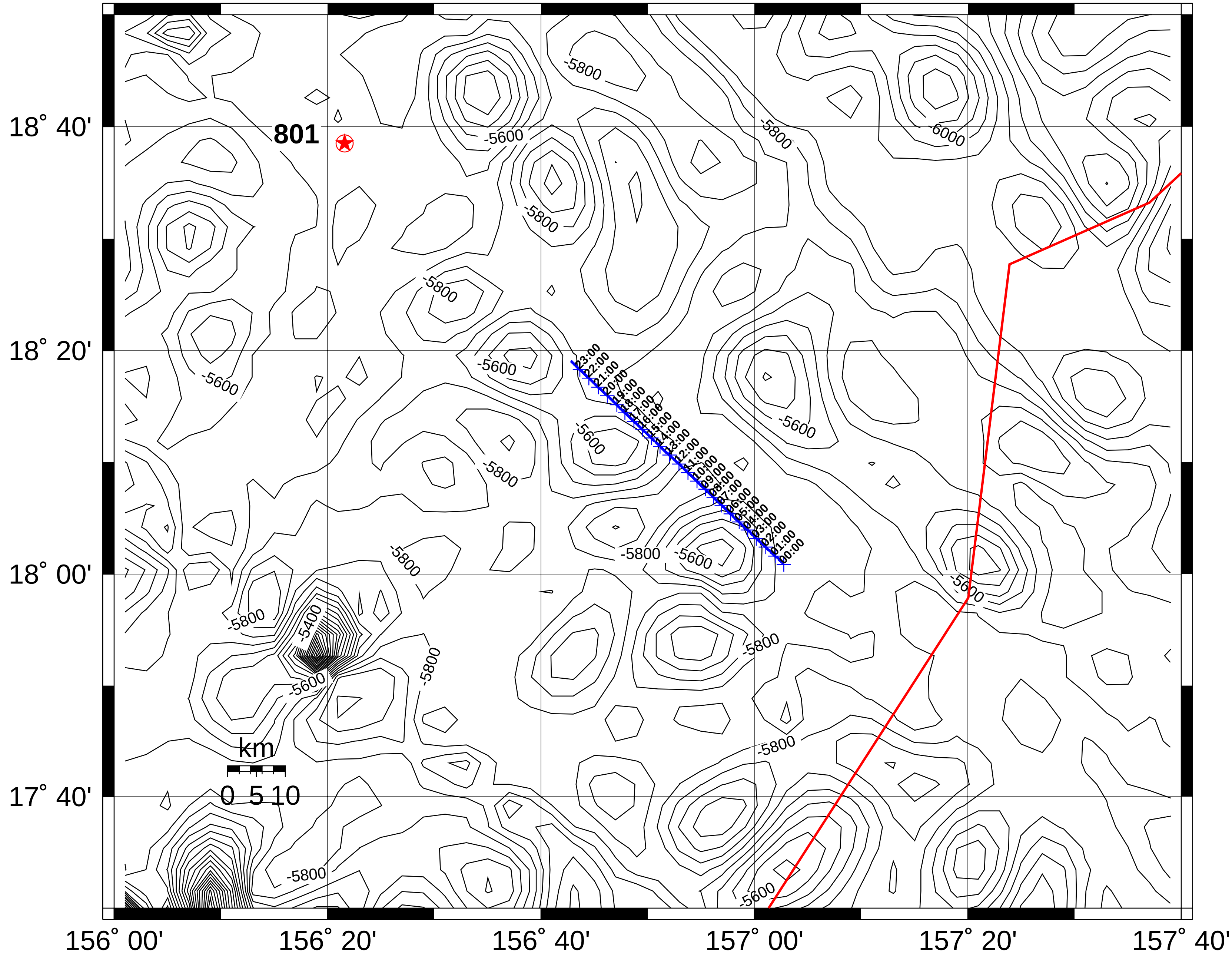


GMT 2002 Dec 13 17:07:20 **TN152 jd345 11/12/02**

TTN152 Ship Track Jurassic Quiet Zone

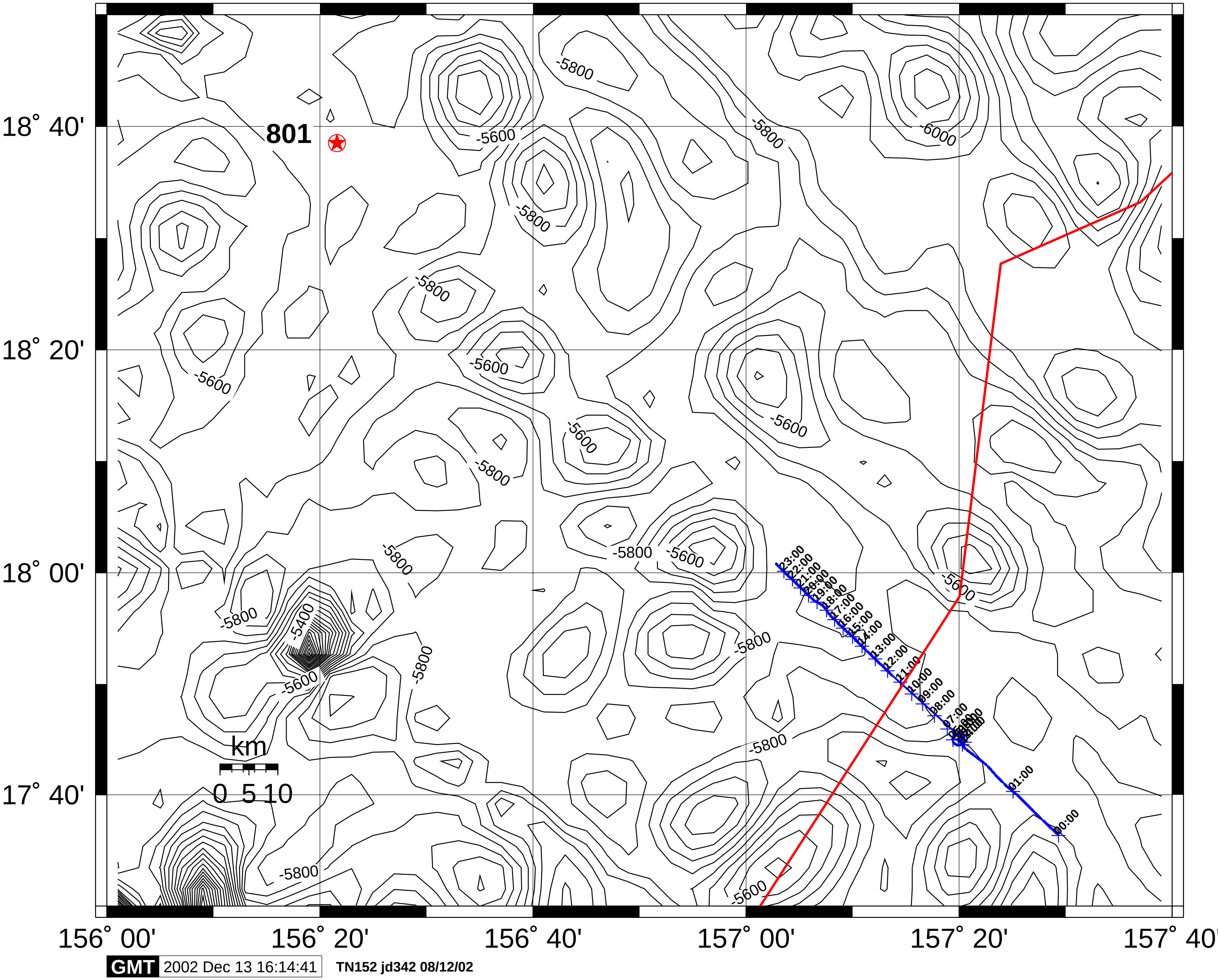


TTN152 Ship Track Jurassic Quiet Zone

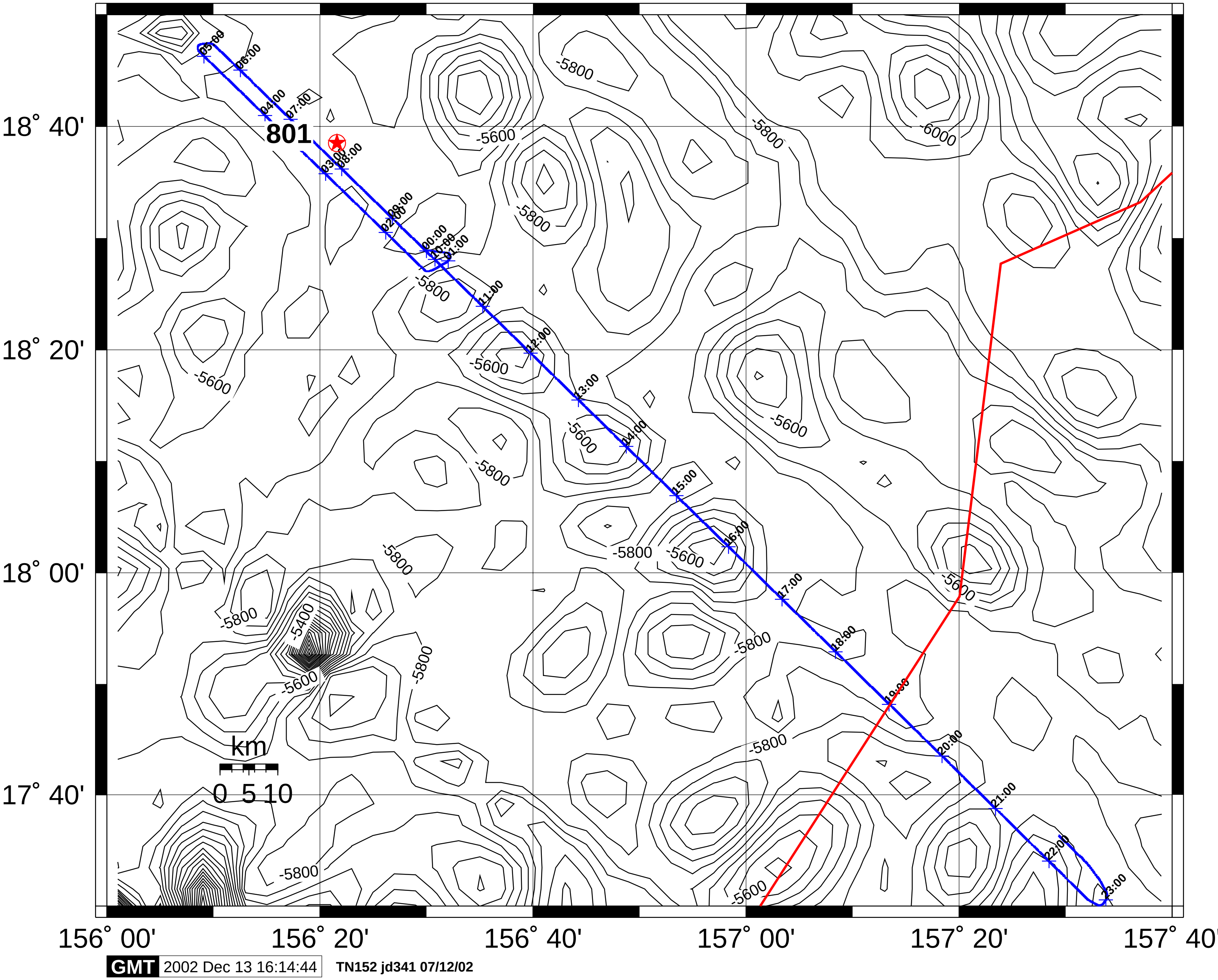


GMT 2002 Dec 13 16:04:19 TN152 jd343 09/12/02

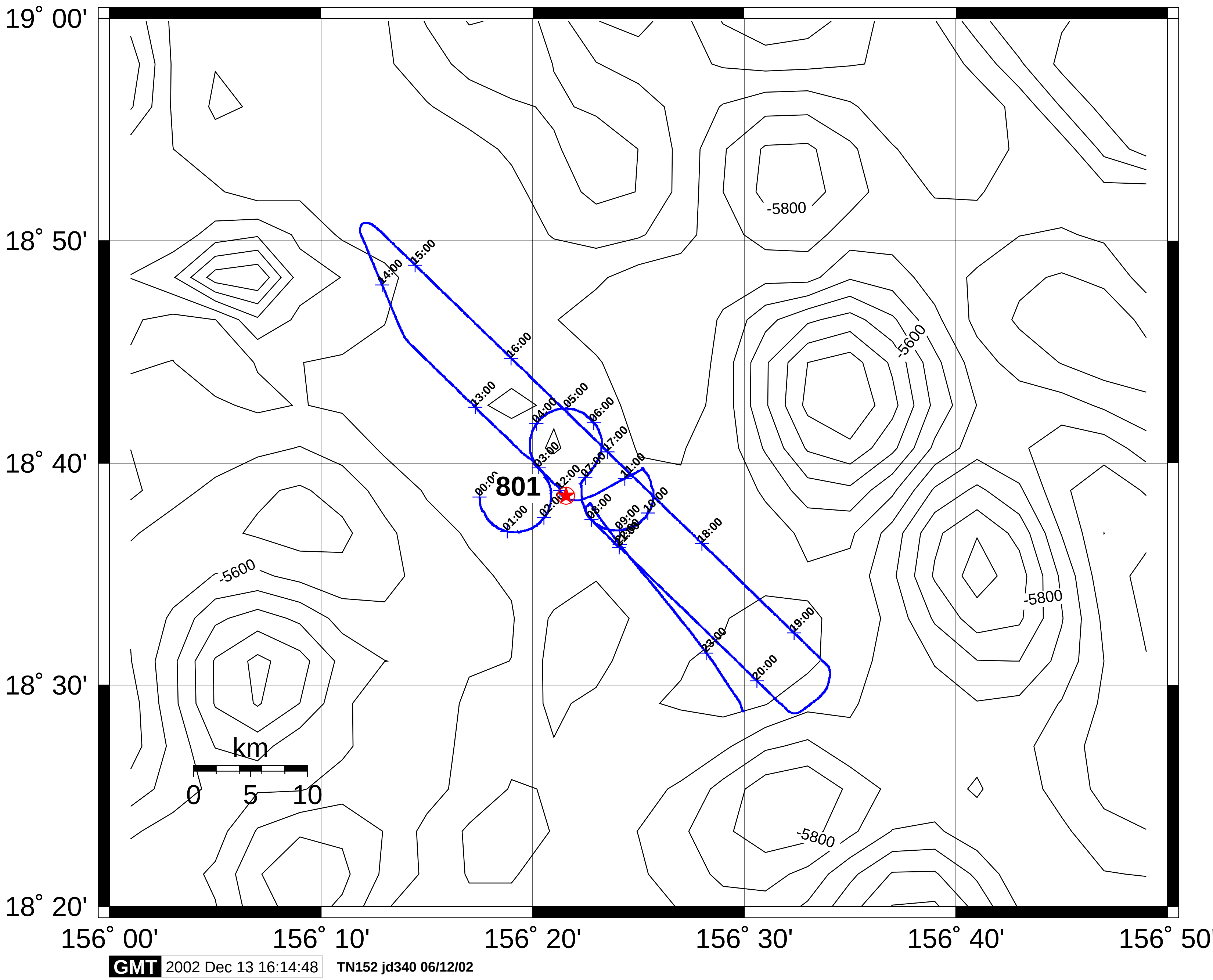
TTN152 Ship Track Jurassic Quiet Zone

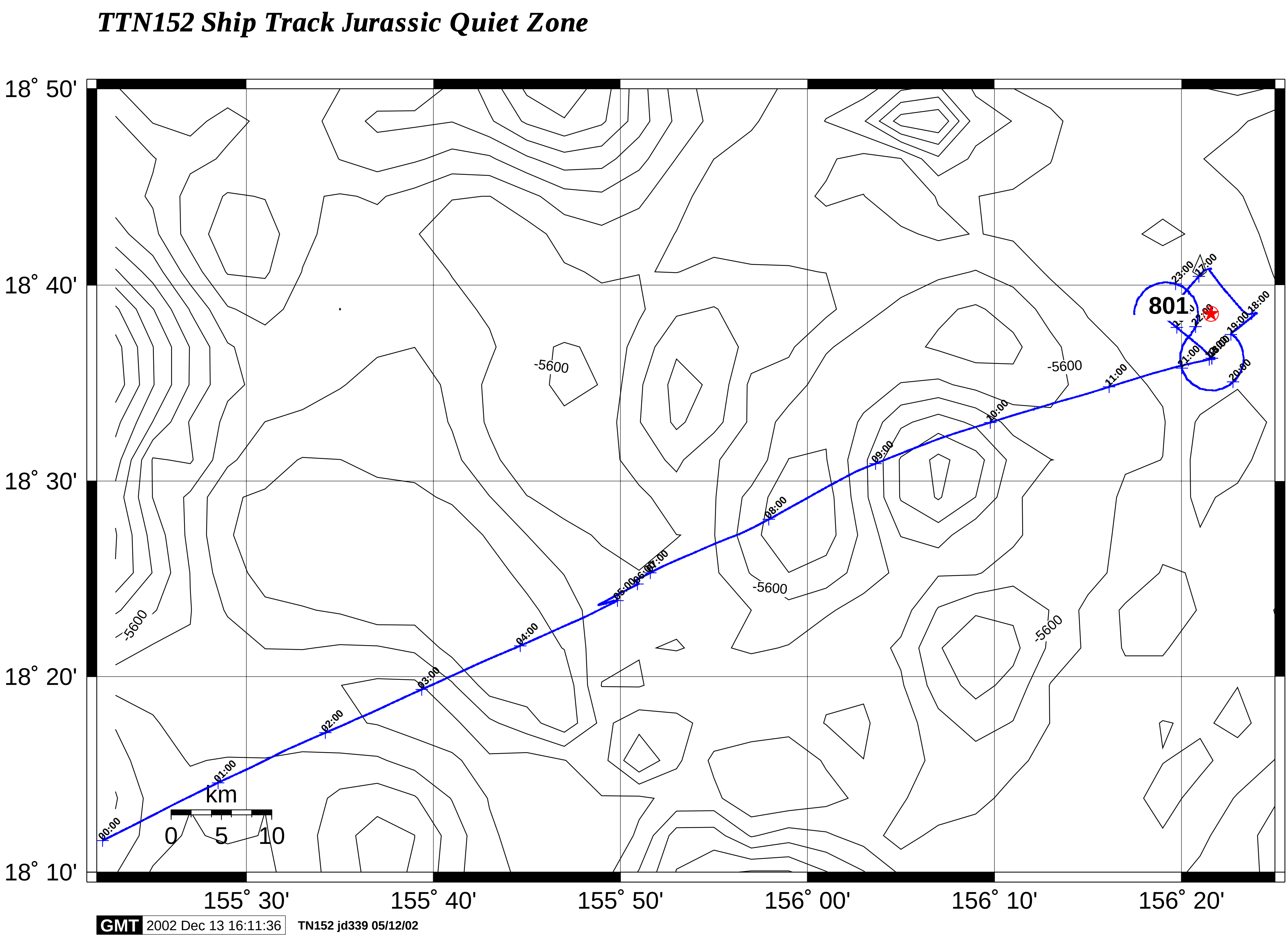


TTN152 Ship Track Jurassic Quiet Zone

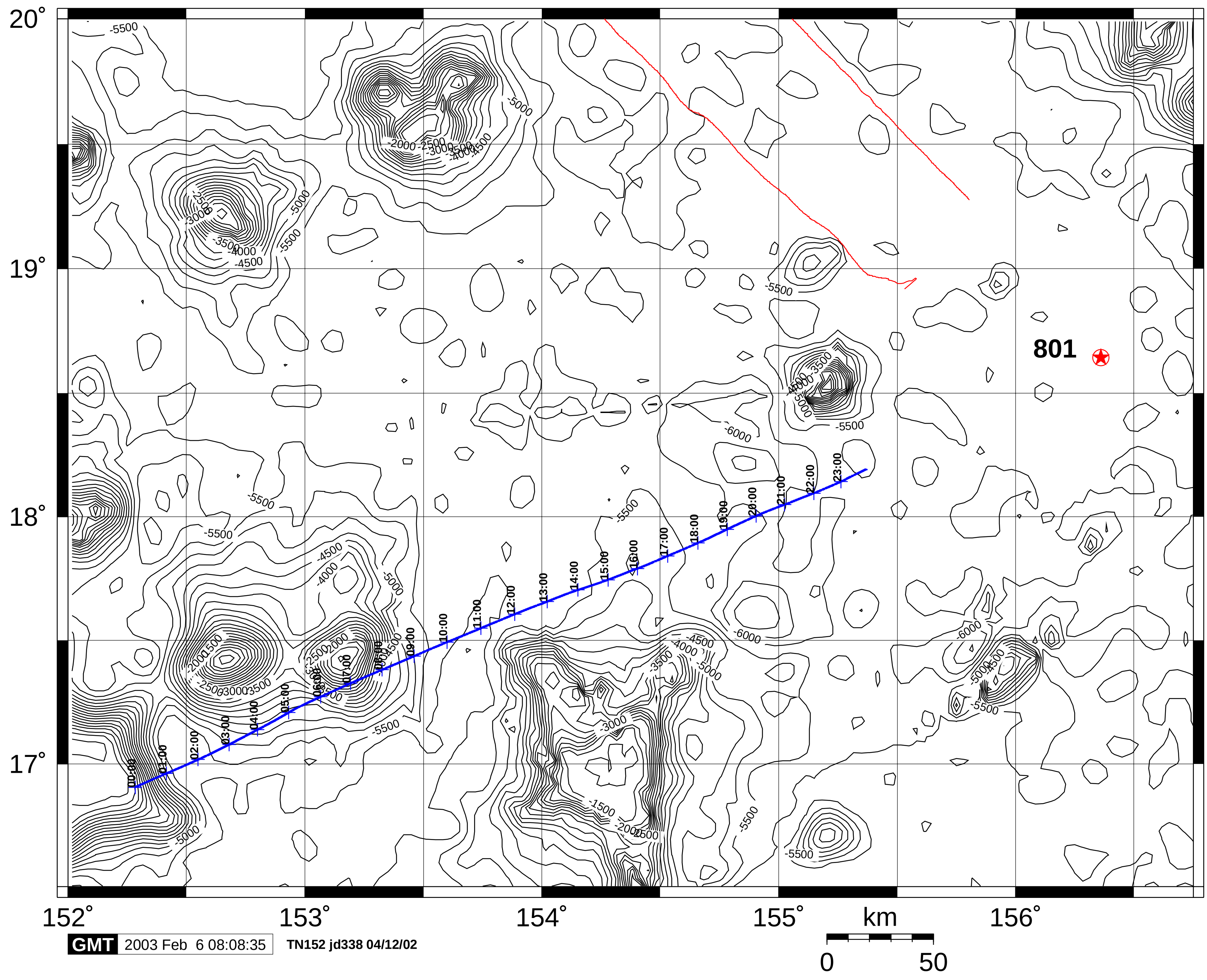


TTN152 Ship Track Jurassic Quiet Zone

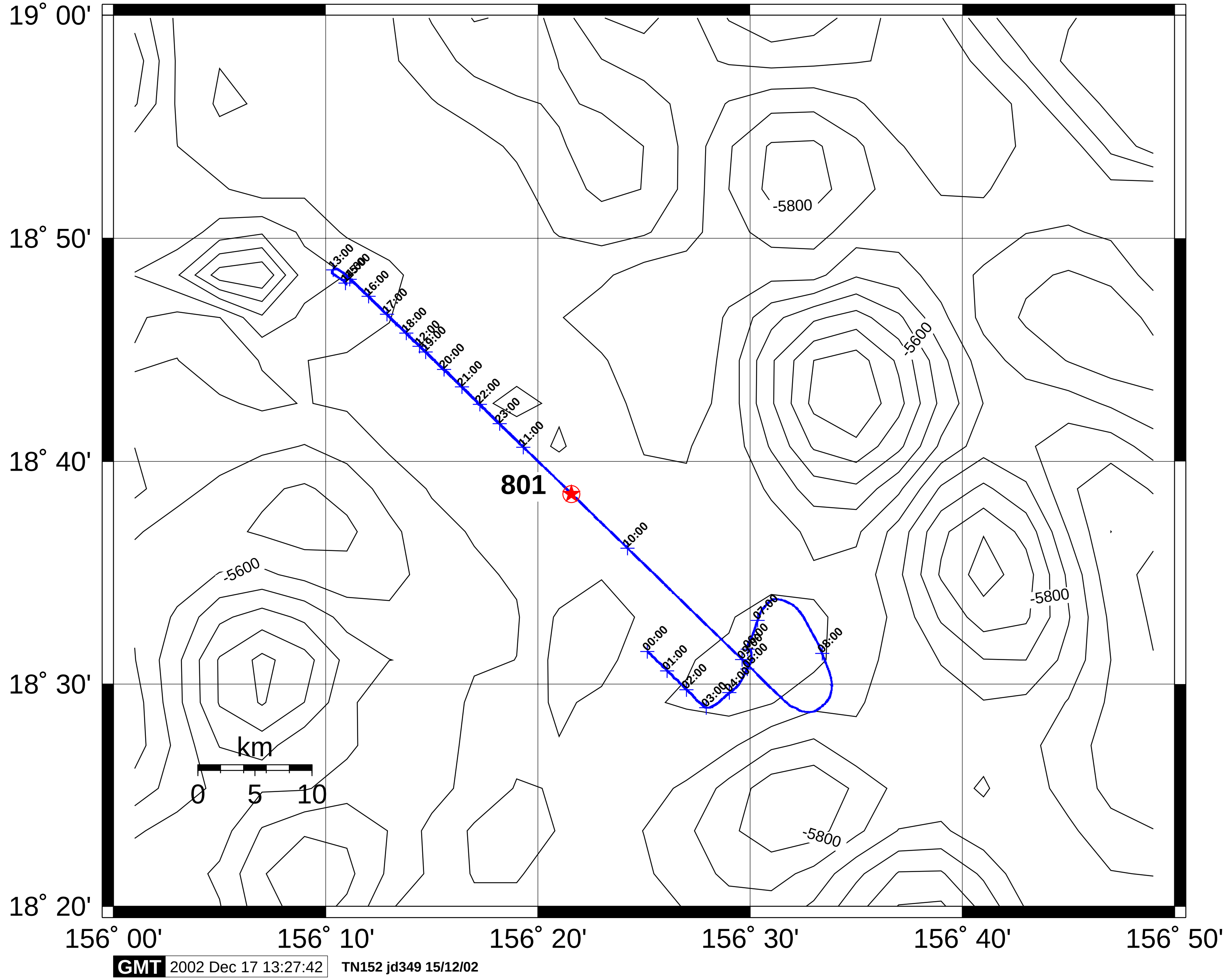



TTN152 Ship Track Jurassic Quiet Zone
18° 50'
18° 40'
18° 30'
18° 20'
18° 10'
155° 30'
155° 40'
155° 50'
156° 00'
156° 10'
156° 20'
-5600
801
km
0 5 10
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
GMT 2002 Dec 13 16:11:36
TN152 jd339 05/12/02

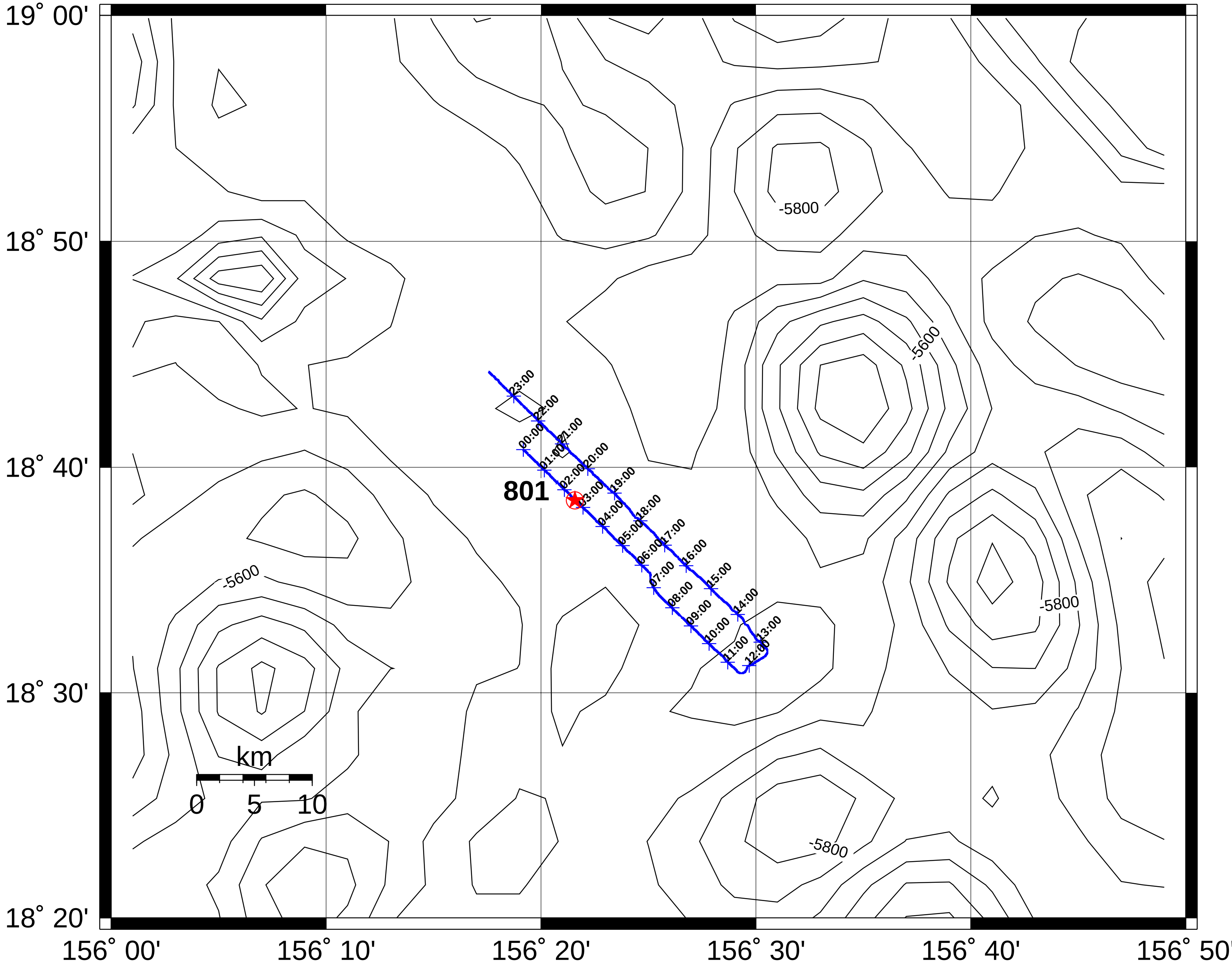
TTN152 Ship Track Jurassic Quiet Zone



TTN152 Ship Track Jurassic Quiet Zone

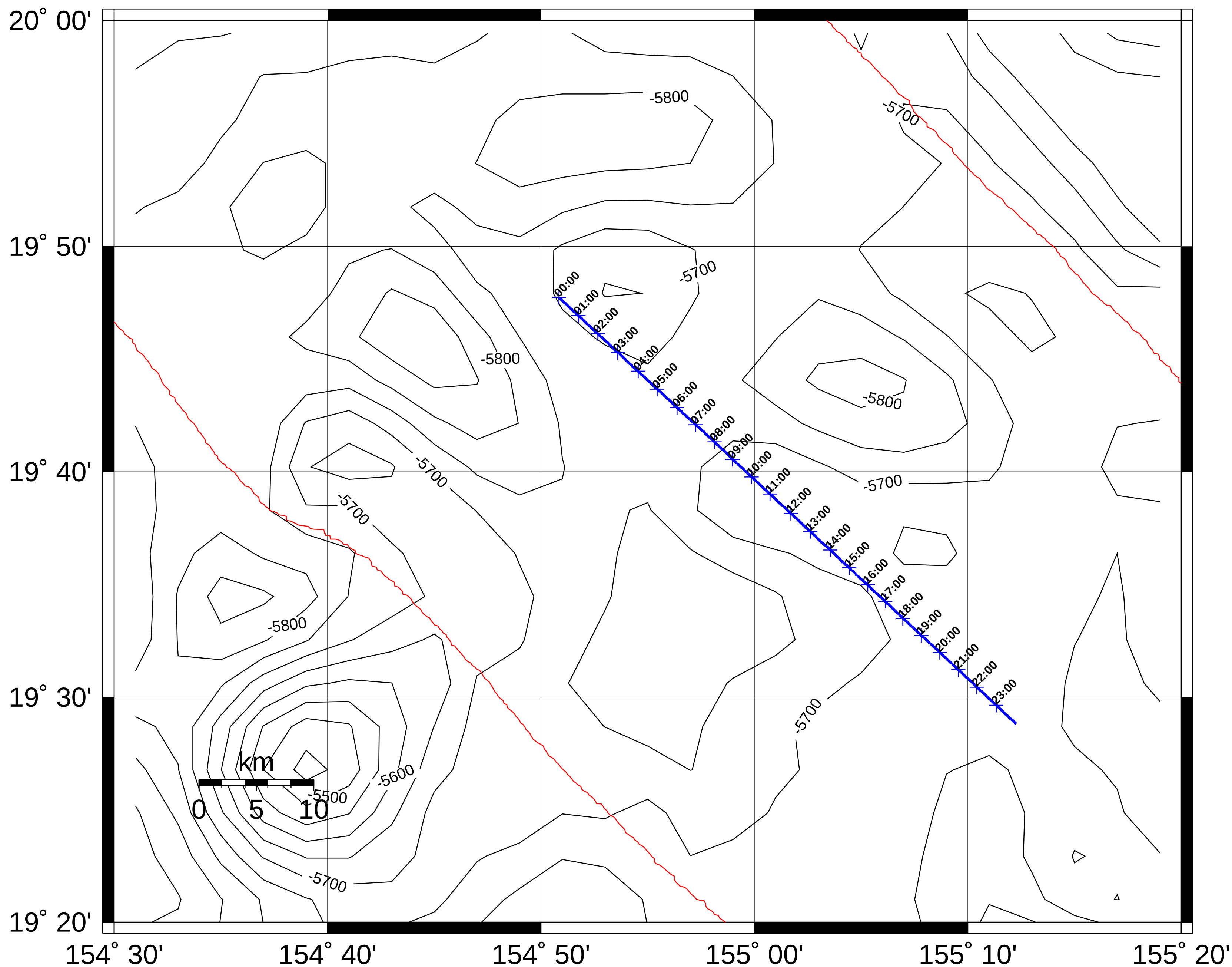


TTN152 Ship Track Jurassic Quiet Zone



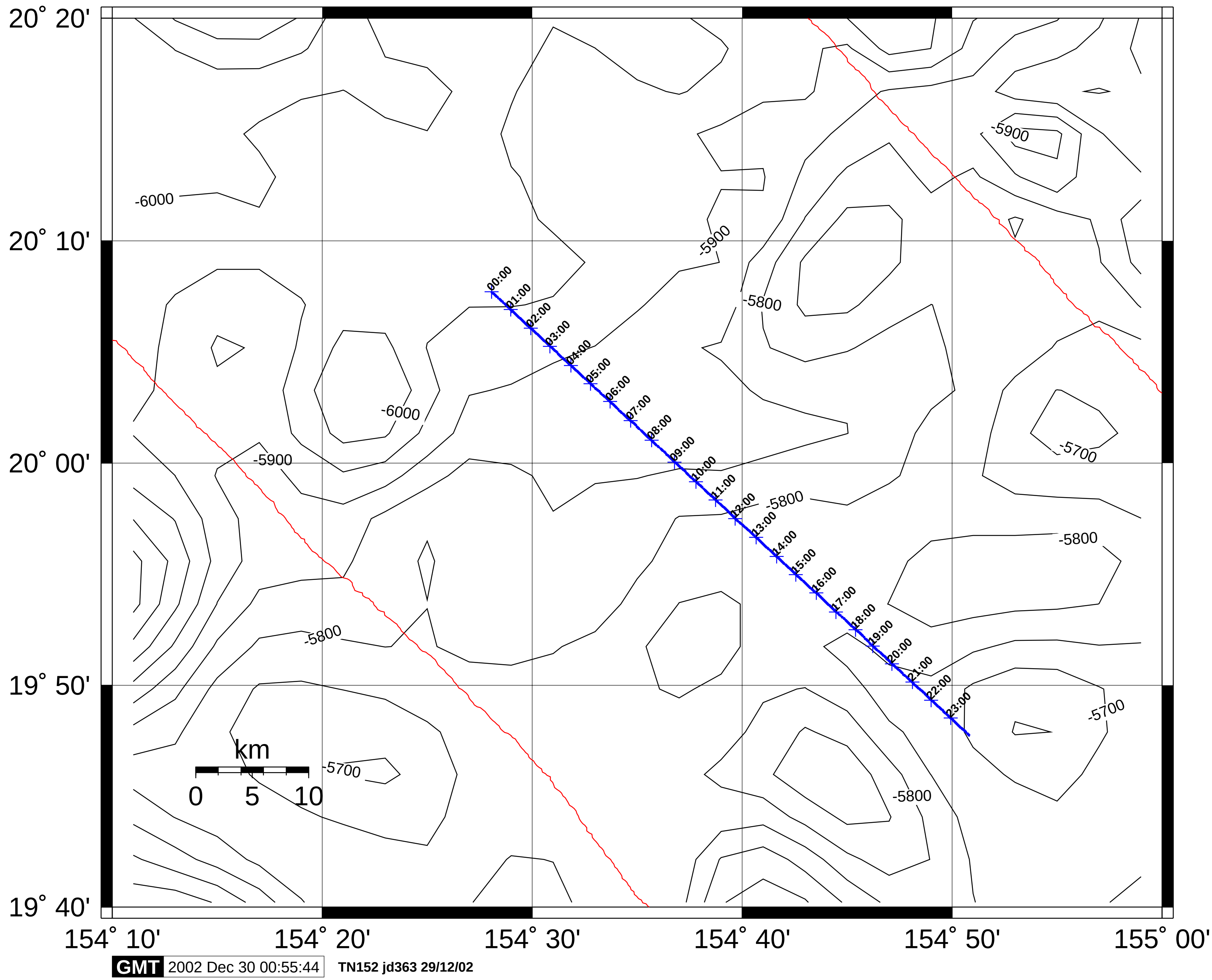
GMT 2002 Dec 17 13:29:23 TN152 jd350 16/12/02

TTN152 Ship Track Jurassic Quiet Zone

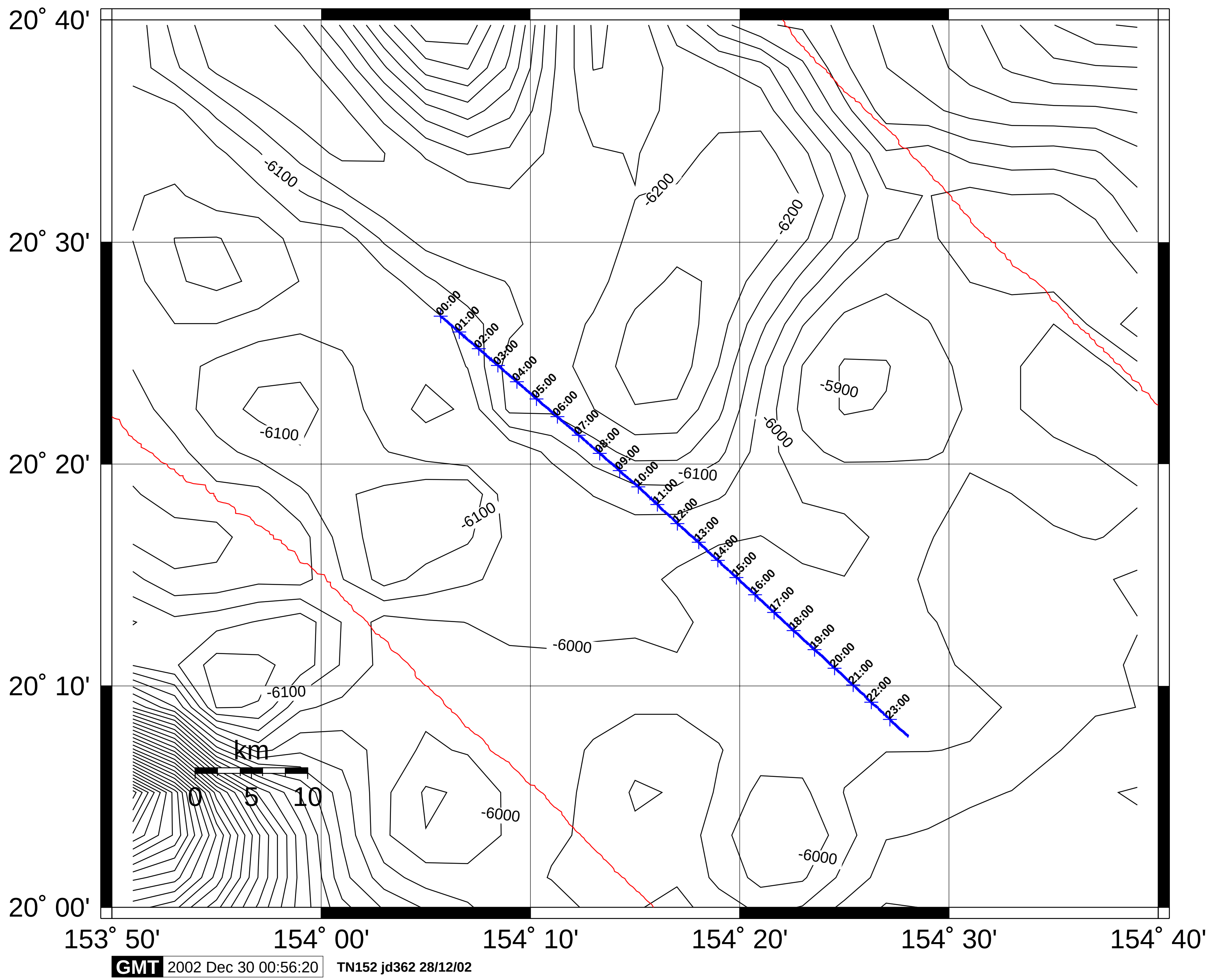


GMT 2003 Jan 3 13:33:30 **TN152 jd364 30/12/02**

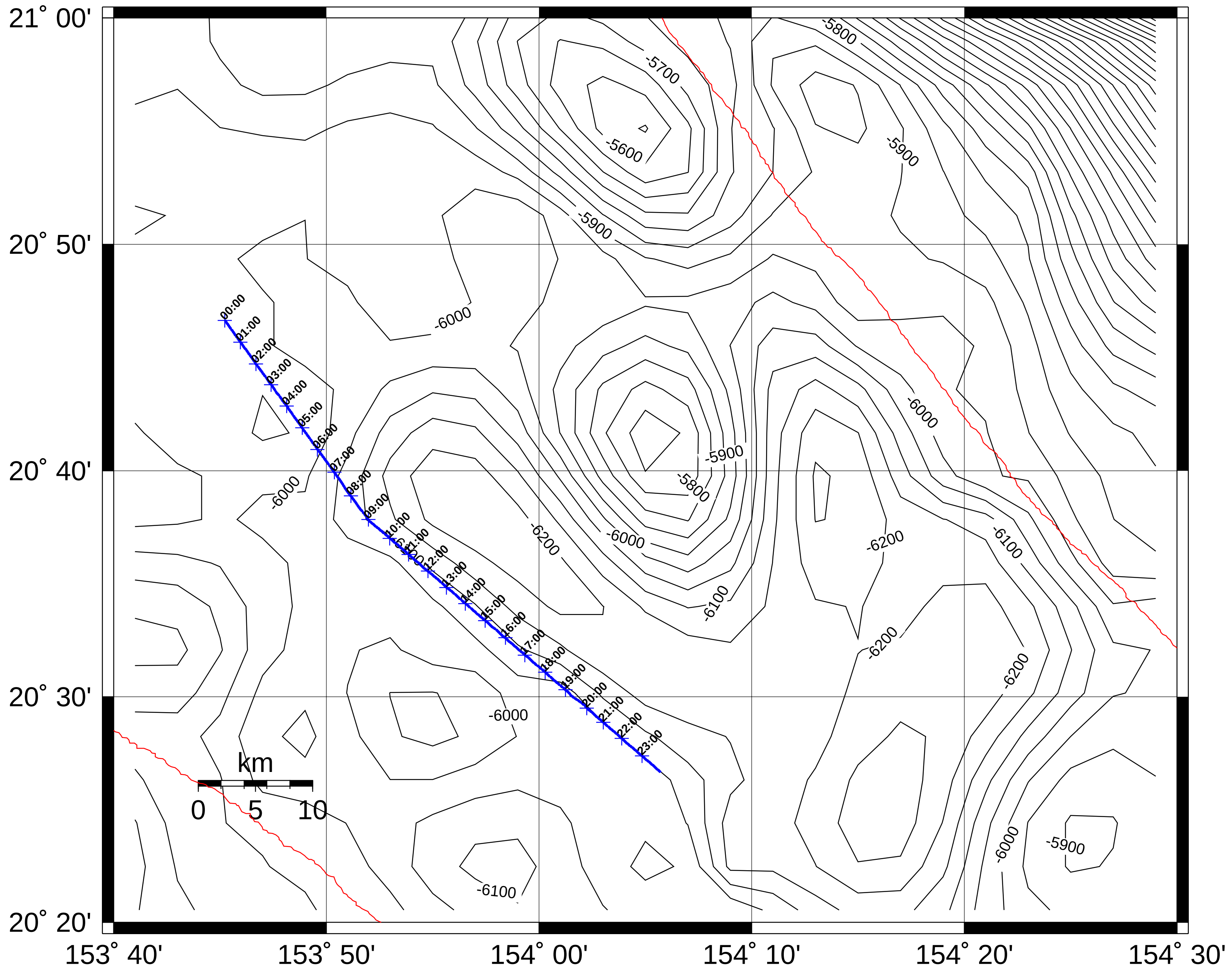
TTN152 Ship Track Jurassic Quiet Zone



TTN152 Ship Track Jurassic Quiet Zone

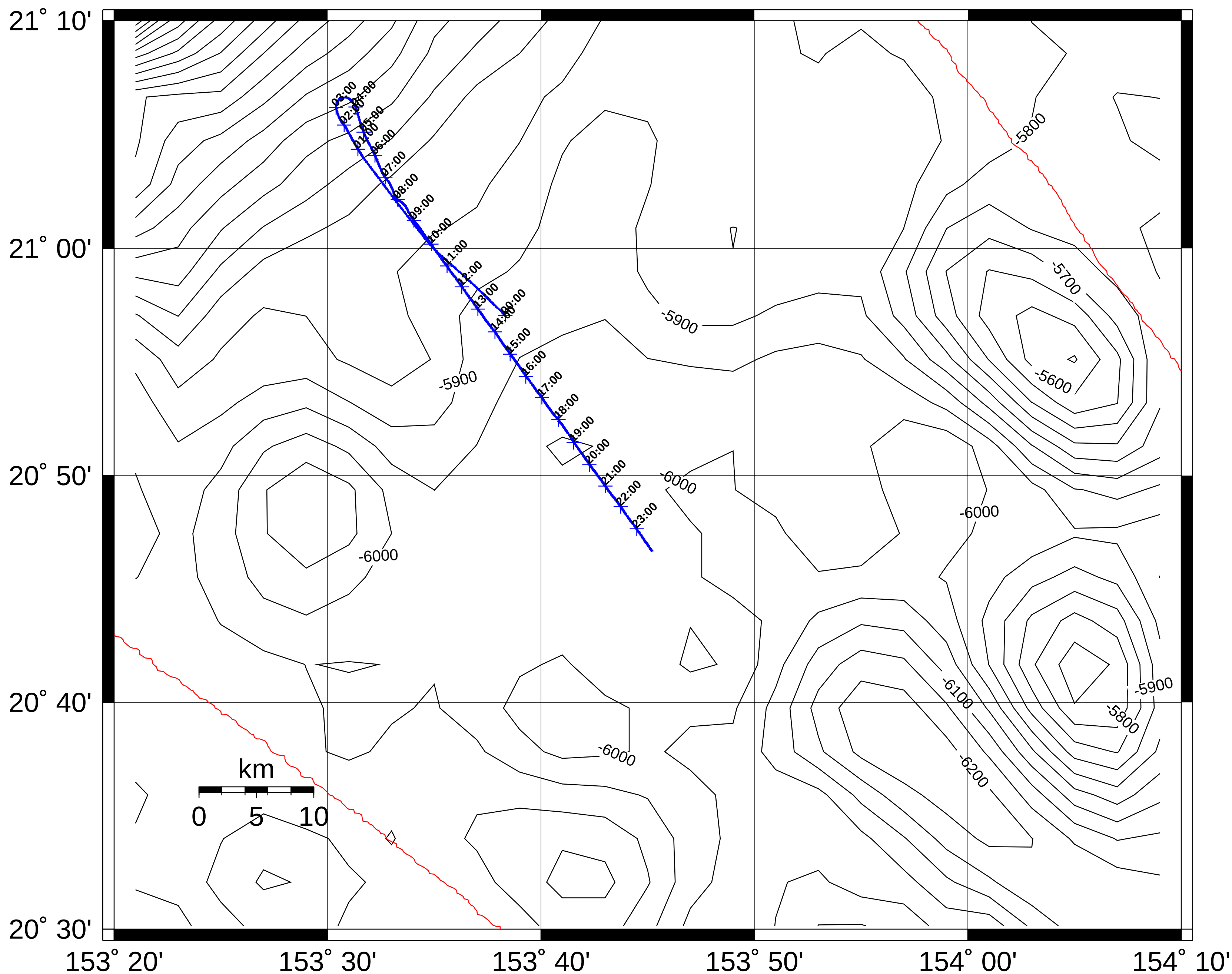


TTN152 Ship Track Jurassic Quiet Zone



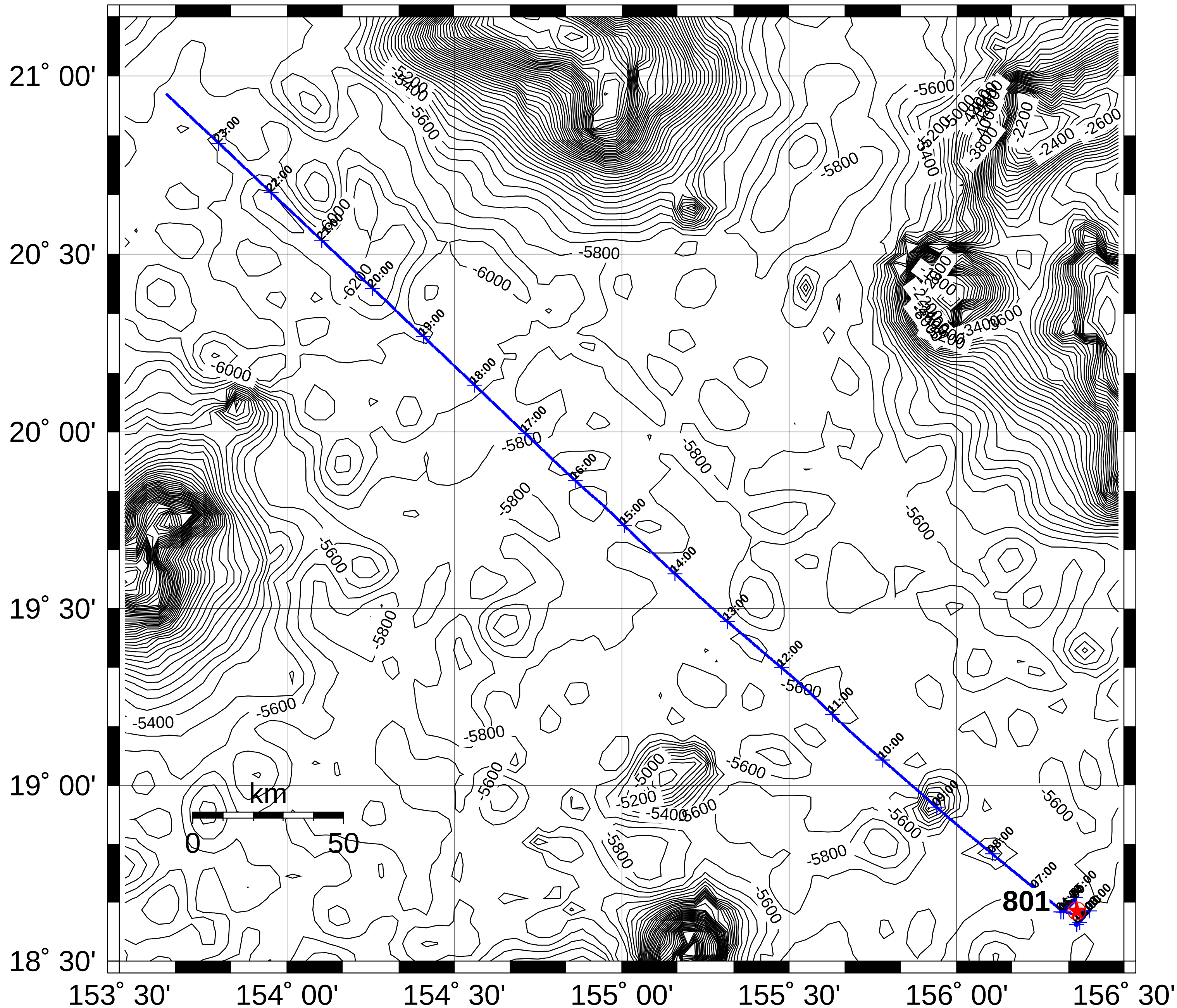
GMT 2002 Dec 30 00:56:58 TN152 jd361 27/12/02

TTN152 Ship Track Jurassic Quiet Zone



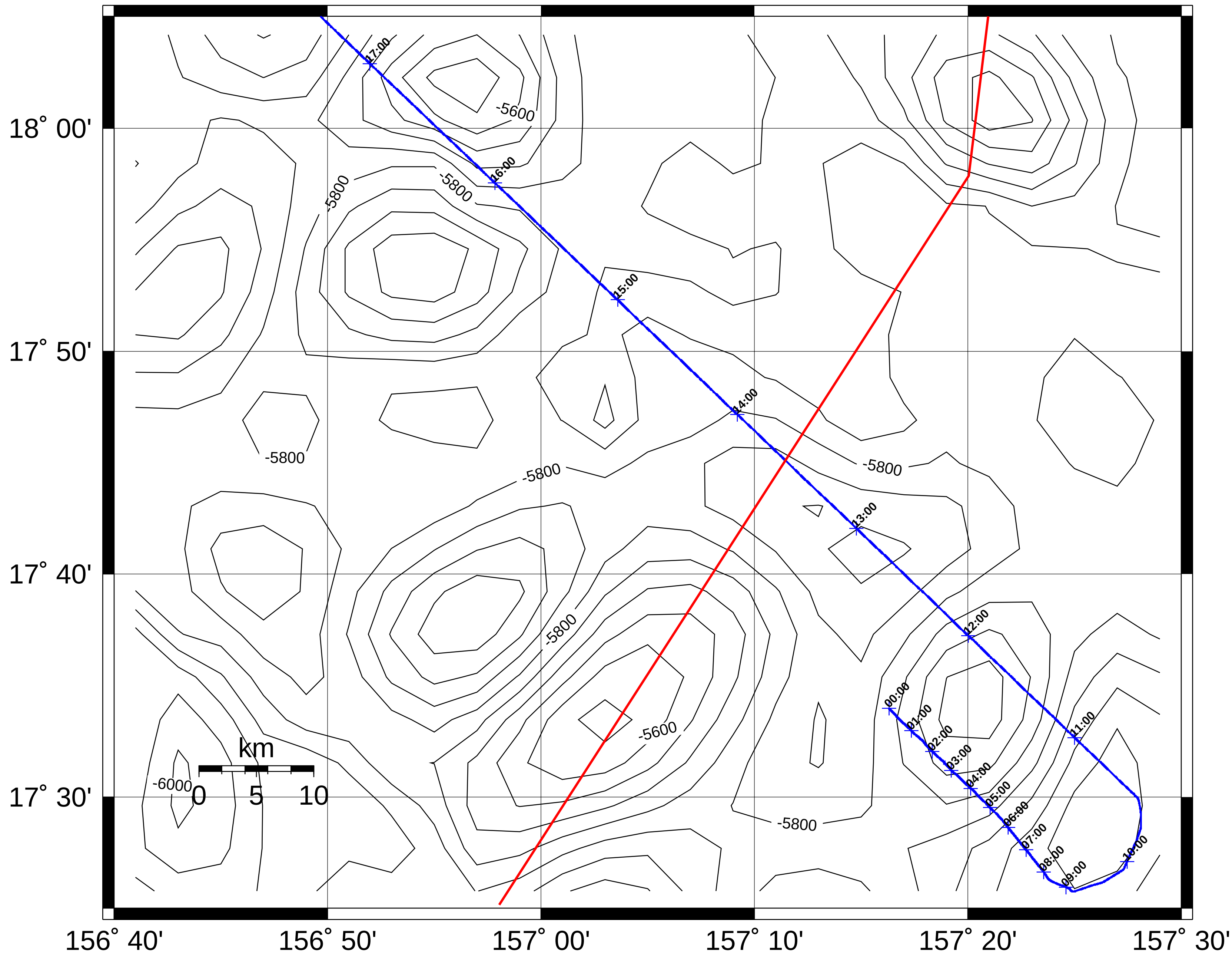
GMT 2002 Dec 30 00:57:49 **TN152 jd360 26/12/02**

TTN152 Ship Track Jurassic Quiet Zone



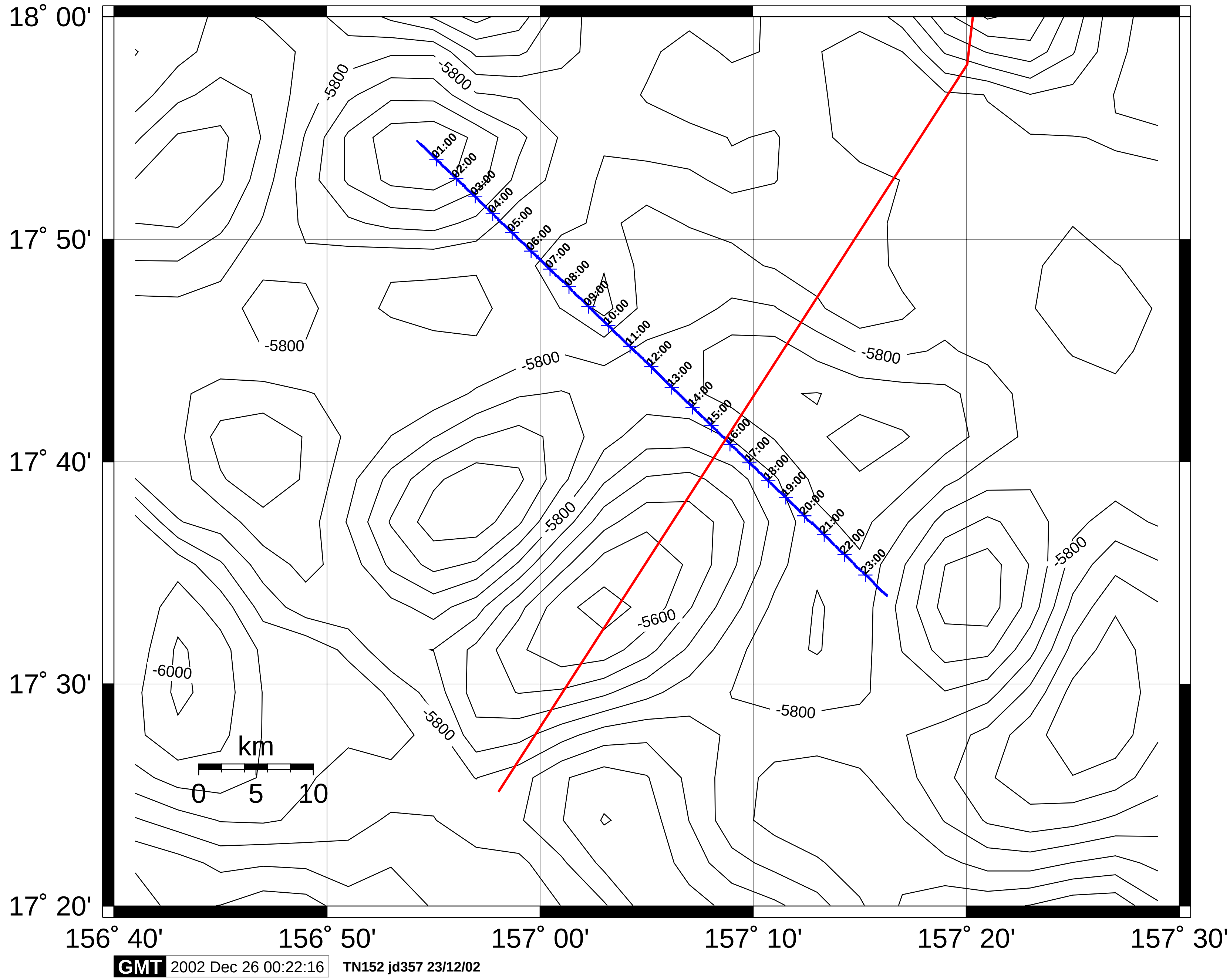
GMT 2002 Dec 26 00:33:53 **TN152 jd359 25/12/02**

TTN152 Ship Track Jurassic Quiet Zone

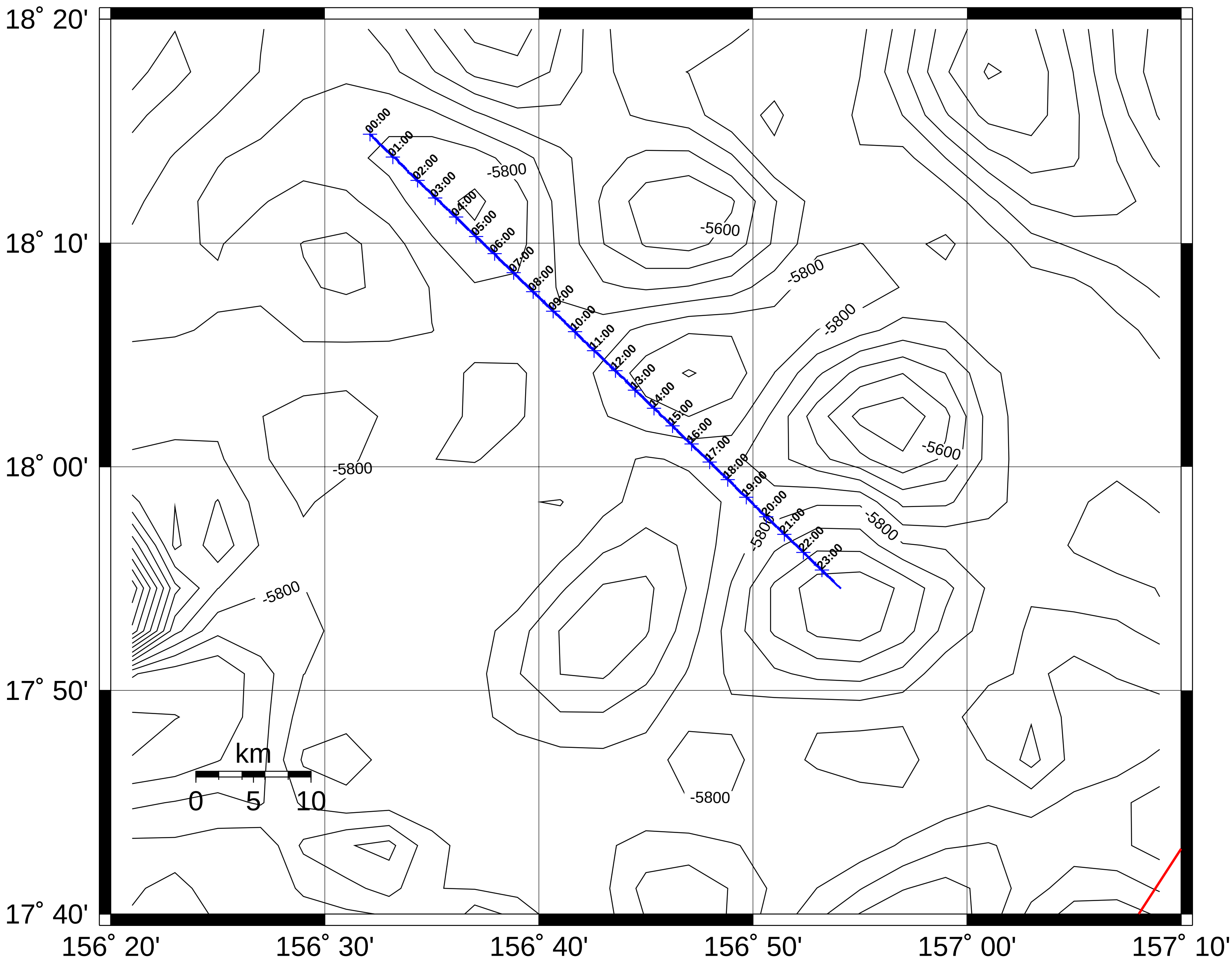


GMT 2002 Dec 26 00:24:15 **TN152 jd358 24/12/02**

TTN152 Ship Track Jurassic Quiet Zone

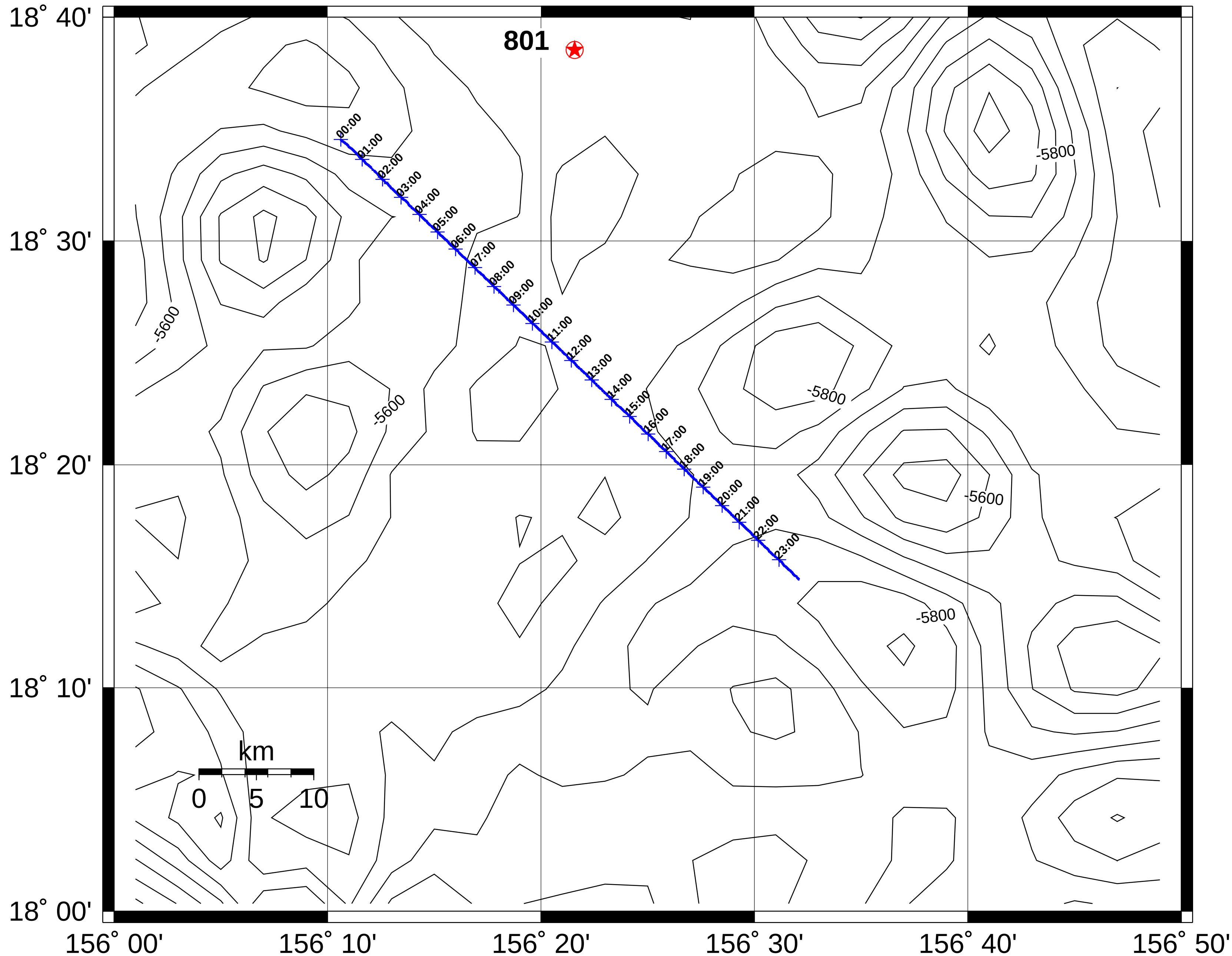


TTN152 Ship Track Jurassic Quiet Zone



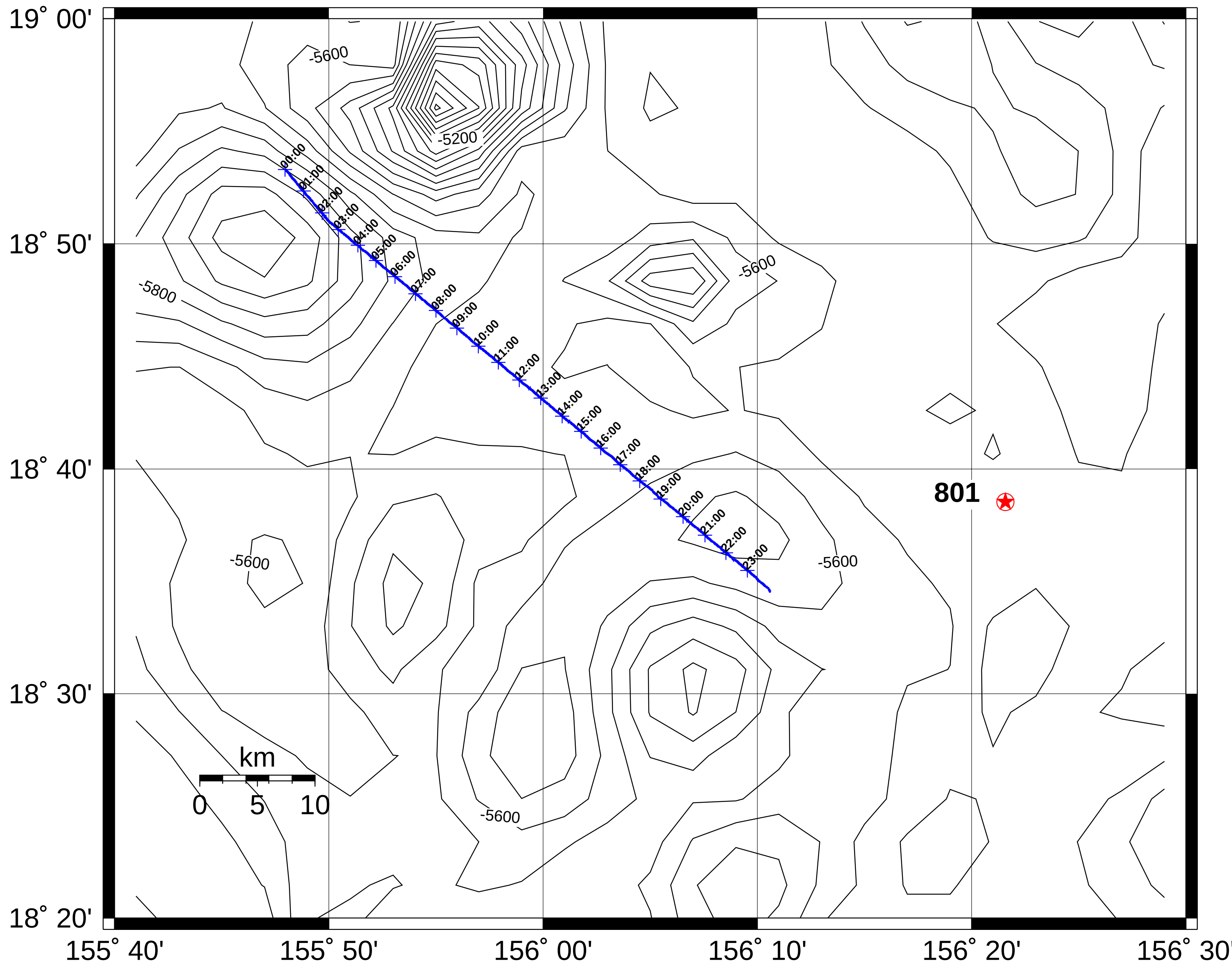
GMT 2002 Dec 26 00:20:41 **TN152 jd356 22/12/02**

TTN152 Ship Track Jurassic Quiet Zone



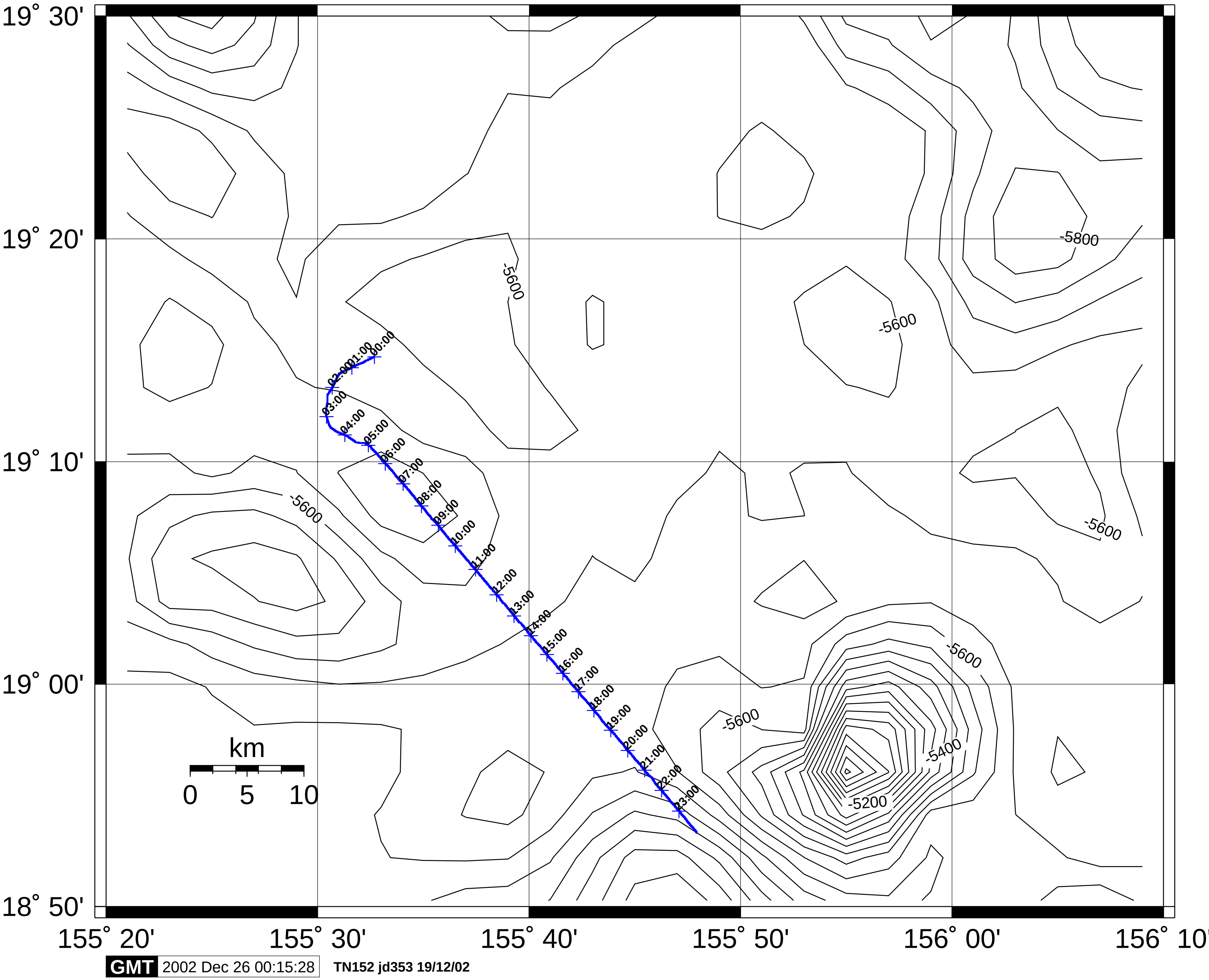
GMT 2002 Dec 26 00:19:03 TN152 jd355 21/12/02

TTN152 Ship Track Jurassic Quiet Zone

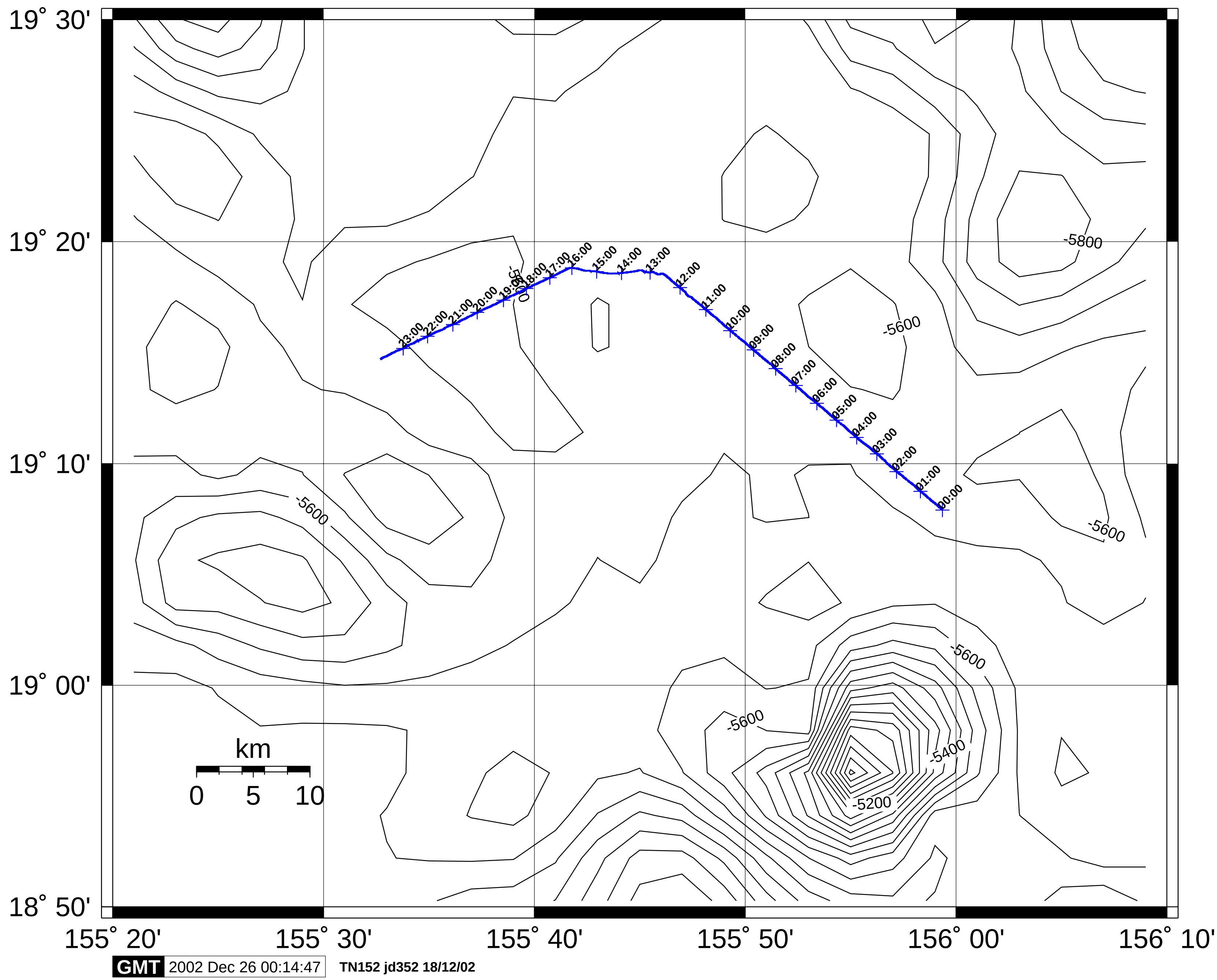


GMT 2002 Dec 26 00:17:28 TN152 jd354 20/12/02

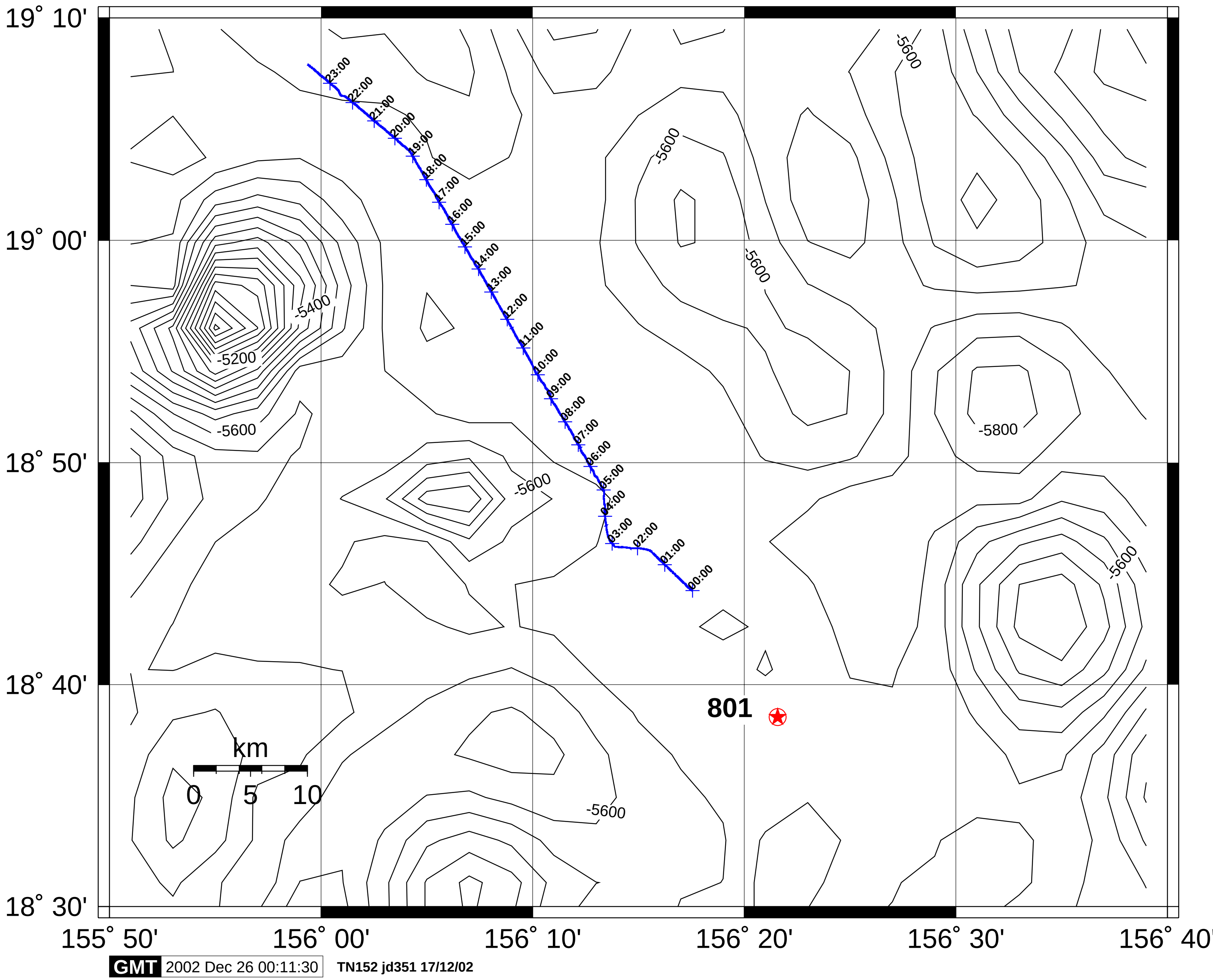
TTN152 Ship Track Jurassic Quiet Zone



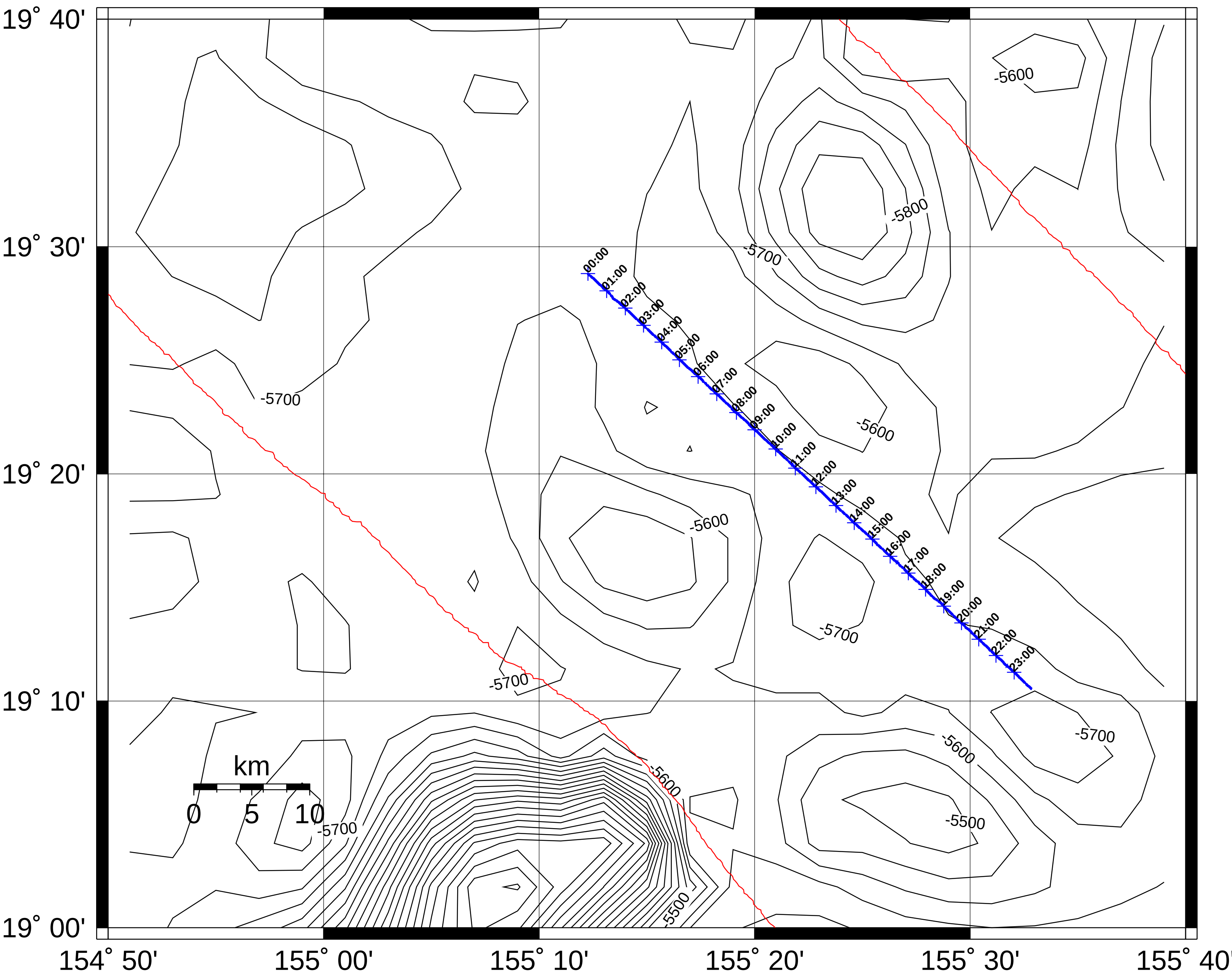
TTN152 Ship Track Jurassic Quiet Zone



TTN152 Ship Track Jurassic Quiet Zone

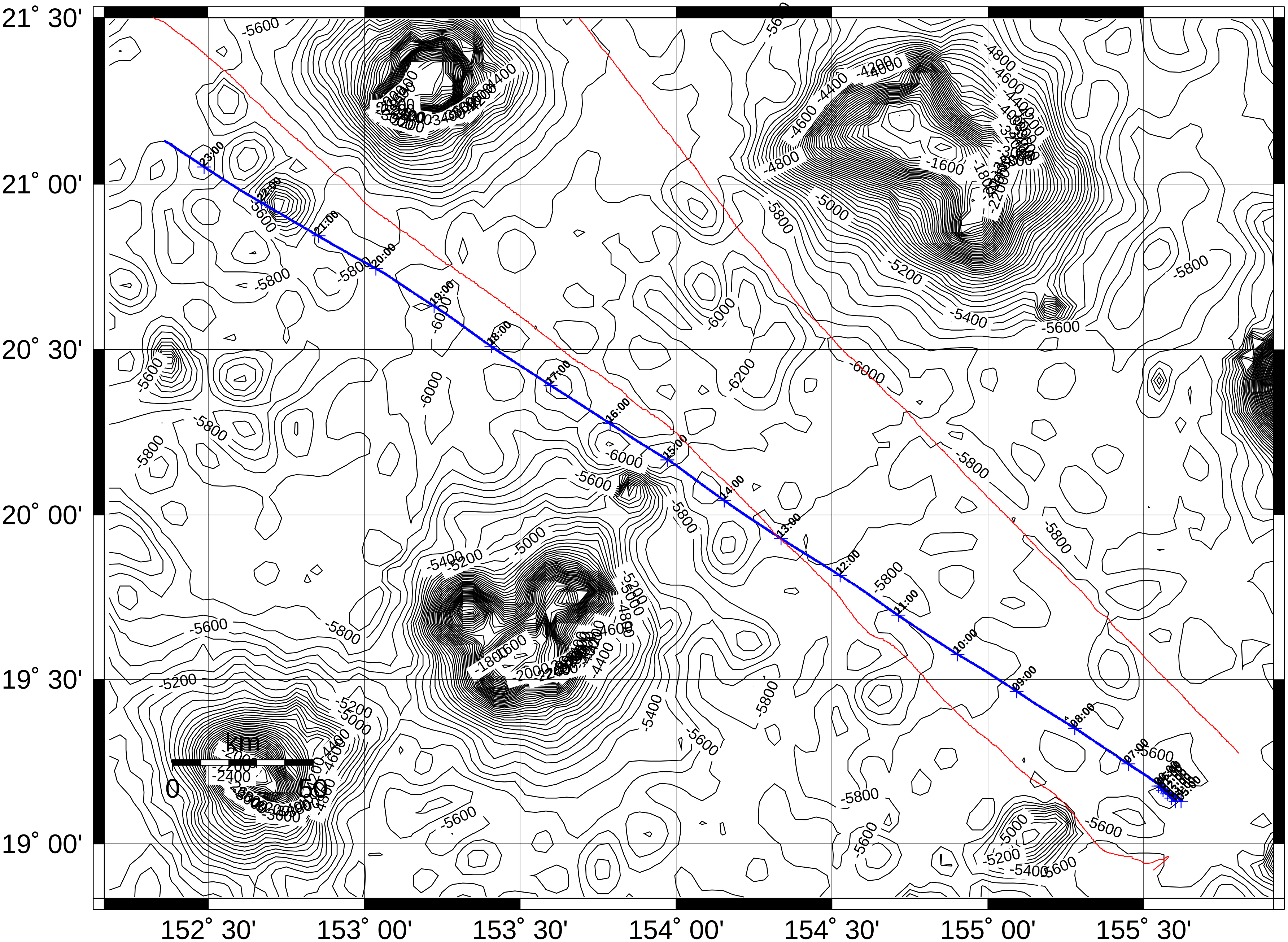


TTN152 Ship Track Jurassic Quiet Zone



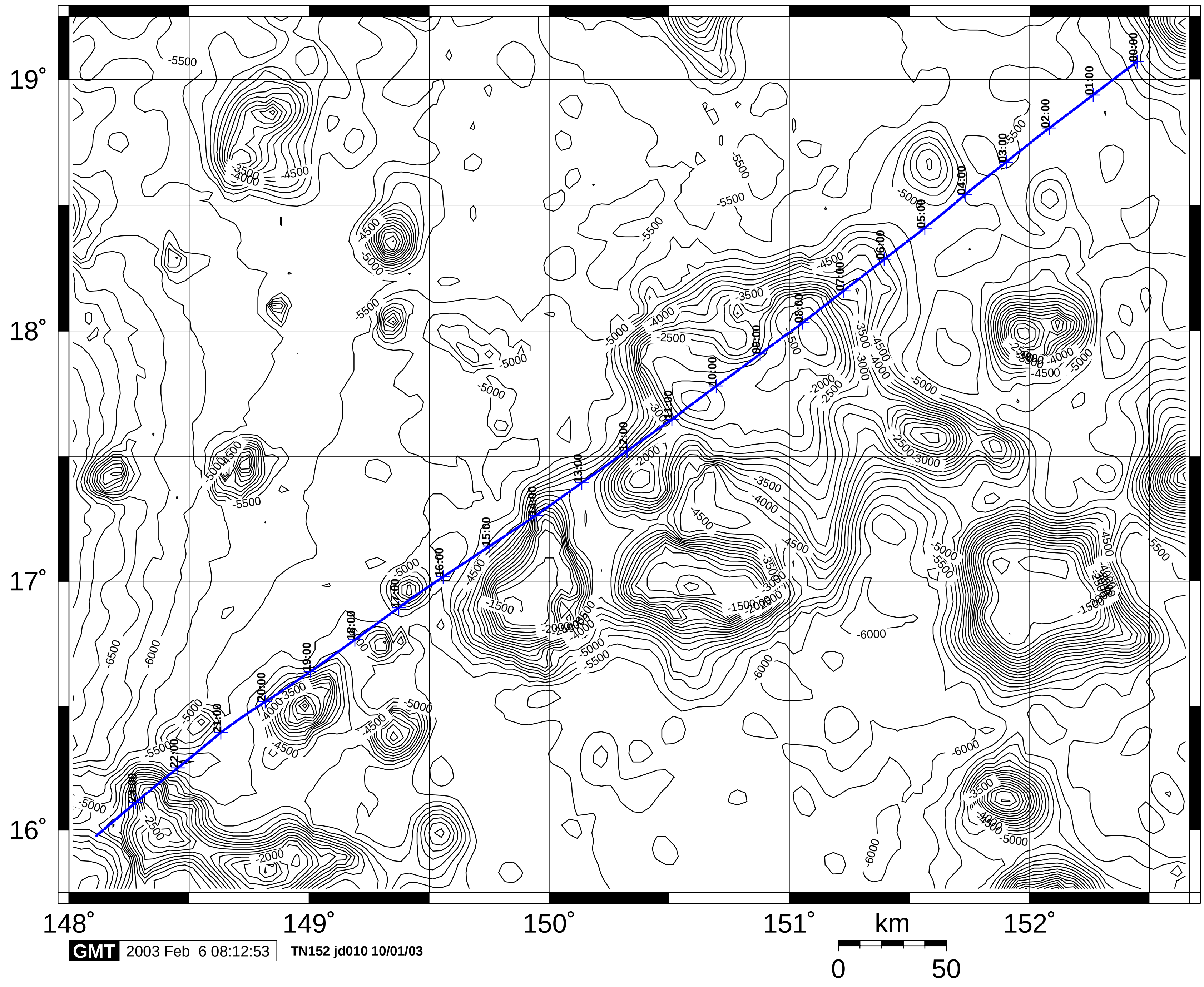
GMT 2002 Dec 31 13:37:37 **TN152 jd365 31/12/02**

TTN152 Ship Track Jurassic Quiet Zone

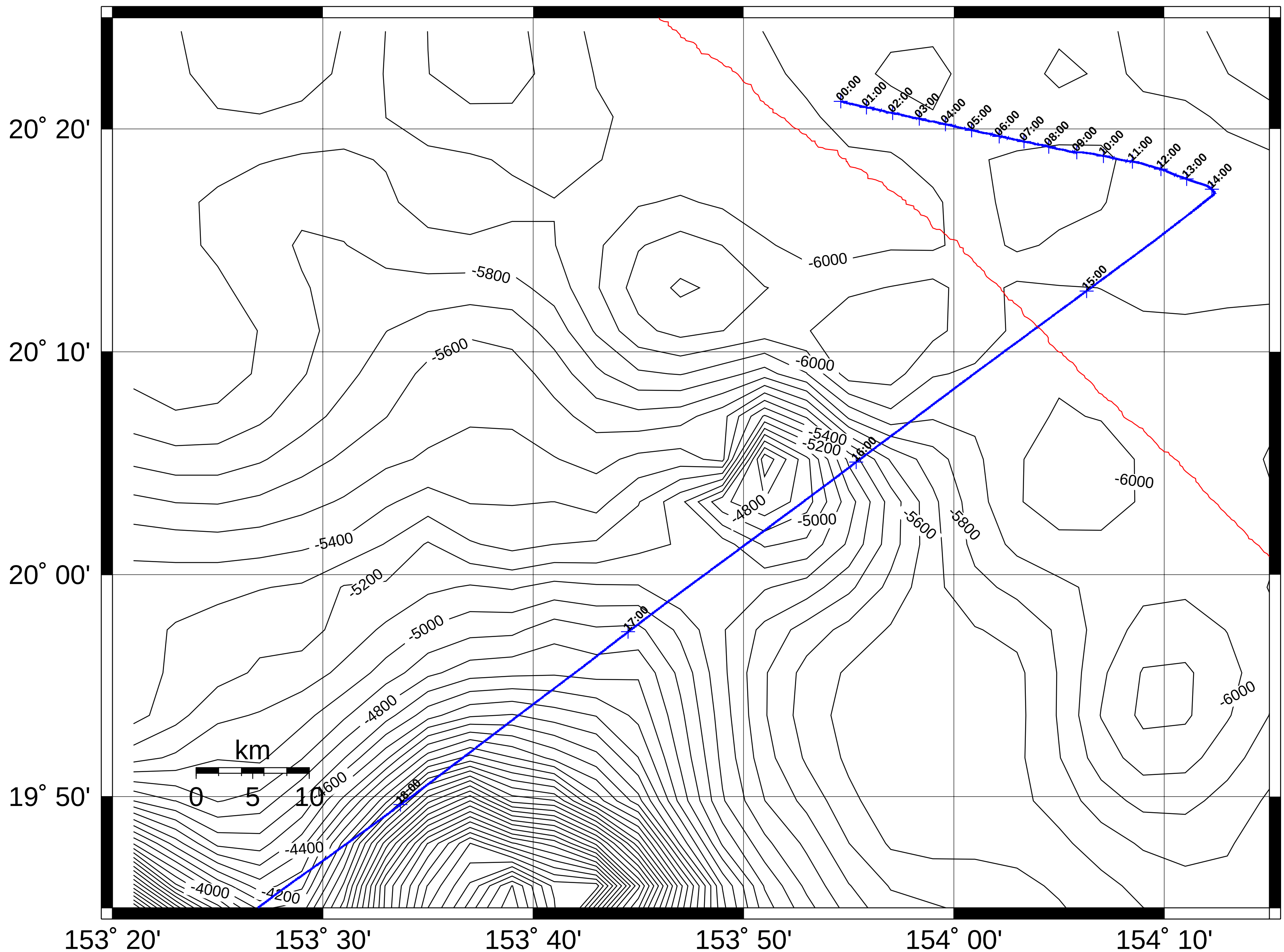


GMT 2003 Jan 3 13:40:48 **TN152 jd001 01/01/03**

TTN152 Ship Track Jurassic Quiet Zone

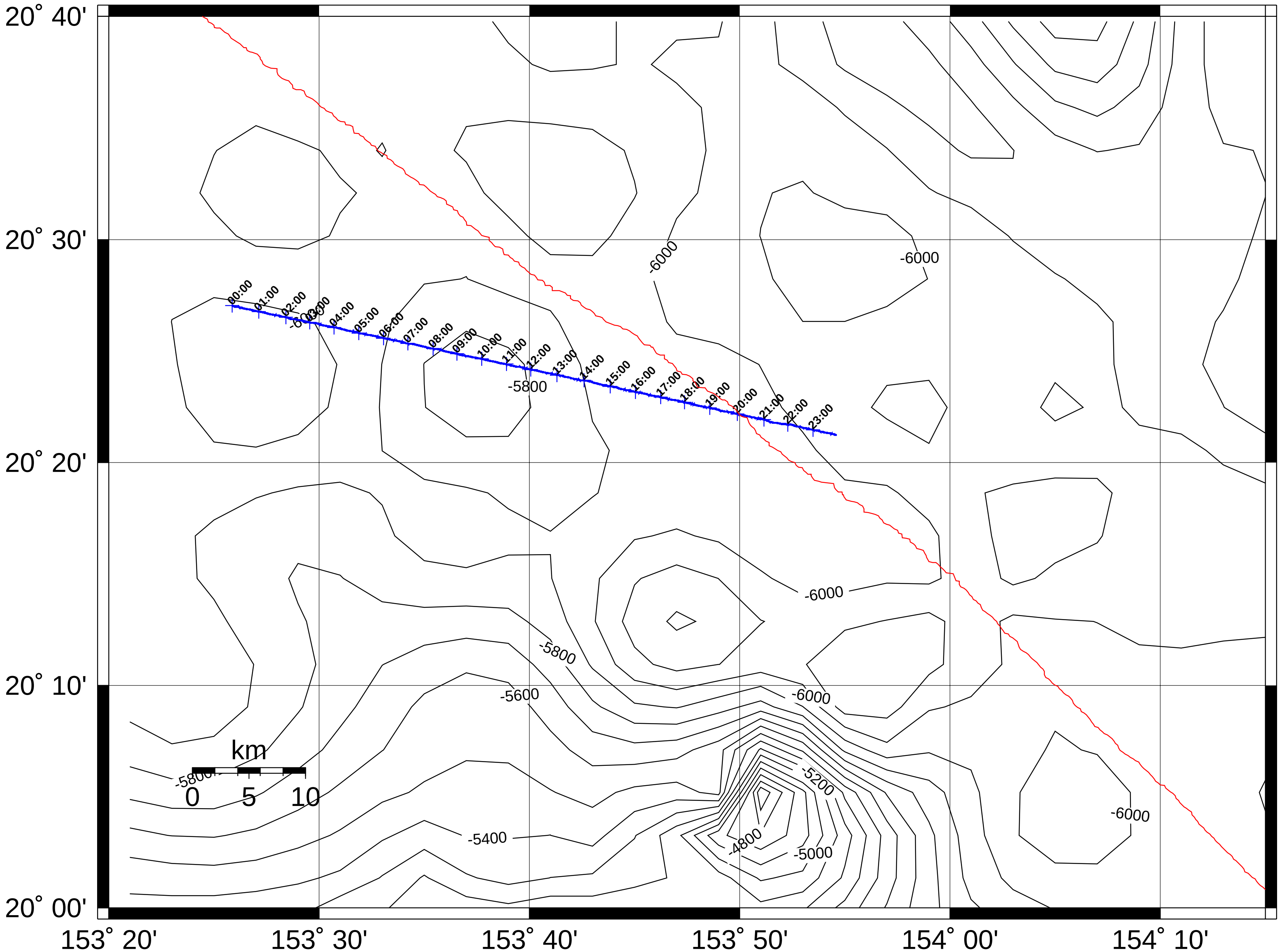


TTN152 Ship Track Jurassic Quiet Zone



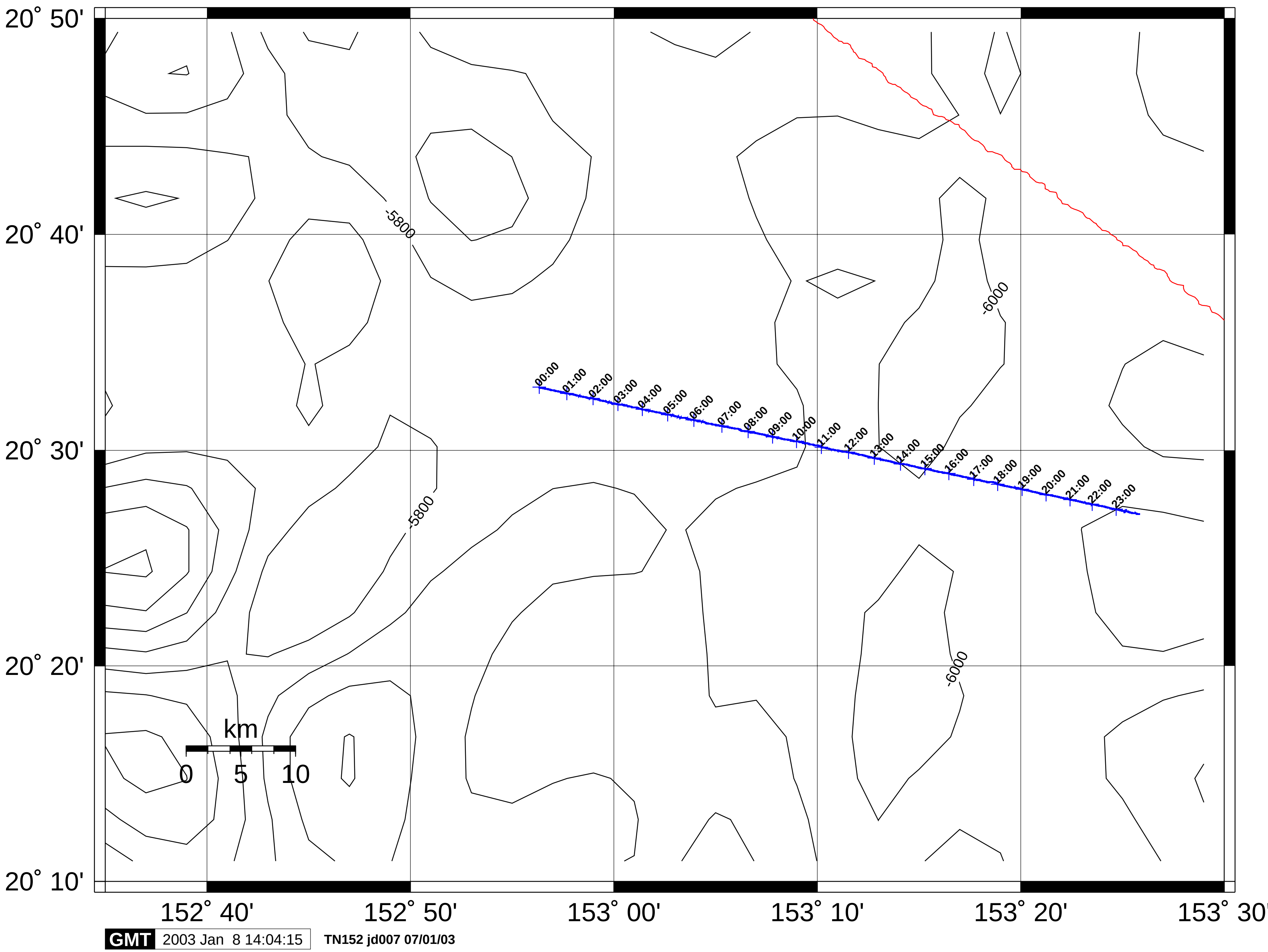
GMT 2003 Jan 10 00:43:36 **TN152 jd009**

TTN152 Ship Track Jurassic Quiet Zone

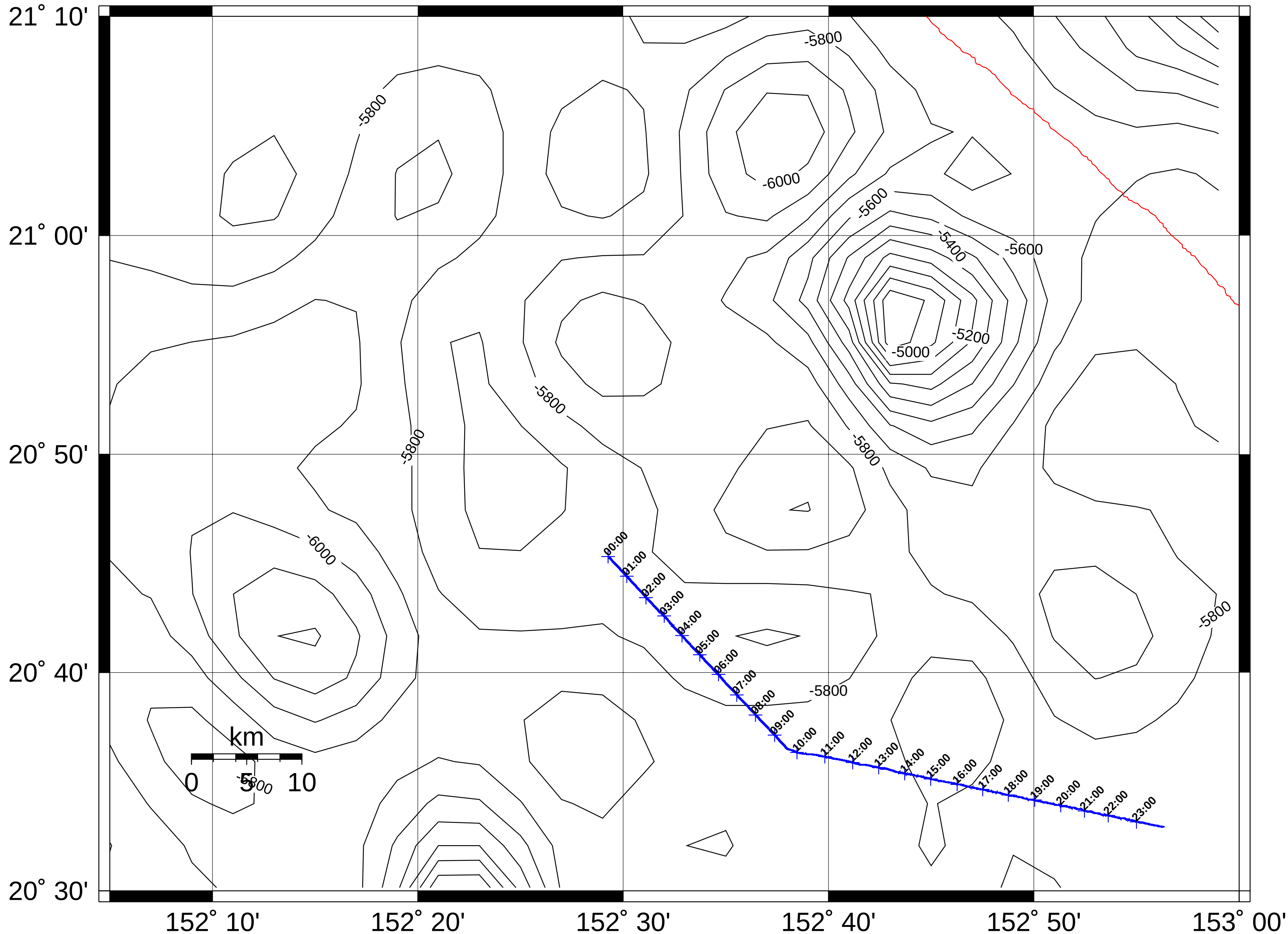


GMT 2003 Jan 8 14:06:44 **TN152 jd008 08/01/03**

TTN152 Ship Track Jurassic Quiet Zone

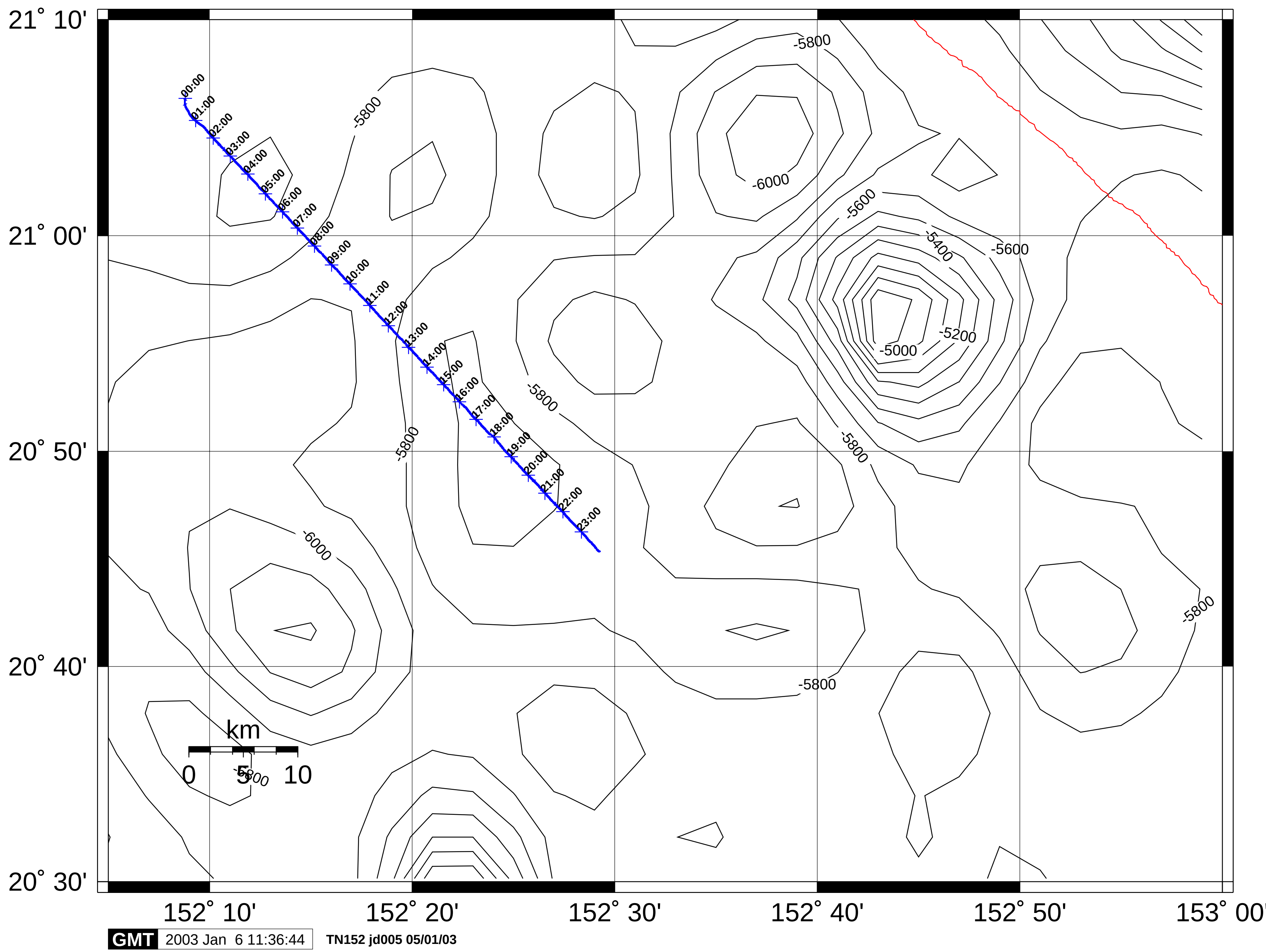


TTN152 Ship Track Jurassic Quiet Zone

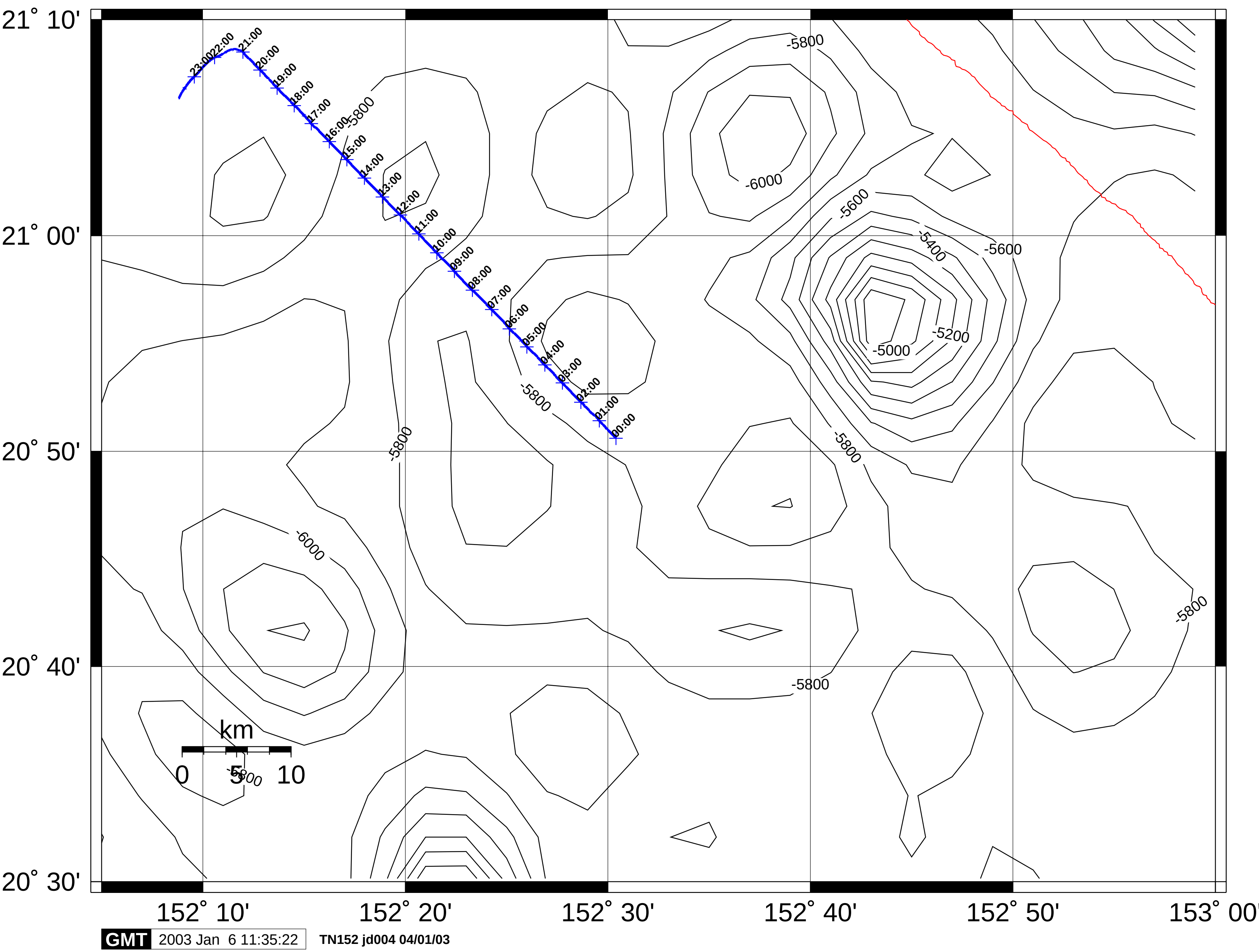


GMT 2003 Jan 8 14:02:07 **TN152 jd006 06/01/03**

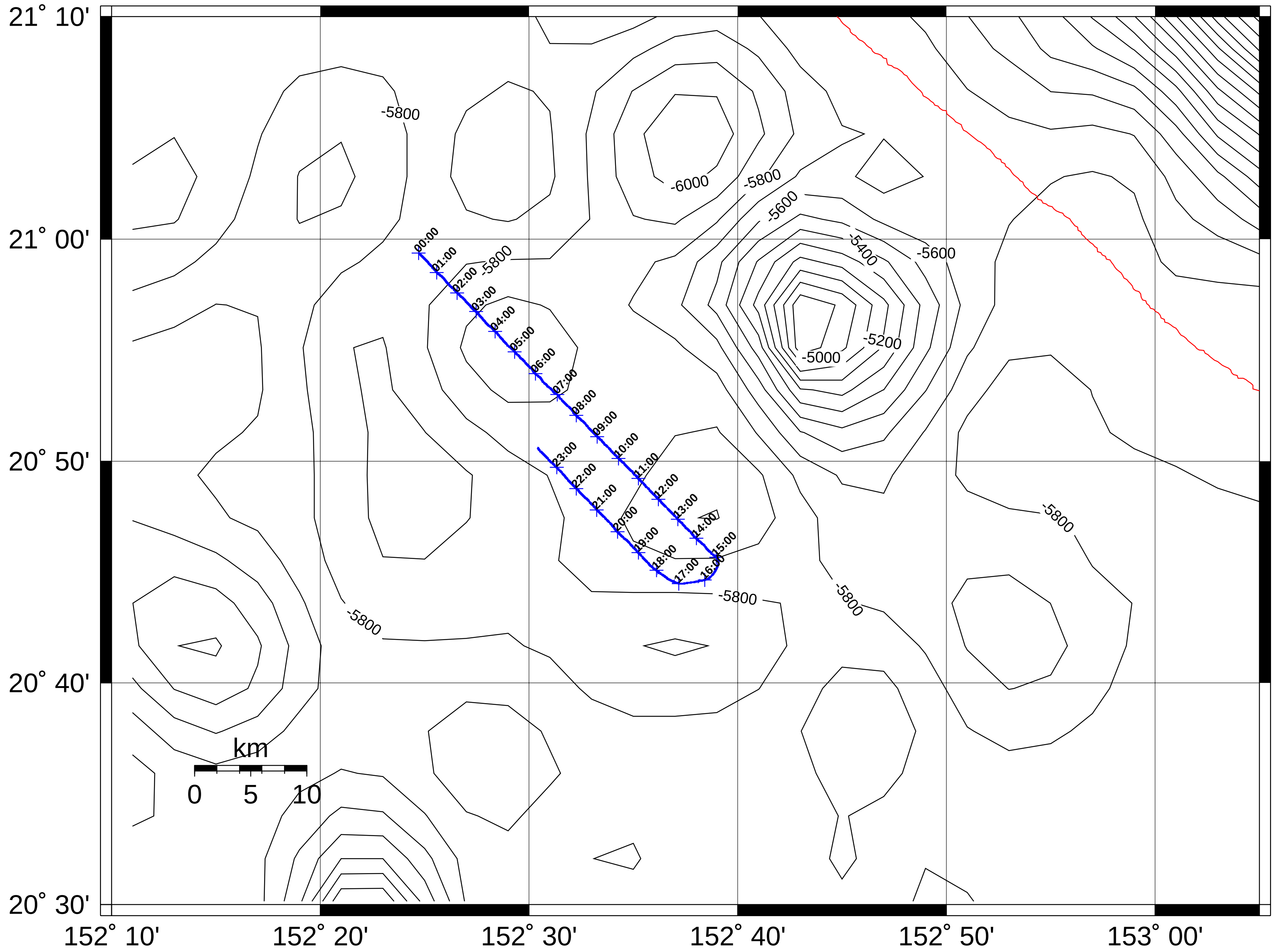
TTN152 Ship Track Jurassic Quiet Zone



TTN152 Ship Track Jurassic Quiet Zone

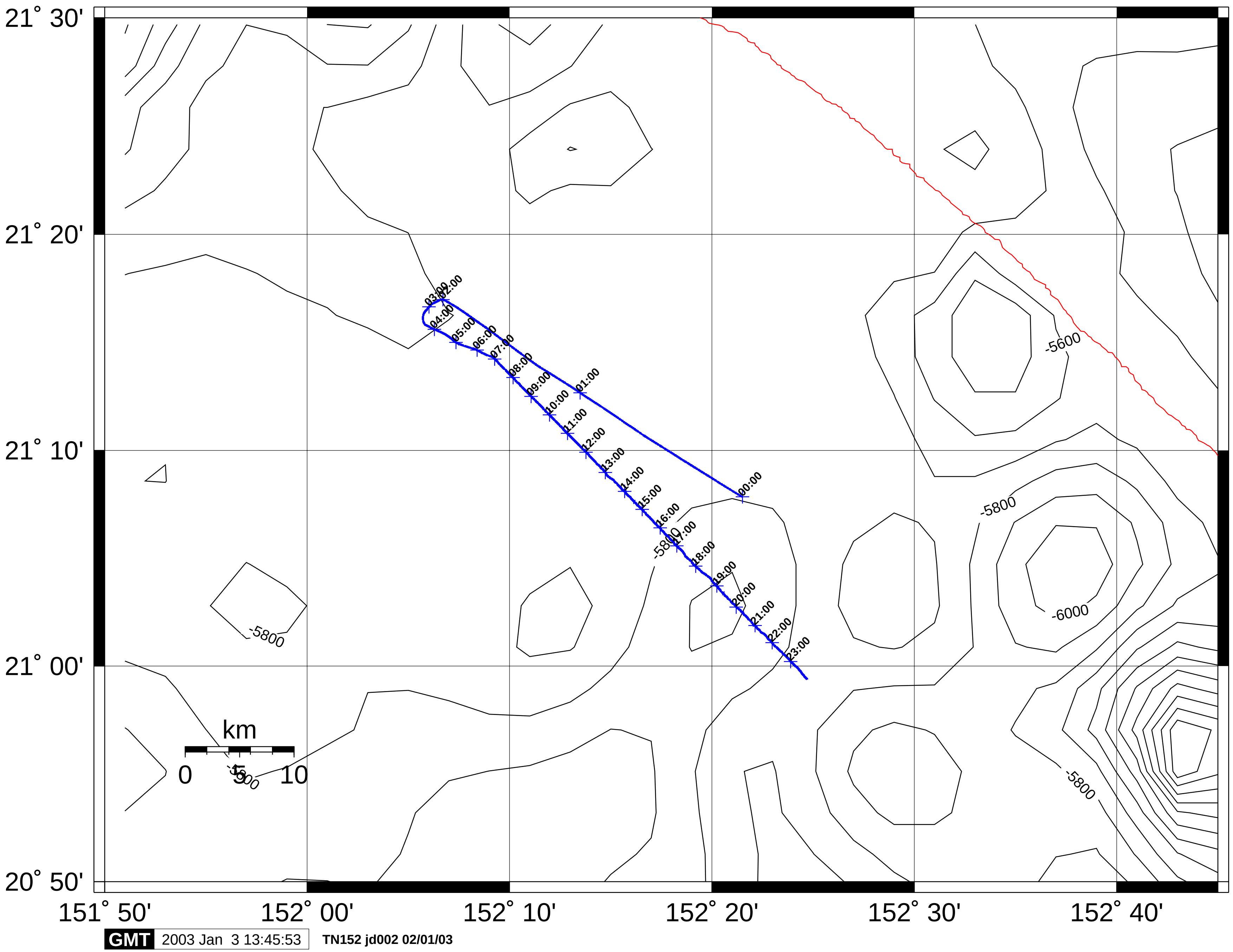


TTN152 Ship Track Jurassic Quiet Zone



GMT 2003 Jan 3 14:28:20 **TN152 jd003 03/01/03**

TTN152 Ship Track Jurassic Quiet Zone



TTN152 Ship Track Jurassic Quiet Zone