200503, MORC Experiment: Archived Data Description

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The MORC (Mantle OR Crust) survey was conducted as part of as as part of a long term study crustal and mantle structure of central North Island, New Zealand. MORC was designed to investigate upper mantle processes at the Taupo Volcanic Zone (TVZ), a 2 Ma back-arc characterised by high heat flow, arc related andesite volcanism and frequent caldera-forming rhyolite eruptions. The experiment is an extension of the earlier NIGHT survey, which also utilised instruments from IRIS/PASSCAL (200103,200133,200403).

Survey Design and Geometry

The MORC survey was designed to build upon and augment the results NIGHT by providing high resolution active source data across the central TVZ. The survey was conducted on days 97-99 of 2005.

Line 1

MORC Line 1 was a 120km long profile that crossed the TVZ immediately north of Lake Taupo. The transect comprised 700 receivers, 9 large shots and was instrumented with a mixture of PASSCAL Texans , 3-component short period seismometers and two 48 channel exploration seismographs. Shots are numbered 1–10, however shot no. 5 was not completed as the land-owner rescinded permission at a late stage.

Shot Number	*Description*	*Shot size*
1, 2, 10	2 x 50m deep cased holes, 50m apart. Location in trace headers is midpoint between shot holes.	2 x ~ 600 kg
3–4, 6–9	40m deep cased hole	~450 kg
5	Abandoned	

Line 2

Morc Line 2 was a short 40 instrument, SW-NE orientated array placed approximately 110 km north of Line1 at the Bay of Plenty Coast. The original NIGHT survey included a > 100km long SW-NE transect (fig. 1), however the shot from the SW end was not recorded correctly due to

technical difficulties. It was hoped that a small array would be sufficient to to provide reversed refraction data for arrivals from deeper interfaces, thereby "completing" the SW-NE NIGHT line.

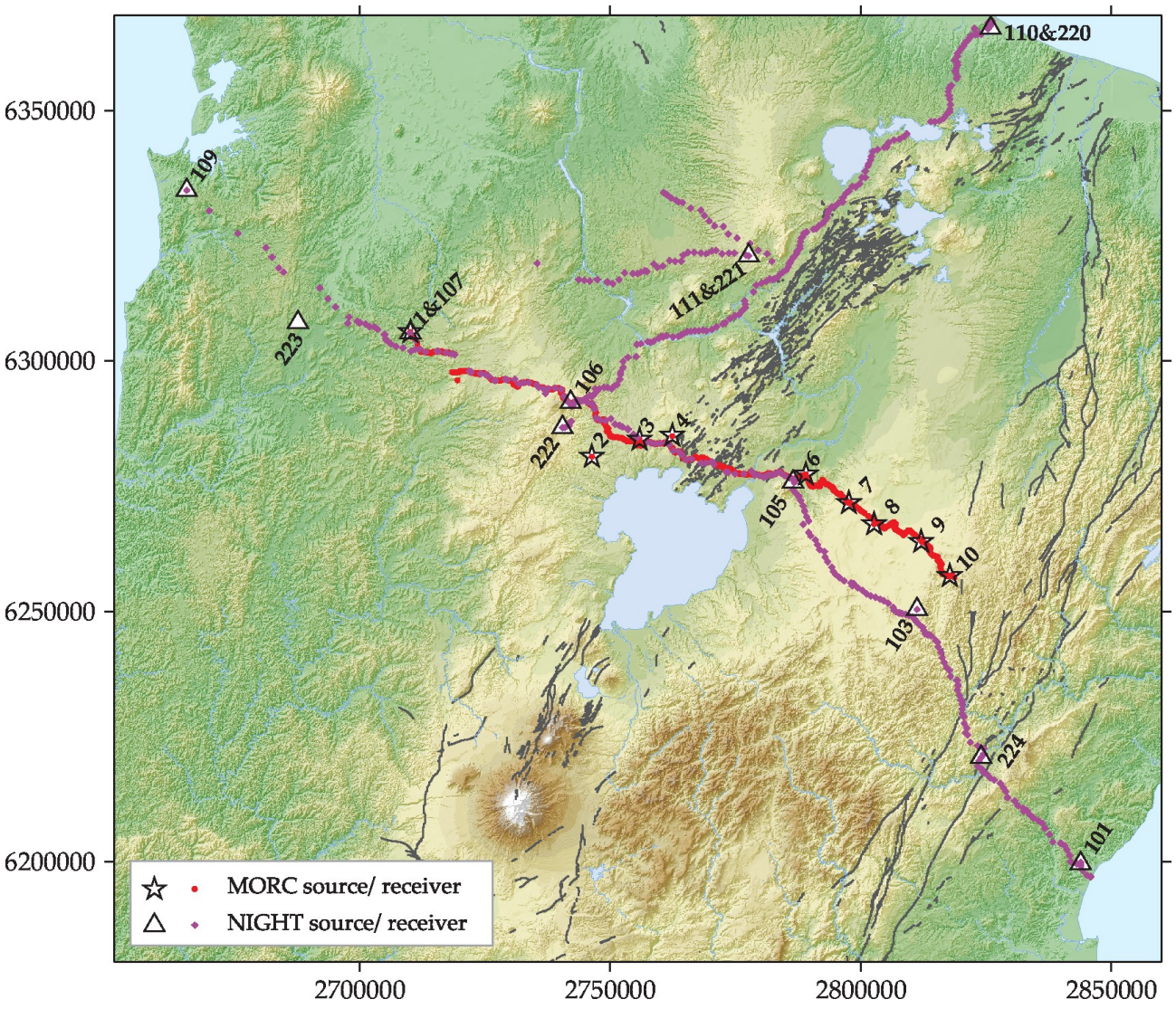

Figure 1 Central North Island show location of the MORC and NIGHT seismic profiles.

MORC Data

The MORC data are provided as two SEG-Y files, one for each MORC line. The data are unfiltered and ungained; a de-bias filter is required before the data are usable. All relevant time corrections have been applied. The data format is in standard SEG-Y: big endian, IBM floating point and EBCIDIC reel headers. Data parameters and customised trace header fields are described below as well as in the 3200 byte textual header field.

Gathers

The data form various acquisition systems have been have been combined to form common shot gathers. Traces are sorted according to a common receiver point (CRP) number determined from a given receivers position along the survey line. The CRP serves as a unique receiver point identifier and as position (in m) along an idealised 2-D MORC transect (calculation details below). Sorting by CRP ensures that the trace order is constant between gathers. Note that only one of the multi-channel systems was deployed for shots 3 & 4 (day 99) so the number traces per gather is not constant.

Data Window

All shots were fired using a GPS trigger at or 30 minutes past a UTC hour mark. The actual data-window recorded in the field varied according to the capabilities of the various seismograph systems used. The provided data have been converted to a common data-window (-9000ms – 78995 ms, shot instant at 0 ms) and sampling rate of 200 Hz.

Instrument	***Original Start*** (ms)*	***Original End*** (ms)*	***Original Samp. Rate*** (Hz)	***Modifications required***
Texan	-9000	78995	200	unchanged
3 component	continuous		100	cut to window; up-sampled to 200 Hz
Multi-channel	0 (GPS triggered)	Variable	500	Zero-padded at front and tail; down-sampled to 200Hz

* assuming shot instant = 0ms

Trace Polarity

The various digitising systems recorded data with inconsistent polarities on the vertical channel. All traces have been converted to a 'left-hand rule' polarity where upward, northward and eastward ground motions produce a +ve voltage. Note that for the vertical/Z component, this is the opposite of data recorded on PASSCAL Texans and 3-component systems. It is consistent with data recorded on conventional multi-channel active-source seismographs, including the Geometrics system provided by PASSCAL.

Trace Header Fields

The trace headers follow the SEG-Y standard as closely as possible with some modifications to allow for the inclusion of important data. Customised trace headers are described below.

Bytes	***Name***	***Description***
9-12	Source number	Shot number
13-16	Trace number	Trace position within a given shot gather
21-24	Common Receiver Point	Unique receiver position identifier Effectively a 2-D profile pseudo-position (m) along the MORC line The profile has azimuth=117, with Source 1 postion set to 10,000m
25-28	Profile Source Point	Pseudo position of the source point as per CRP above. Included for completeness.
29-30	Trace Type	1 = data; 2 = dead
35-36	Instrument/Sensor Type	1 = PASSCAL Texan 2 = 4 Hz geophone on Geometrics 48 channel seismograph 3 = 10 Hz geophone on Geometrics 48 channel seismograph 31–33 = 3comp seismometer, Z, N, & E channels
37-40	Offset	Source-receiver separation (m)
41-44	Receiver elevation	All elevations are relative to the NZGD49 height datum (m). The NZGD49 datum is derived from levelling surveys tied to coastal tide gauges Heights are geoidal / msl.
45-48	Source elevation	
71 – 72	Coord Scale	-10, ie divide coordinate values by 10 to obtain arc-seconds
73 – 76	Source X	Longitude in 1/10th of arcsec
77 – 80	Source Y	Latitude in 1/10th of arcsec
81 – 84	Receiver X	Longitude in 1/10th of arcsec
85 – 88	Receiver Y	Latitude in 1/10th of arcsec
175-176	Texan No	The serial number of PASSCAL Texan or zero