
Part 5: Regional overview, Mount Read Volcanics

Introduction

The Mount Read Volcanics survey area covers much of the extent of the Cambrian Mount Read Volcanics, as well as the Zeehan mineral field and the margins of the Heemskirk Granite. The survey covers a number of major operating or former mines, including Renison, Rosebery, Mt Lyell, Henty Gold and Hellyer, and hundreds of smaller deposits. The area is prospective for copper, tin, silver-lead-zinc, gold and nickel mineralisation. Regional geology is shown in Figure 5.1.

Interpretation

The large size and complex geology of the Mount Read Volcanics survey has precluded any detailed interpretation within the timeframe of this study. However, the dataset appears to contain significant geological information, and further detailed interpretation and anomaly picking are warranted.

Apparent resistivity maps

Figures 5.2 and 5.3 show the 980 Hz apparent resistivity and HCP ternary conductivity maps of the area. Regional magnetic and ternary radiometric images covering the survey area are shown in Figures 5.4 and 5.5. The 1:250 000 scale geological outlines have been superimposed on these figures. A digital elevation model of the area is shown in Figure 5.6.

HEM data from the Mount Read Volcanics contain a number of strong anomalies due to cultural sources. These include extensive high voltage and extra-high voltage power transmission lines as well as electrically grounded railway tracks. Figure 5.7 shows the power transmission and railway lines superimposed on the 980 Hz apparent resistivity map, along with the locations of known mineralisation.

Major regional features of the data are indicated on Figure 5.8, and are discussed individually below.

- A. Conductive Tertiary basalts are widespread to the north of Hellyer, and also near the coast northwest of Zeehan (337 000 mE, 5 372 000 mN). The electromagnetic responses of basalts have been discussed in previous sections of this report.
- B. A north-trending conductive zone (centred on 384 000 mE, 5 385 300 mN–5 392 900 mN) corresponds to mapped Quaternary alluvium (Corbett and McNeill, 1988). Bishop and Lewis (1988) have reported TEM and DC resistivity soundings over Pleistocene glacial deposits around 100 m thick at Boco Siding (384 000 mE, 5 387 000 mN). The glacial deposits were found to have resistivities of 100 to 500 ohm-m, consistent with the apparent resistivities determined from the HEM data. However, TEM and resistivity data

also indicated a 18 m thick, highly conductive (<0.5 ohm-m) layer within the glacial cover, which was interpreted by Bishop and Lewis (1988) as clays. Model calculations indicate that the Hummingbird system is unable to effectively explore beneath a layer of this thickness and conductivity. Further studies are required in order to determine whether conductive clay layers within the glacial cover are widespread or isolated features.

- C. Areas of predominantly very high apparent resistivity (around 385 600 mE, 5 383 300 mN; 381 400 mE, 5 375 600 mN; and 378 430 mE, 5 366 400 mN) correspond to outcrop of the Central Volcanic Complex of the Mt Read Volcanics (Dundas Group) at Mt Block, Mt Black, and Mt Read.
- D. A conductor extending from 378 600 mE, 5 360 400 mN to 376 000 mE, 5 352 200 mN is probably due to conductive alluvium in the Henty River, the path of which has been structurally controlled by the South Henty Fault.
- E. A large number of stratigraphic conductors are evident in the central part of the survey area between Tullah and Renison Bell. These are considered to be mainly due to conductive Cambrian ultramafic units such as the Razorback Mafic-Ultramafic complex (369 500 mE, 5 363 900 mN) and other ultramafic rocks north of Renison Bell (e.g. 371 000 mE, 5 375 200 mN), as well as to extensive graphitic/pyritic shales (Bishop and Lewis, 1988). Some conductors within this zone correspond to linear drainages, which have presumably been structurally controlled. These HEM anomalies could be due either to alluvial deposits within the drainages, or to preferential weathering of the underlying structures.
- F. A zone of high conductivity to the west of Zeehan (around 358 400 mE, 5 360 300 mN) is due to graphitic/pyritic shale within the Oonah Formation (D'Andrea, 2001). The McIvor Hill Mafic-Ultramafic complex to the west (355 800 mE, 5 359 900 mN) is relatively resistive, in contrast to the more conductive ultramafic rocks to the east (E). The low conductivity of the McIvor Hill complex is in part an artifact related to magnetic polarisation of the low frequency HEM response. Differences in conductivity between the McIvor Hill Complex and the other ultramafic units could also be related to differences in the degree of weathering and/or serpentinisation (D'Andrea, 2001).
- G. The Devonian Heemskirk Granite is highly resistive. A resistive zone within the Oonah

Formation (near 354 400 mE, 5 363 400 mN) could represent the shallow eastern extent of the granite. The regional potential field interpretation of Leaman and Richardson (1989) indicates granite within one kilometre of the surface in this area. The resistive zone to the east of the granite boundary could also be due to contact metamorphism of the Oonah Formation by granite lying below the depth of investigation of the HEM system (as has been observed for the Cleveland–Waratah Association rocks at the north-eastern margin of the Meredith Granite).

- H. A highly conductive zone near 351 800 mE, 5 352 600 mN corresponds to mapped Quaternary alluvium, and is probably due to saline groundwater within highly porous coastal sediments.
- I. A resistive zone around 352 400 mE, 5 369 000 mN corresponds to outcropping Jurassic dolerite. The high apparent resistivities over the dolerite (≈ 1000 ohm-m) suggest that it is massive and unjointed.
- J. The resistive zone around 325 600 mE, 5 331 000 mN corresponds to mapped Owen Conglomerate.
- K. An east-trending conductive zone corresponds to mapped Quaternary alluvium within the Lyell Comstock Creek valley (386800 mE, 5 345 300 mN).

Responses of known mineralisation

There are a very large number of bedrock conductors within the survey area, and it is beyond the scope of this report to relate all of these to known mineral deposits. Strong Hummingbird HEM anomalies have been obtained over the Renison Bell (370 000 mE, 5 371 400 mN) and Que River (391 550 mE, 5 393 500 mN) deposits, both of which have responded strongly to previous frequency-domain airborne EM surveys (Bishop and Lewis, 1988; Burrett and Martin, 1989). D'Andrea (2001) has noted Hummingbird anomalies associated with small deposits within the Zeehan mineral field. Some Hummingbird anomalies associated with operating or former mines could be due to mine infrastructure, tailings dams etc., and a careful analysis of the HEM data is required to identify those responses caused by mineralisation.

EMFlow and Sengpiel conductivity-depth sections

Conductivity-depth sections for three profiles within the survey area are shown in Figures 5.9 to 5.11.

Line 11101 (fig. 5.9, 5 391 580 mN)

The bulk of this flight line crosses relatively resistive quartzwacke slate siltstone, quartz-feldspar porphyry, volcanic rocks and sedimentary rocks of the Dundas Group.

The conductive zone between 383 100 mE and 384 700 mE corresponds to Quaternary glacial sediments (marked B in fig. 5.8). High conductivities at depth in the EMFlow CDI are not seen in the Sengpiel section, and are considered to be processing artifacts. The Sengpiel section indicates high resistivities at around 60 m depth between 383 600 mE and 384 100 mE. This may indicate a zone of locally thinner Quaternary cover.

A strong local anomaly at 389 300 mE is of unknown origin – the closest known deposit is Mt Charter (Ba), which has associated lead, copper and pyrite mineralisation.

High conductivities at depth in the EMFlow CDI around 386 500 mE, 391 400 mE and between 389 400–390800mE occur at depth close to or beyond the maximum depth of investigation of the Hummingbird HEM system, and are considered to be processing artifacts.

Line 13562 (fig. 5.10, 5 359 580 mN)

This line crosses units of the Eldon Group (Bell Shale, Florence Quartzite, Crotty Quartzite) between 362 000 mE and 367 200 mE. Oonah Formation rocks crop out between 358 600 mE and 361 100 mE, and Cambrian ultramafic rocks of the McIvor Hill Complex crop out between 354 800 mE and 357 000 mE. Conductive Quaternary alluvium overlies bedrock on parts of the survey line. The western end of the line terminates just short of the eastern margin of the Heemskirk Granite.

The major conductive zone between 359 200 mE and 360 000 mE is related to carbonaceous shale, dolomite, graphitic and pyritic shales within the Oonah Formation (D'Andrea, 2001). Conductors at 355 200 mE and 356 500 mE correspond to alluvium overlying otherwise resistive Cambrian mafic/ultramafic rocks of the McIvor Hill Complex.

Line 14621 (fig. 5.11, 5 346 180 mN)

This flight line crosses highly resistive volcanoclastic and volcanic rocks of the Tyndall Group. Highly-resistive Owen Conglomerate crops out at the western end of the line. A conductive zone between 382 700 mE and 384 500 mE corresponds to mapped Quaternary alluvium. The Sengpiel section indicates possible resistive basement at a depth of approximately 80 m between 383 200 mE and 383 800 mE. A sharp spike in the measured HEM responses at 379 400 mE is due to a power transmission line.

EMFlow conductivity-depth slices

Conductivity-depth slices from EMFlow data at 20 m, 70 m, and 120 m below surface are shown in Figures 5.12 to 5.14.

The dominant features in the 20 m depth slice are the conductive Tertiary basalts in the northern part of the

survey and northwest of Zeehan, conductive Quaternary alluvium on the coast southwest of Zeehan, cultural anomalies due to power and railway lines, and stratigraphic conductors in the Renison Bell–Rosebery area.

Some east-west striping is evident in the 70 m and 120 m depth slices (e.g. north of Zeehan). This striping is not evident in the apparent resistivity maps (e.g. fig. 5.2), and is probably due to the use of the amplitude-altitude apparent resistivity algorithm for data levelling (see *Levelling Errors* section, Part 1).

Considerable geological detail is evident in the 70 m depth slice, particularly in the Renison–Rosebery area.

There appears to be relatively little geological information in the 120 m depth slice. The widespread high conductivities at depth in the Renison–Rosebery area are most likely to be EMFlow processing artifacts, given that the generally high near-surface conductivities in this area would be expected to limit the depth of investigation of the Hummingbird system.

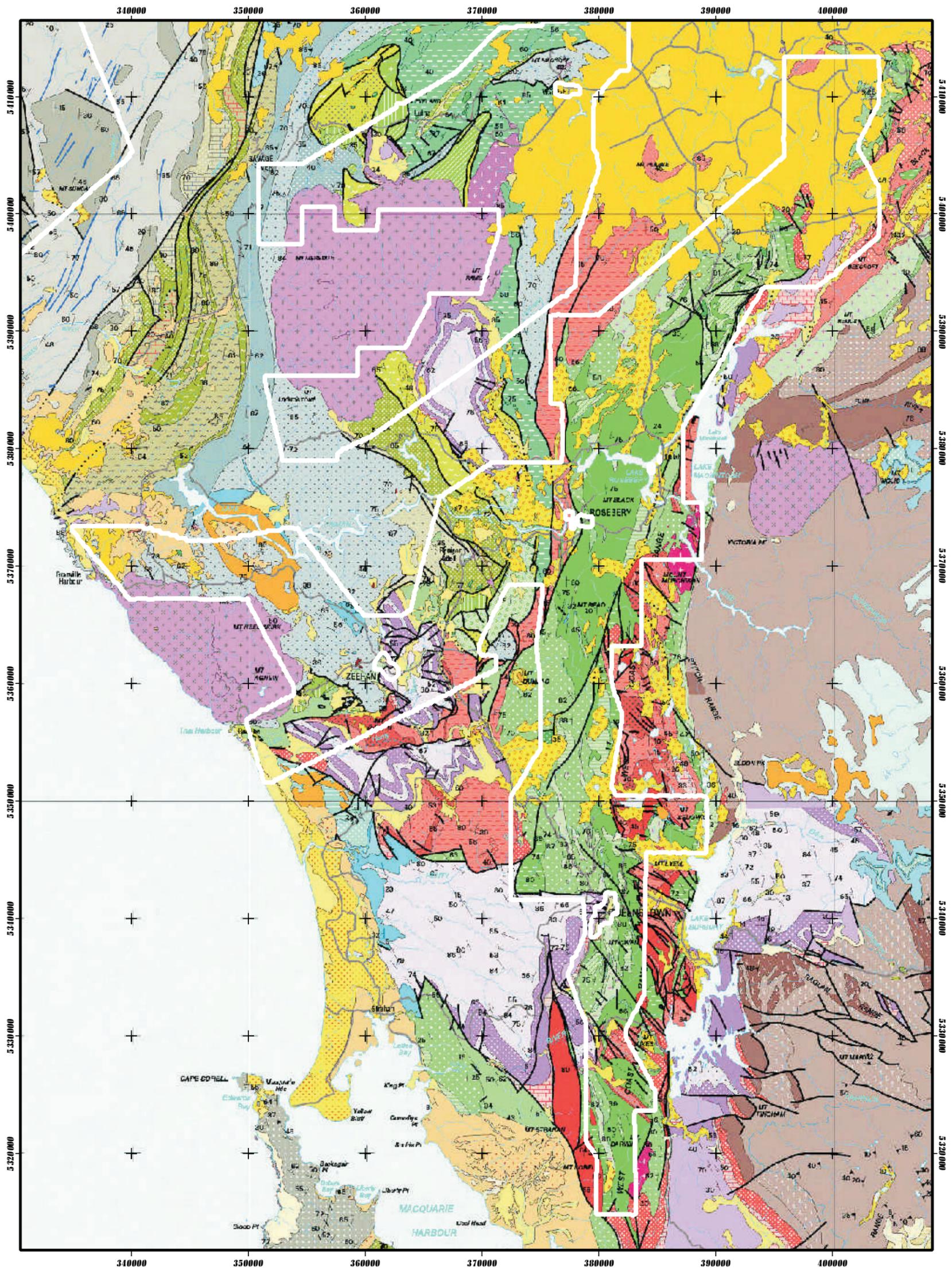


Figure 5.1
Mount Read Volcanics
1:250,000 geology with EM survey boundary

5000 0 5000 10000 15000 Meters



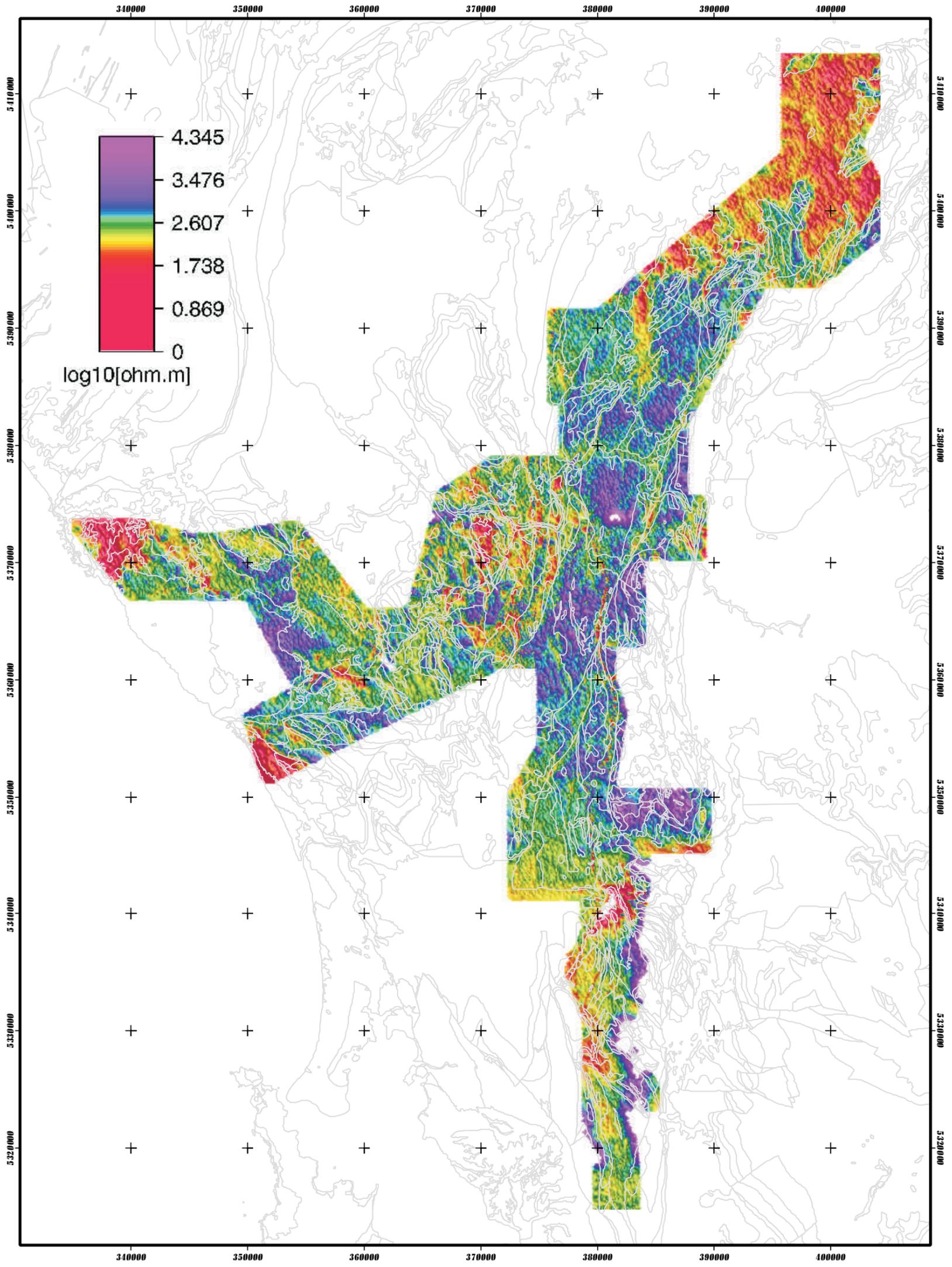


Figure 5.2
Mount Read Volcanics
980 Hz apparent resistivity with 1:250,000 geology

5000 0 5000 10000 15000 Meters



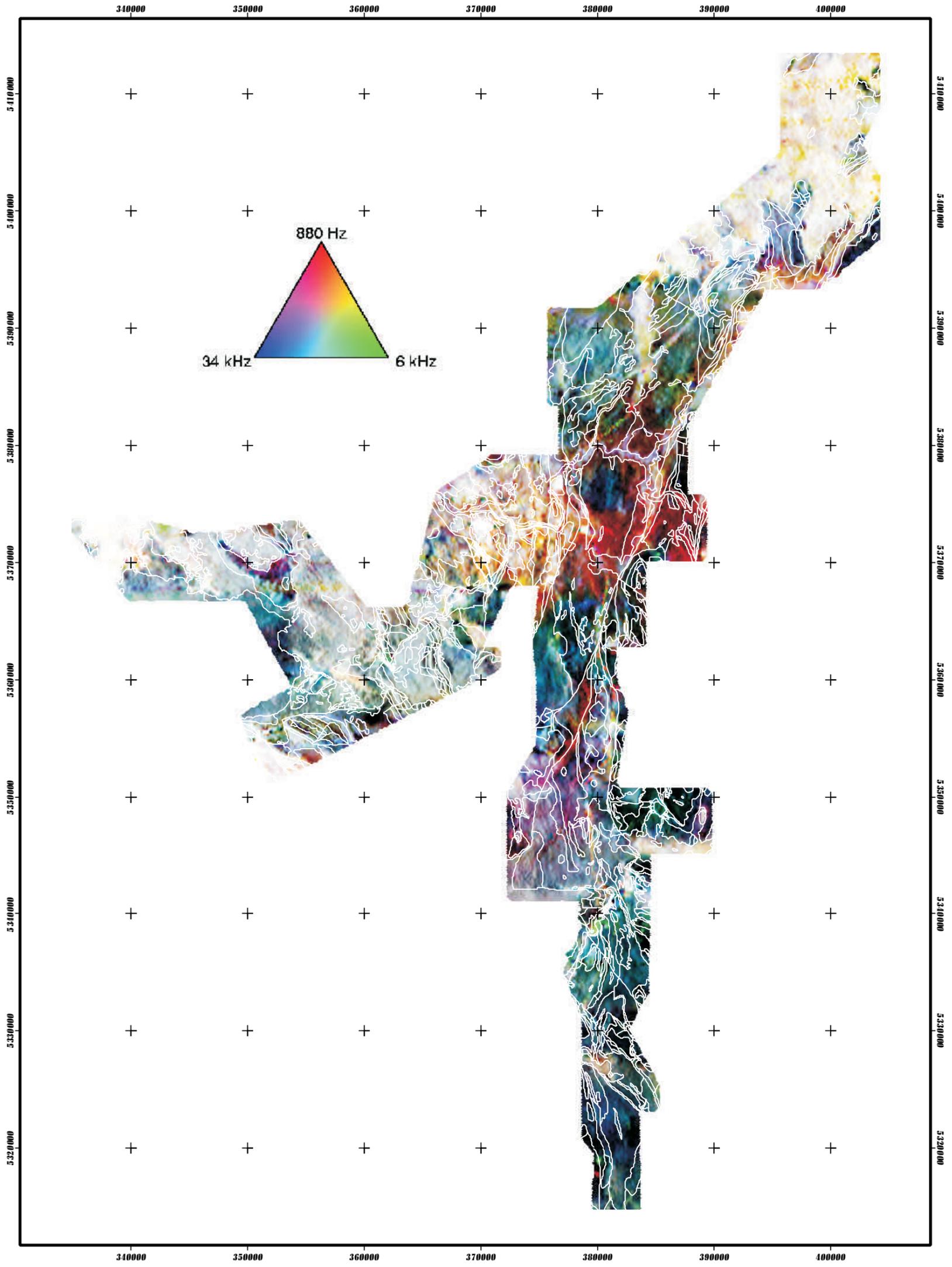


Figure 5.3
Mount Read Volcanics
HCP ternary conductivity with 1:250,000 geology

5000 0 5000 10000 15000 Meters



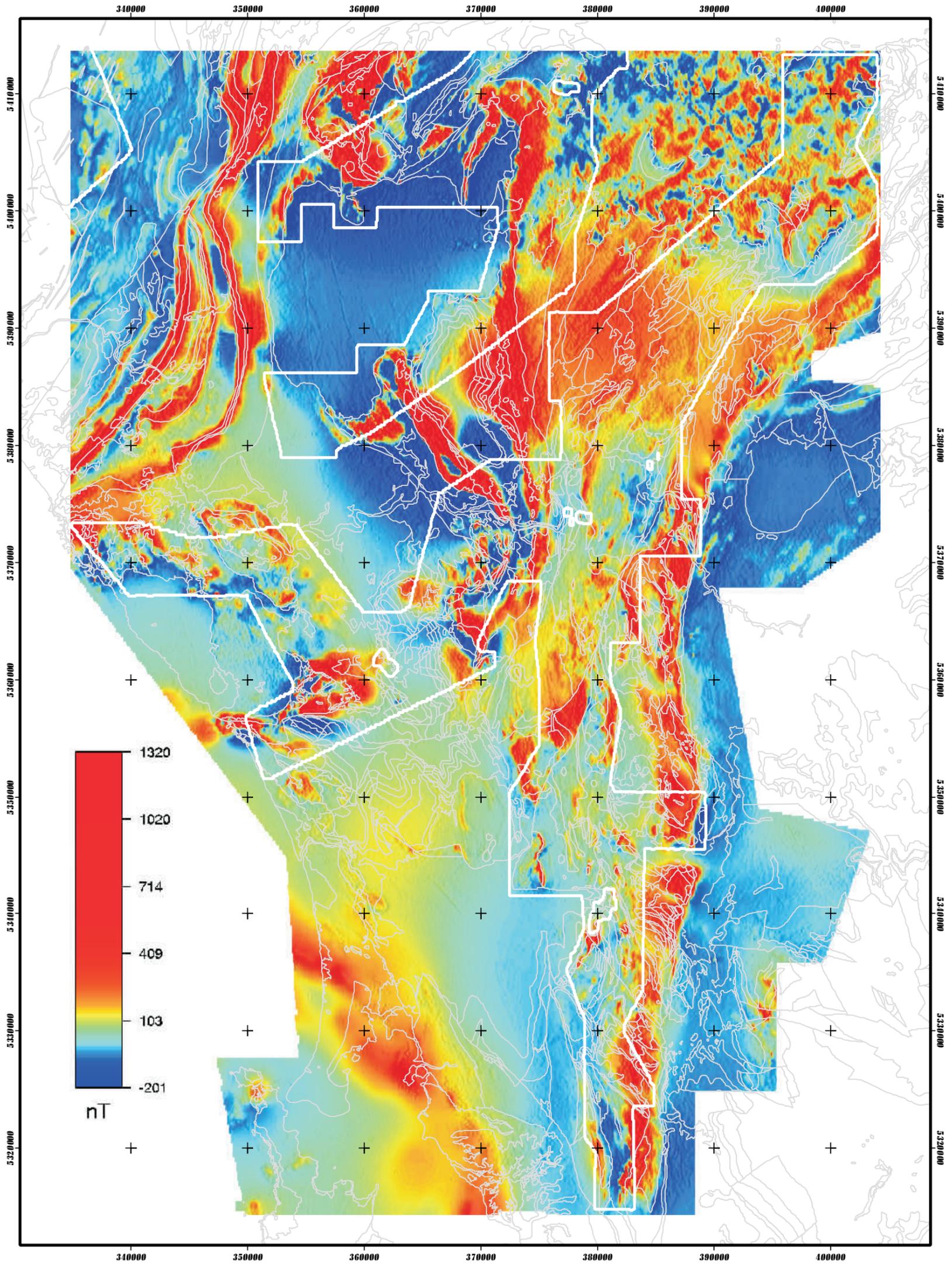


Figure 5.4
Mount Read Volcanics
WTRMP TMI with 1VD enhancement,
EM survey boundary and 1:250,000 geology

5000 0 5000 10000 15000 Meters



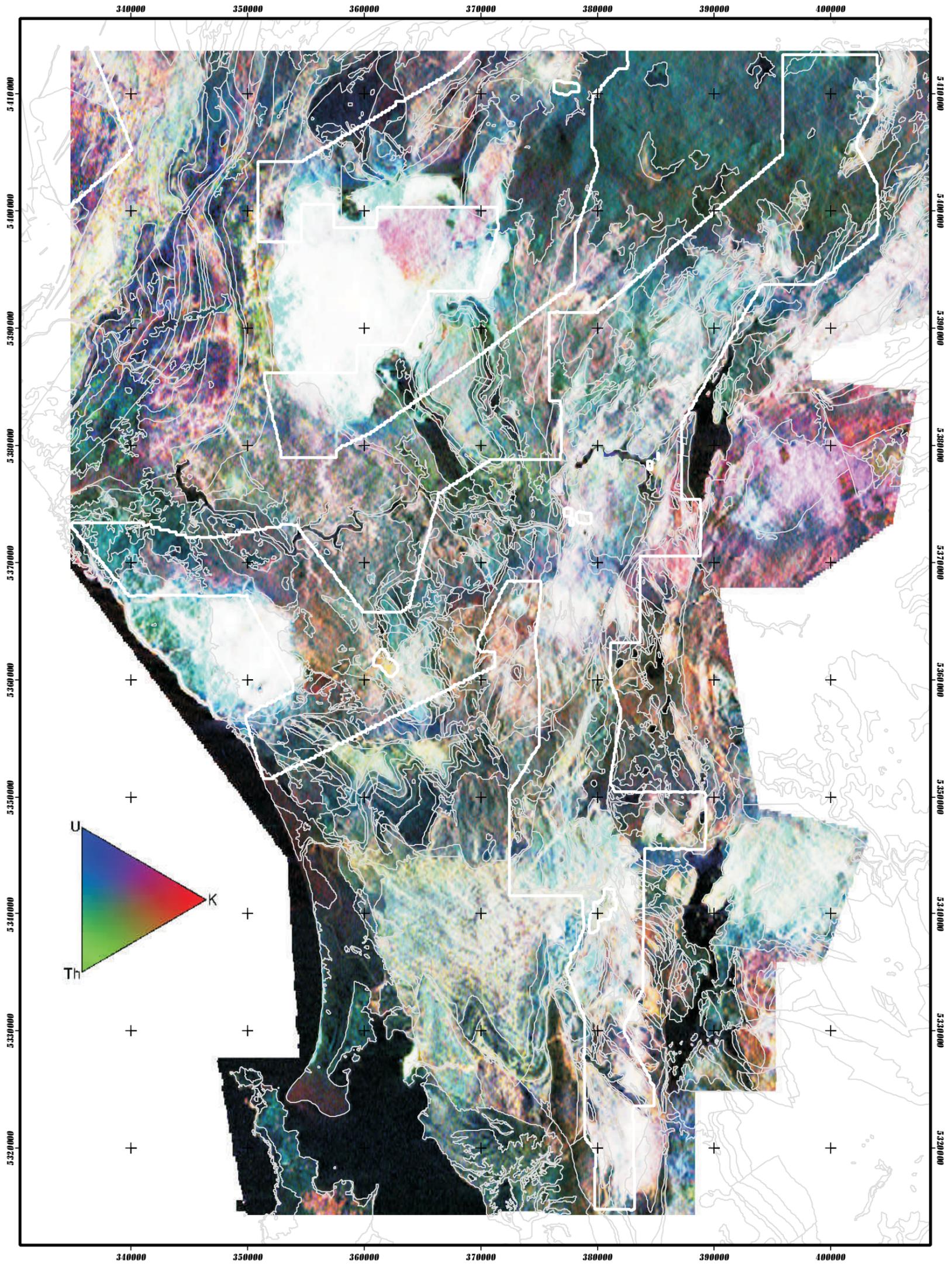


Figure 5.5
Mount Read Volcanics
WTRMP ternary radiometrics with EM survey
boundary and 1:250,000 geology

5000 0 5000 10000 15000 Meters



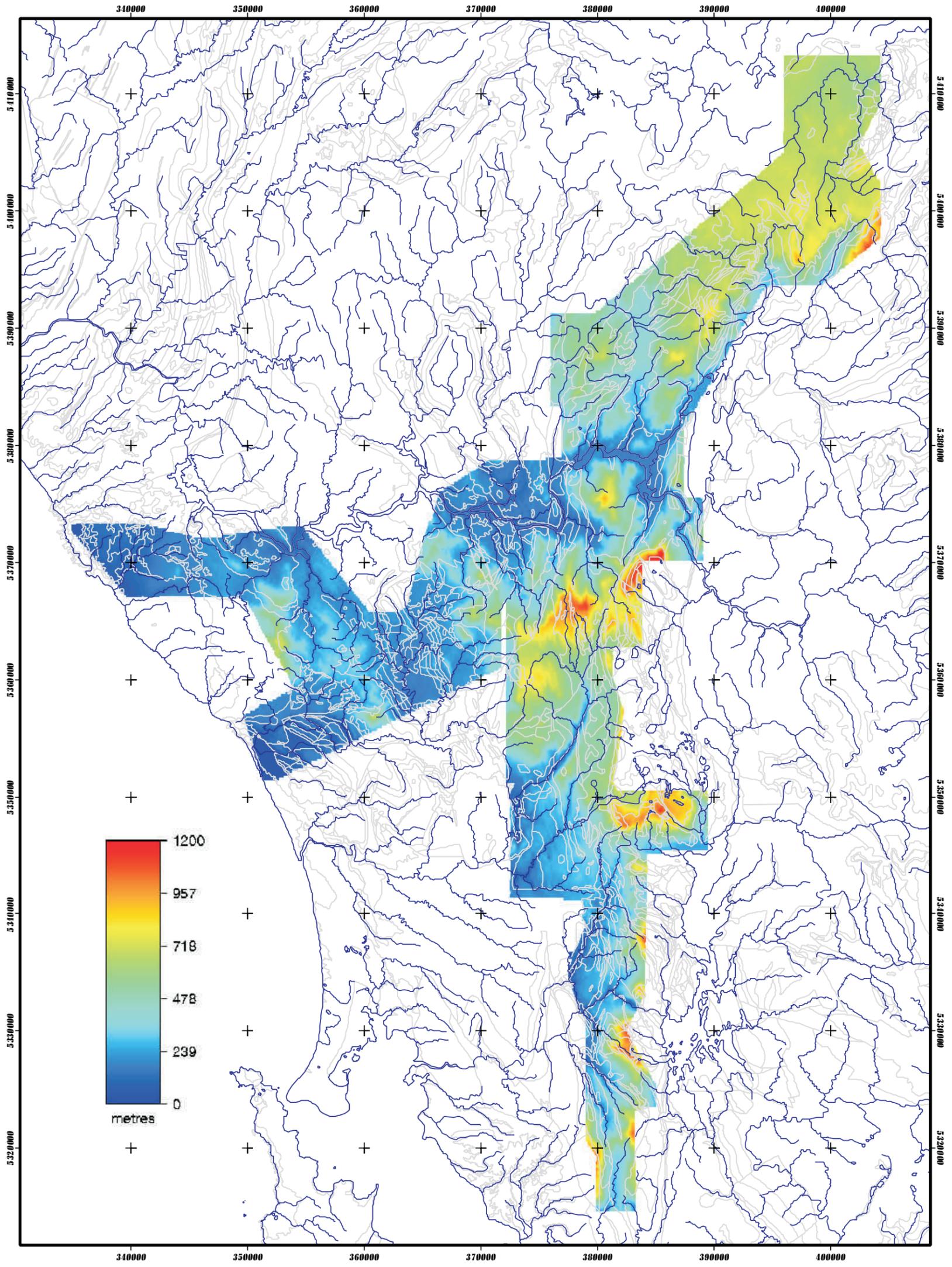


Figure 5.6
Mount Read Volcanics
Digital elevation model with drainage
and 1:250,000 geology

5000 0 5000 10000 15000 Meters



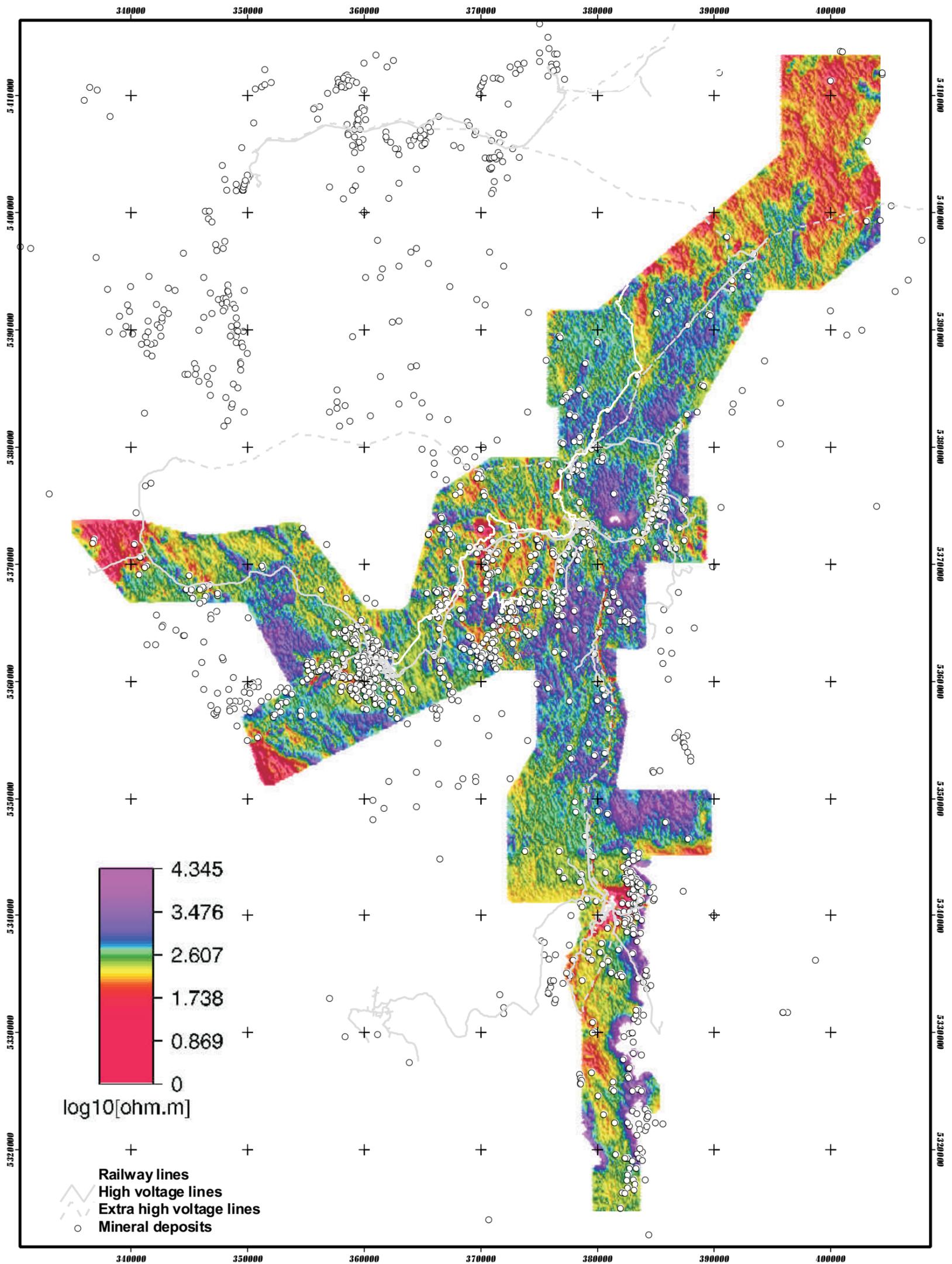


Figure 5.7
Mount Read Volcanics
980 Hz apparent resistivity with
culture and mineral deposits

5000 0 5000 10000 15000 Meters



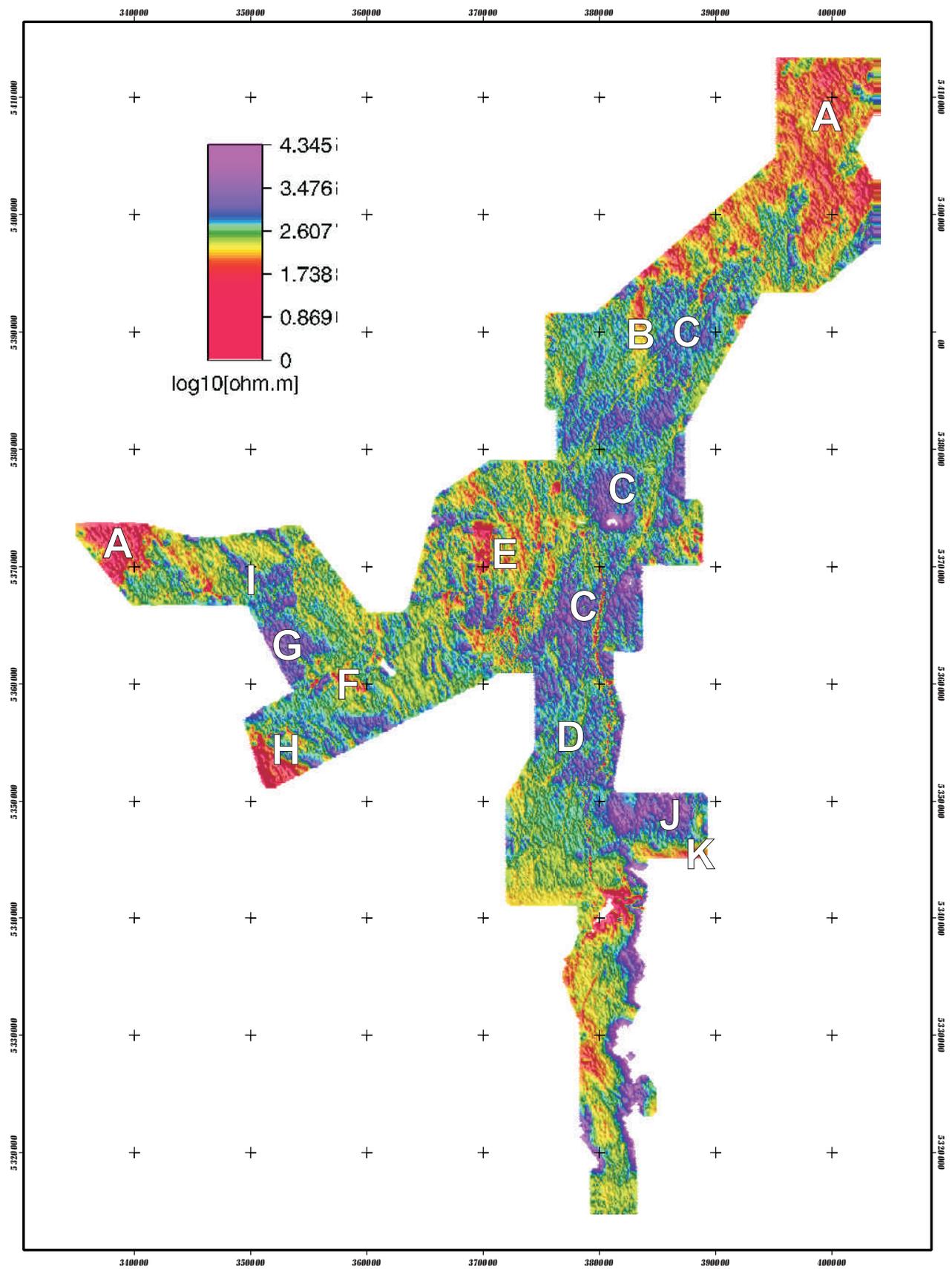


Figure 5.8

Mount Read Volcanics 980 Hz apparent resistivity with interpretation key

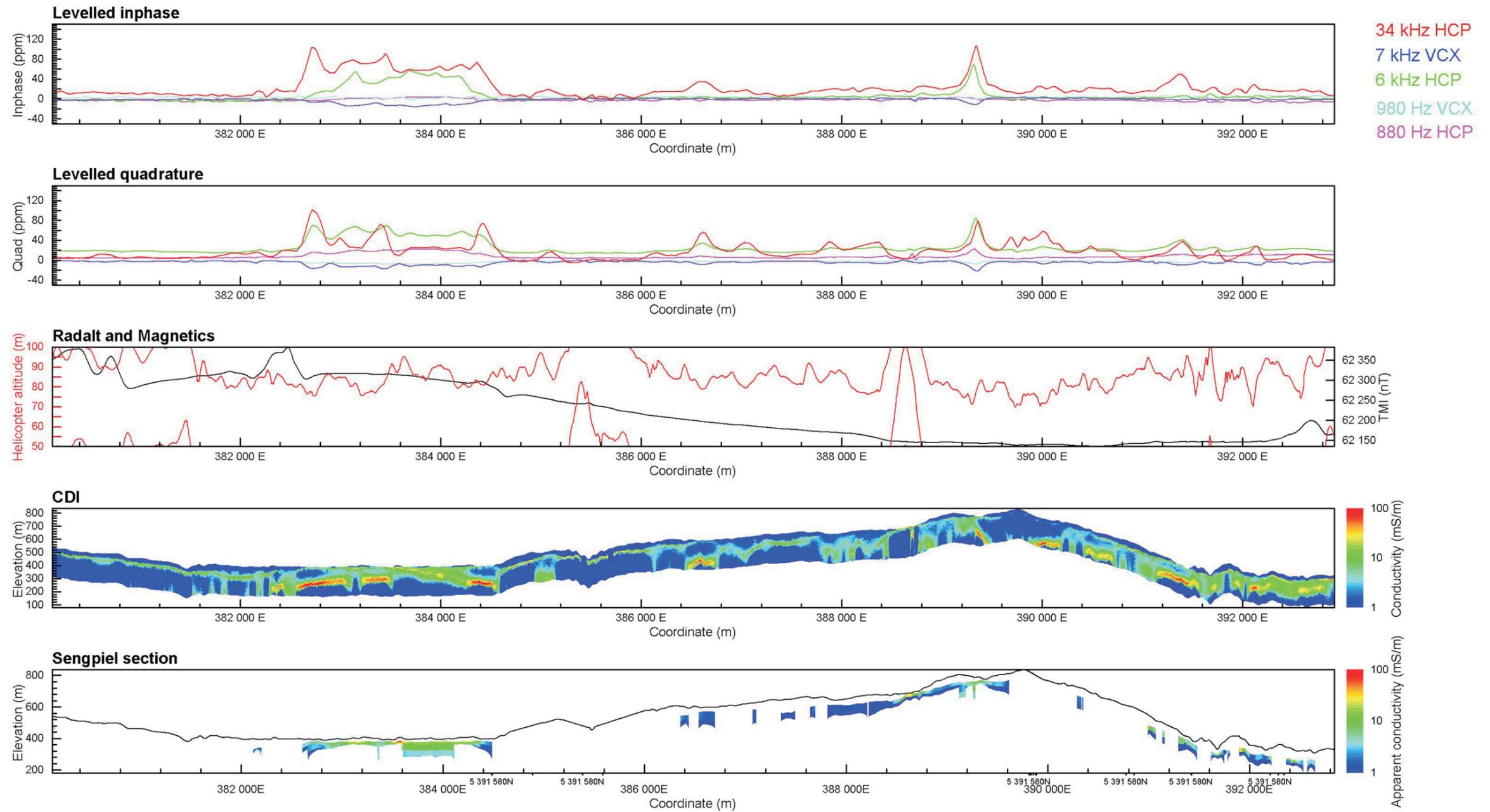


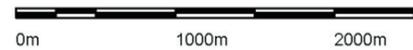
Figure 5.9
Mount Read Volcanics, W Tasmania
Line D11101

Levelled inphase and quadrature data
Radar altimeter and TMI
EMFlow v3.2 conductivity-depth image
Sengpiel section

Collaborative Research Project:
 An electromagnetic interpretation of west
 and northwest Tasmania

March 2003

Coordinates: AGD66/TMAMG 55



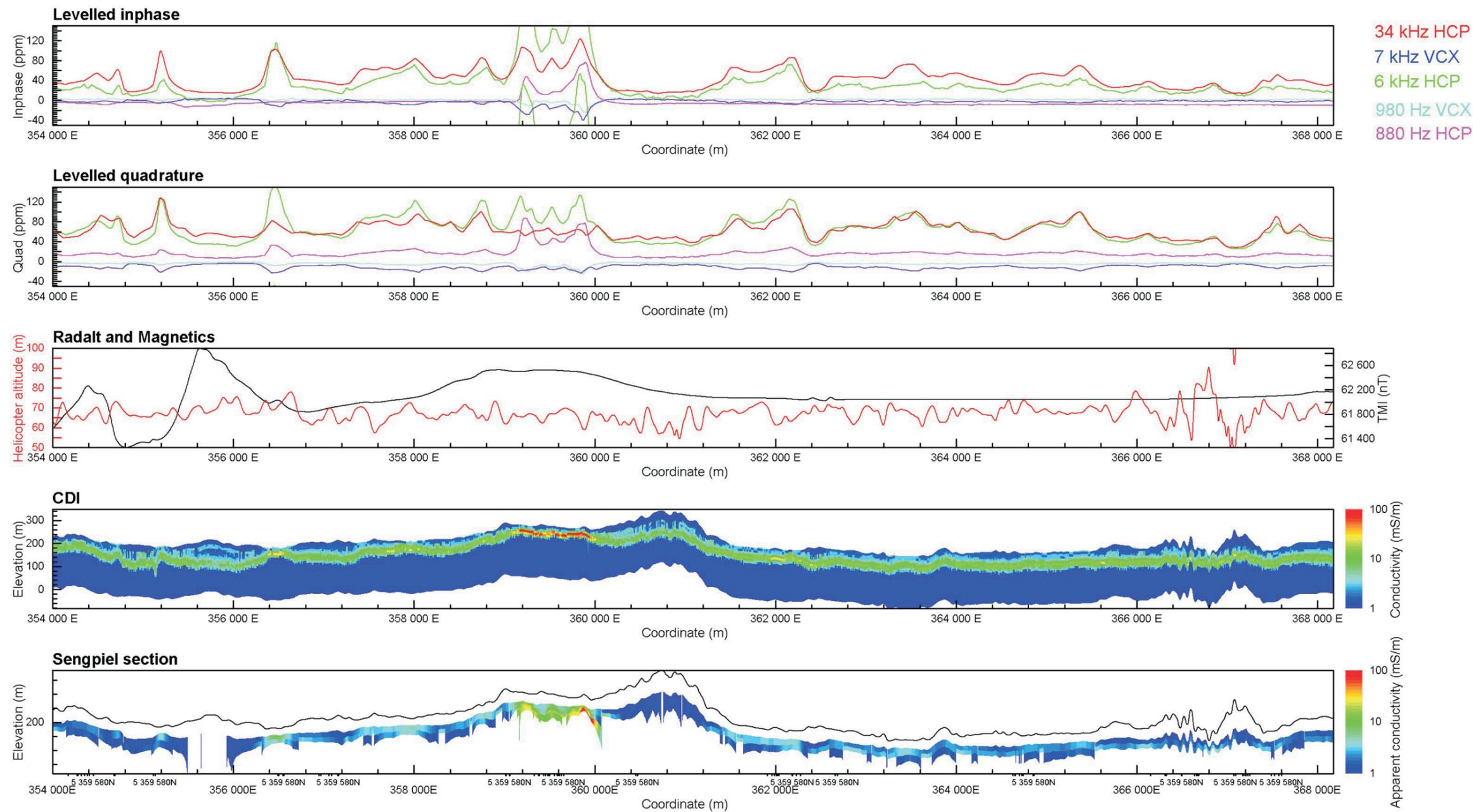


Figure 5.10
Mount Read Volcanics, W Tasmania
Line D13562

Levelled inphase and quadrature data
Radar altimeter and TMI
EMFlow v3.2 conductivity-depth image
Sengpiel section

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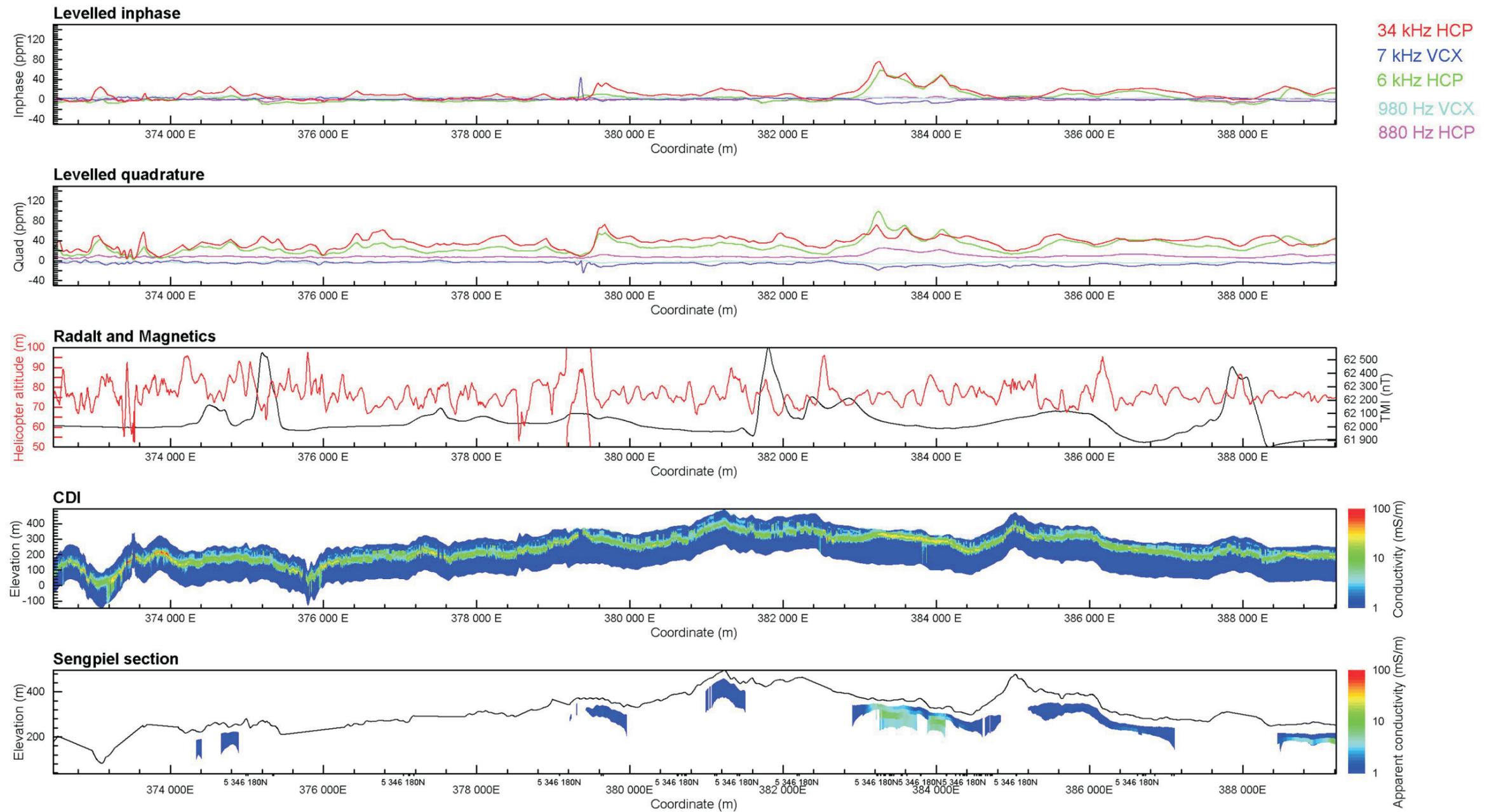


Figure 5.11
Mount Read Volcanics, W Tasmania
Line D14621

Levelled inphase and quadrature data
Radalt altimeter and TMI
EMFlow v3.2 conductivity-depth image
Sengpiel section

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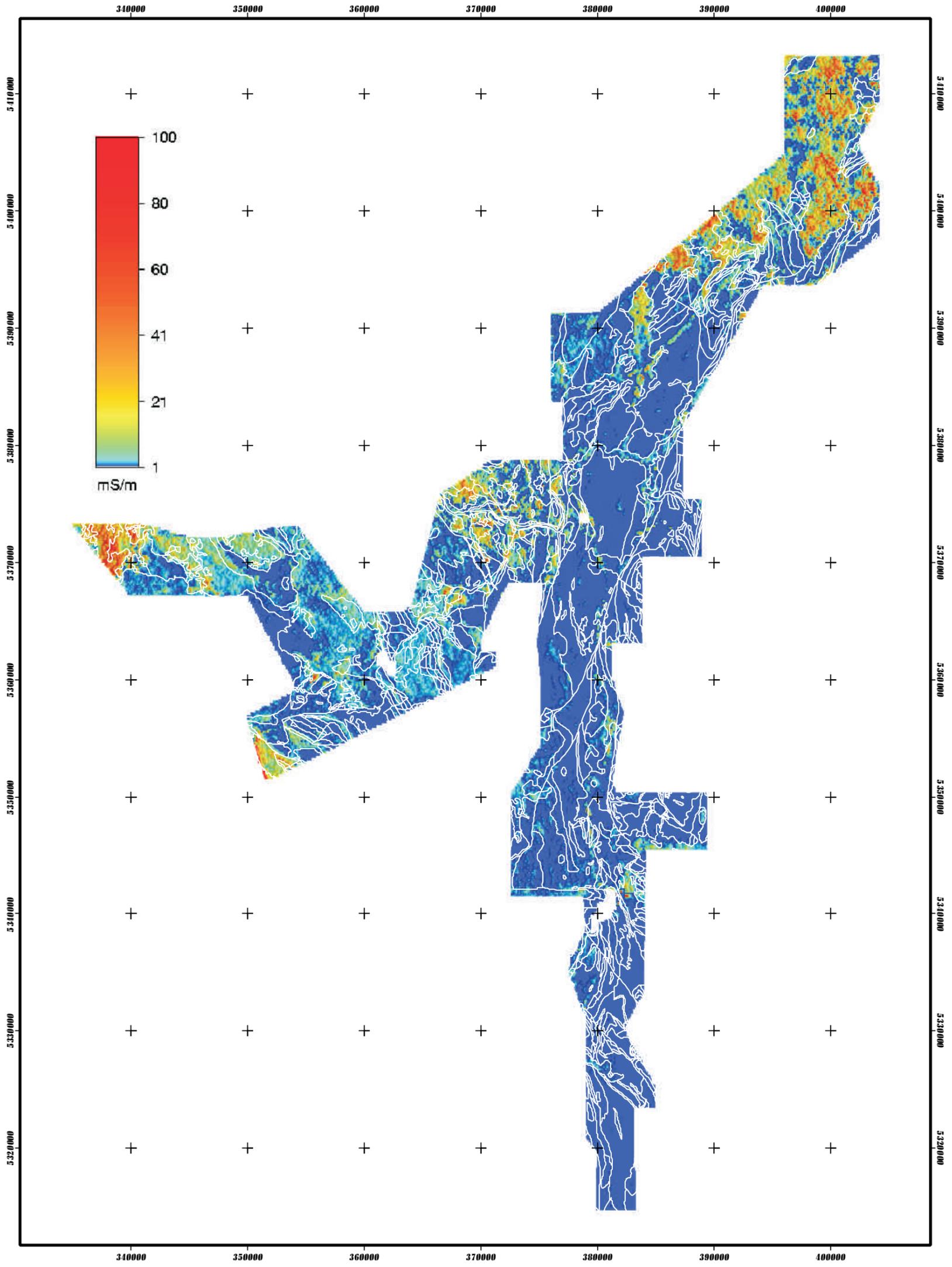


Figure 5.12
 Mount Read Volcanics
 EMFlow 20 m depth slice with 1:250,000 geology

5000 0 5000 10000 15000 Meters



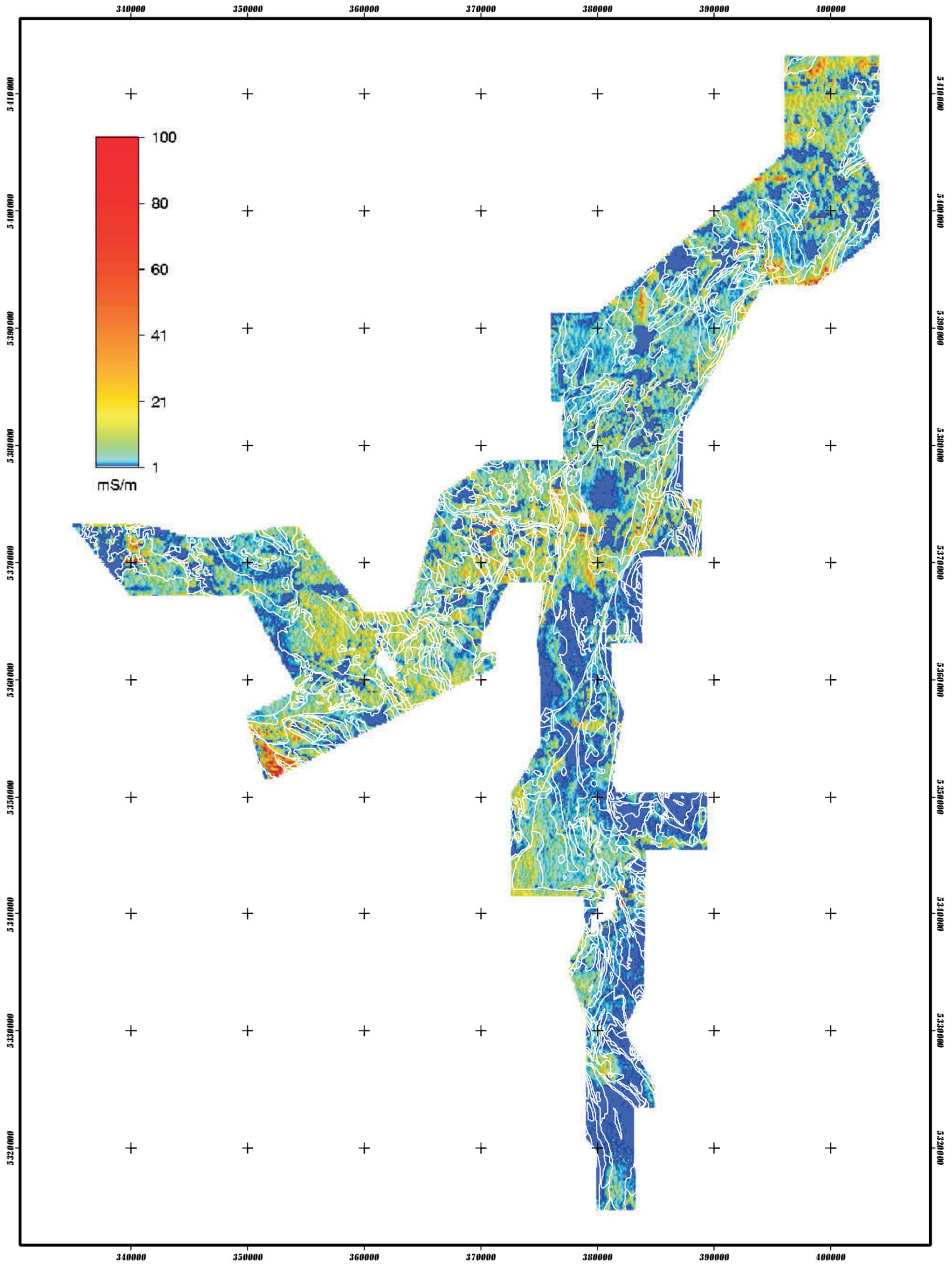
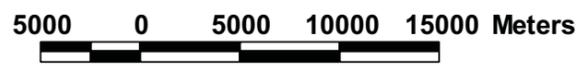


Figure 5.13
 Mount Read Volcanics
 EMFlow 70 m depth slice with 1:250,000 geology



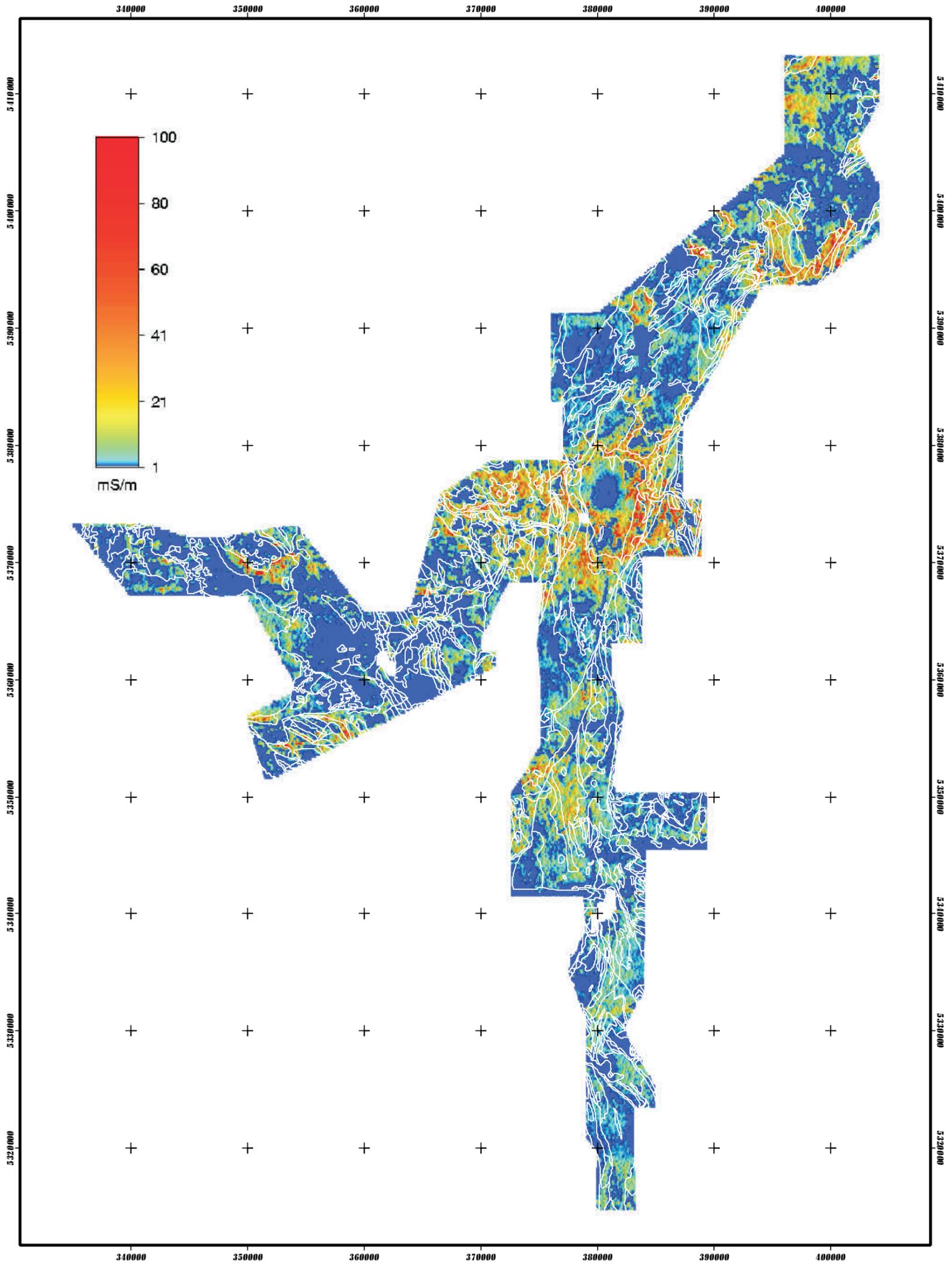
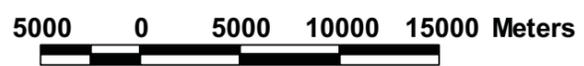


Figure 5.14
 Mount Read Volcanics
 EMFlow 120 m depth slice with 1:250,000 geology



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