GEOSCIENCES 2012
Hamilton November 25-28

Geoscience Society of New Zealand 2012 Conference

FIELD TRIP GUIDES

HAMILTON 25 - 28 November 2012

Geoscience Society of New Zealand

Geosciences 2012

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Field Trip Guides

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Geosciences 2012

Annual Conference of the Geoscience Society of New Zealand, Hamilton

Field Trip 9

Thursday 29 November

Huntly Coal, Power Station and the Wandering Waikato River

Leader: Vicki Moon

University of Waikato

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HEALTH AND SAFETY

PLEASE READ

Certain hazards will be encountered on this field trip. At all times, participants must heed and observe the warnings and directions of the hosts from Solid Energy and Huntly power station, and the field trip leader.

This trip will be visiting active industrial sites, so personal protective equipment will be required as advised by the site hosts; hi-viz vests, hard hats, ear muffs and safety glasses will be provided for use when needed. At Solid Energy all participants will need to wear steel-capped boots - these will be provided as required. Note however, that due to gas hazard at the power station it is important that no exposed steel is worn. If in doubt about your own boots, borrow boots for the mine, and wear normal shoes for the power station.

This trip will only require a minimal level of fitness. Participants should be aware of uneven ground surfaces and rockfall hazards in an active mine site. Noise at the power station.

Participants should carry their own sunscreen and insect repellent, and any personal medications they may require. A sunhat, sunscreen, and waterproof and windproof jacket are recommended.

Route and Itinerary

The route is:

Depart University 8 am

University to Rotowaro offices of Solid Energy via Gordonton Road (State Highway 1B)

Site visit to Rotowaro Opencast (9 – 12)

Lunch

Lunch to Huntly Power Station

Site visit to Huntly Power Station (1 – 3)

Return to Hamilton via Ngaruawhia (State Highway 1) (3 – 4.30'ish)

Introduction

We will be focusing on the energy resources of the Huntly area – the coalfield and the thermal power station. We will also consider the geology and geomorphology of the Waikato Basin. Our juourney takes us from the older to yougest deposits.

Geology of Hamilton Lowlands

Hamilton lies within the Hamilton Basin which is defined by greywacke ranges to the east and west (Figure 1). The basin runs roughly S – N and is paralleled by the Hauraki Basin to the east. The Waikato River enters the basin to the south at Karapiro near Cambridge, and exits through the Taupiri Gorge just south of Huntly. We will travel through the gorge to Huntly in the Lower Waikato Basin.

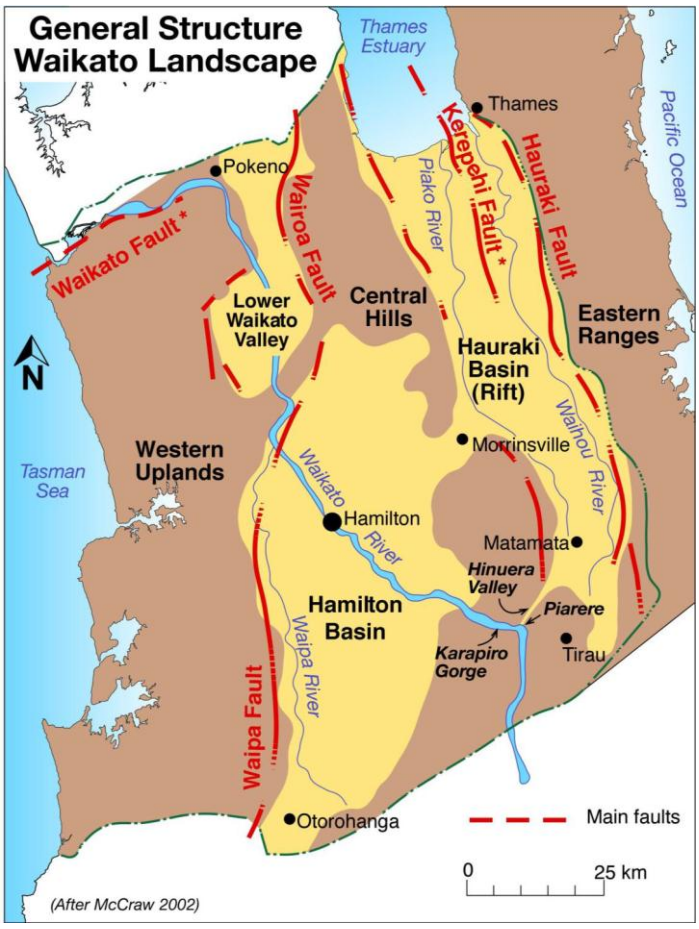


Figure 1: General structure of the Waikato landscape (from Lowe, 2010).

The overall stratigraphy sees has deeply weathered basement rocks at depth. These are unconformably overlain with Tertiary Te Kuiti Group, a largely transgressive sequence found across much of the north western North Island (Edbrooke, 2005). These are overlain unconformably with Pliocene to Holocene terrestrial sediments of the Tauranga Group which form the present soil patterns of the Hamilton Lowlands and Lower Waikato Valley. .

Waikato Coal Region

Coal mining in the Waikato began in the late 1840s. Production increased to over 1 million tonnes a year in the 1950's, and is now about 2.5 million tonnes a year, making up about 50 % of New Zealand's total production and 70% of coal used for domestic consumption (Ministry of Economic Development, 2012). Waikato coal is provided to Glenbrook steel mill and Huntly power station, among other users.

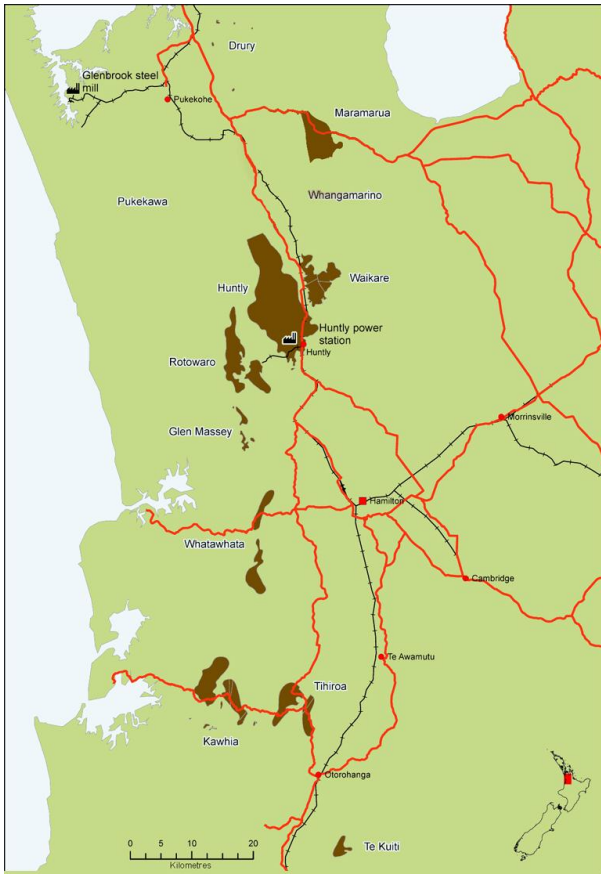


Figure 2: Coalfields of the Waikato Coal Region (Ministry of Economic Development, 2012)

Thirteen coalfields make up the Waikato Coal Region which extends from Drury in the north to Mangapehi south of Te Kuiti. The main coalfields are Maramarua, Waikare, Huntly, Rotowaro, Kawhia, Tihiroa and Mangapehi (Figure 2). Coals are sub-bituminous, with those from Rotowaro being sub-bituminous B rank with. low to medium ash and low sulphur contents. However, coal quality is variable within and between seams (see Paris et al., 2012). Coal resources are approximately 2 billion tonnes, representing one of the country's most important energy resources. (Ministry of Economic Development, 2012).

Figure 3 summarises the stratigraphy of the Te Kuiti Group in the Rotowaro area. The Waikato Coal Measures are the basal sequence of the Tertiary Te Kuiti Group. . The Te Kuiti Group is up to 500 m thick near Rotowaro and thins to the south. The Waikato Coal Measures are up to 200 m thick in the Rotowaro area, including sub-bituminous coal seams up to 20 m thick (Edbrooke, 2005). Four seams are recognised within the coal measures: the Taupiri, Kupakupa, Renown, and Ngaro seams. The Kupakupa seam is the most commonly mined, it is typically 3-10 m thick, but reaches 20 m (Ministry of Economic Development, 2012). Block faulting and erosion has affected the present distribution, depth and structure of coal seams. Other lithologies within the Waikato Coal Measures include carbonaceous mudstone (dominant), sandy mudstones, muddy sandstones, and rare conglomerates. In the Rotowaro area the coal measures are believed to have accumulated in an inland environment (Edbrooke, 2005).

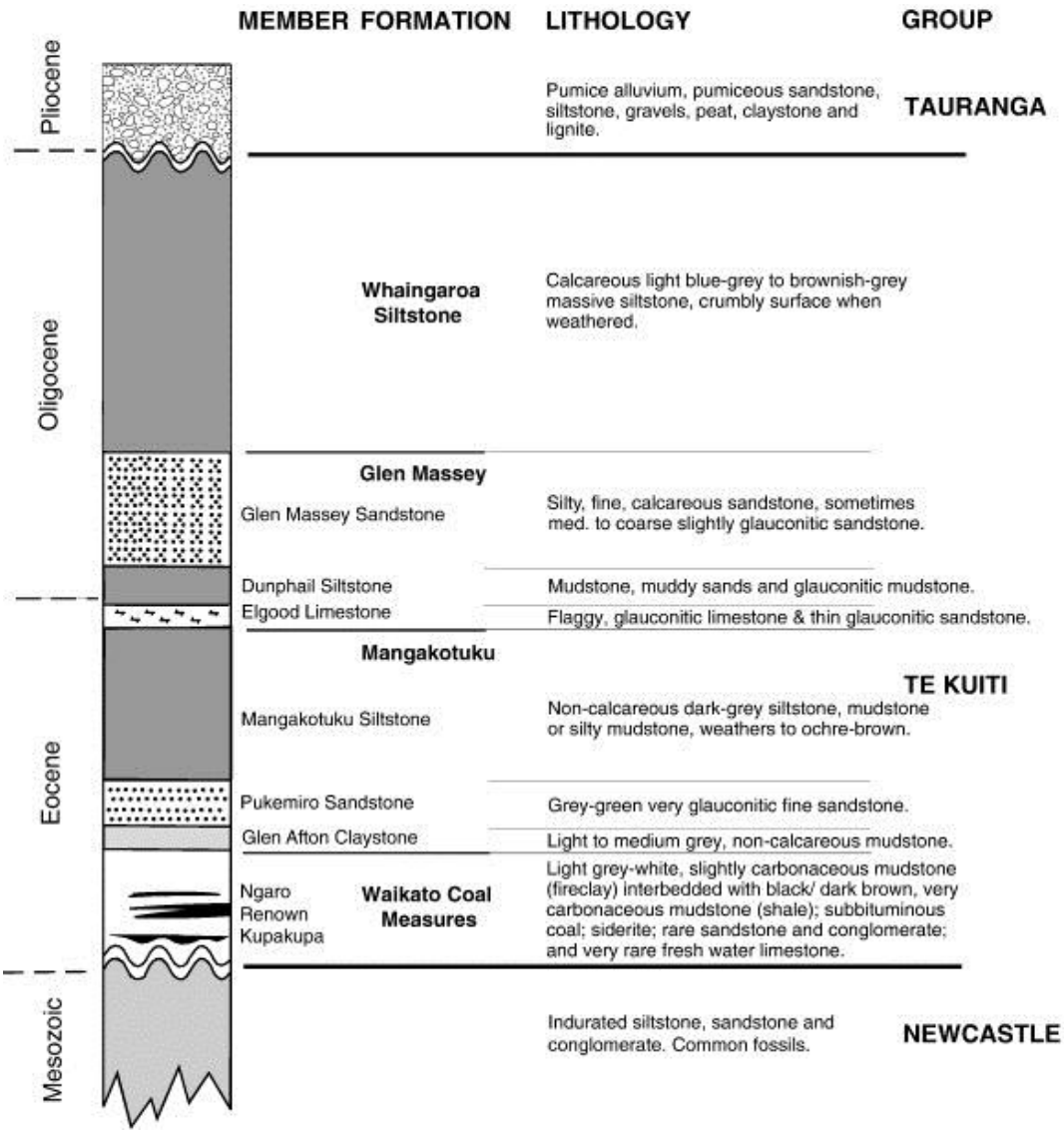


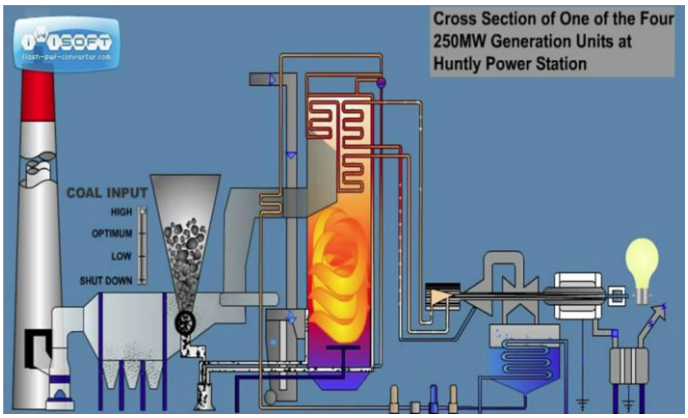
Figure 3: Simplified stratigraphy of the Rotowaro area concentrating on the Te Kuiti Group rocks (from Mares *et al*., 2009).

Three other key formations comprise the Te Kuiti Group sequence in this area:

- The **Mangakotuku Formation** overlies the coal measures and is the first largely marine formation in the sequence. It is typically a non-calcereous siltstone or mudstone, often with glauconitic sandstone beds at the base (Edbrooke, 2005).
- This is overlain by the calcareous **Glen Massey Formation** which is up to 100 m thick at Rotowaro and typically consists of three units: a thin, flaggy, sandy limestone or glauconitic sandstone at the base, overlain by a grey, calcareous siltstone, which grades up to a massive, calcareous sandstone (Edbrooke, 2005).
- The **Whaingaroa Formation** overlies either the Glen Massey or Mangakotuku Formations in the north. It is dominated by massive, light grey to blue-grey, glauconitic, calcareous siltstone that characteristically fritters to small fragments when exposed (Edbrooke, 2005).

Genesis Energy Huntly Power Station

Huntly Power Station is a thermal power station that can use coal, gas or both simultaneously as fuel. Coal is delivered to the station primarily via an overland conveyor belt from Rotowaro. Huntly is the largest power station in NZ with 4 X 250 MW steam turbo-alternators with coal and gas fired boilers, 1X 50MW simple cycle gas turbine and 1X 385 MW combined cycle gas turbine. A total installed capacity of 1435 MW. Huntly is strategically located only 70km from Auckland, the largest load centre, and plays a critical role in supplying New Zealand with power (Genesis Energy, 2012)



The Wandering River

Younger (Pliocene – Holocene) terrestrial sediments and products of North Island volcanism lie unconformably on the Tertiary sequence throughout the Waikato Basin. These Tauranga Group sediments are of variable thickness, typically up to approximately 80 m but reaching as much as 600 m (Edbrooke, 2005); they form the present soil patterns of the Hamilton lowlands. The Walton Sub-group and Hinuera Formations are two key parts of this sediment cover.

Walton Subgroup

Earliest deposits consist of Late Pliocene to mid-Pleistocene sands and gravels formed from alluvial deposition and distal ignimbrites from the Central North Island (Karapiro and Puketoka Formations). These deposits were eroded into a dissected landscape with prominent hills (Figure 4); deep, extensive weathering occurred during this time of erosion. During formation of these beds rhyolitic volcanism in the Central North Island and Coromandel deposited extensive tephra sequences which are both incorporated within the basin deposits and form a mantle across the eroded hills. These are also strongly weathered and are largely of clay texture (Selby and Lowe, 1992).

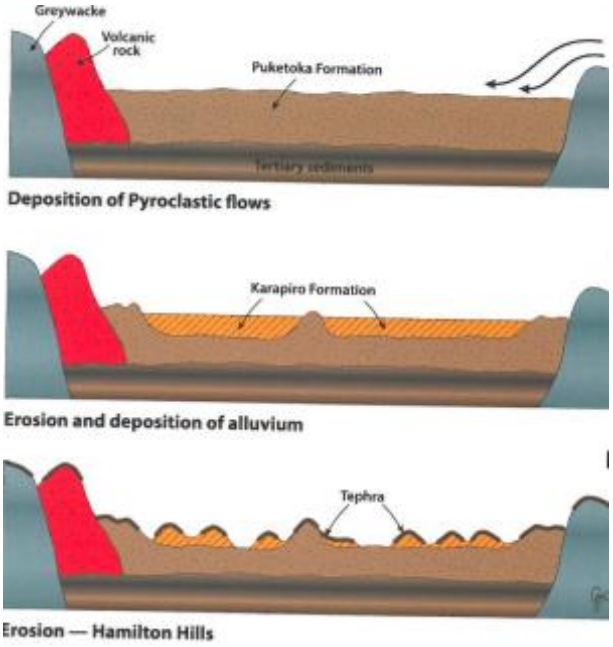


Figure 4: Infilling of basin with ignimbrites (Puketoka Fm) and alluvial sediments (Karapiro Fm) was followed by erosion into a hilly landscape that was mantled with tephras (from McCraw, 2011).

Hinuera Formation

A later phase of alluvial deposition formed a large alluvial fan extending out from Karapiro near Cambridge. These materials are of Late Pleistocene age, from about 50,000 years (Edbrooke, 2005) to 15,000 years (Selby and Lowe, 1992). The alluvial fan has buried all but the highest hills of the former topography. These materials are highly variable, ranging from loose gravels and sands to thick silt. They reach up to 90 m thick (Edbrooke, 2005). The deposition of the Hinuera Formation impeded the drainage within the basin, and led to the formation of small lakes and peat swamps.

This fan forms the present plains of the Hamilton Lowlands, the "Hinuera Surface". (Figure 5). A complex pattern of former river channels can be seen across the fan surface. The Waikato River has since incised into the present-day channel, with an extensive series of steep-sided gullies developed in response to this incision.

A drill hole through a hill will typically show the following sequence (Lowe, 2010):

- Silty cover bed of post-Hamilton-Ash tephras from multiple sources; ~0.5 m thick; c. 60 ka*
- Red-brown, clayey weathered tephra beds (Hamilton Ash); ~13 m thick; top bed c. 80125 ka, basal c. 350 ka
- Orange/reddish/cream gravelly alluvial clays (Karapiro Formation); variable thickness (few metres); c. 500 ka
- Very dark red-brown, clayey weathered tephra beds (part of Kauroa Ash Formation); patchy; older than c. 0.78 Ma (magnetically reversed)
- Cream-coloured ignimbrite; up to 1020 m thick. Three main units: Ongatiti Ig., Rocky Hill Ig., Kidnappers Ig., aged from c. 1.2 to c. 1.0 Ma.

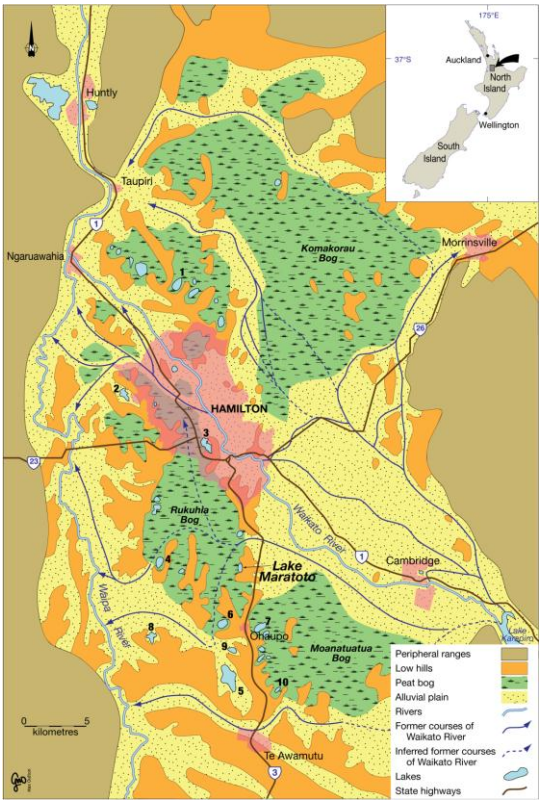


Figure 5: Peat bogs and previous river channels across the alluvial fan of the Hinuera Surface (from Lowe, 2010).

Holocene Sediments

A break-out flood following the Taupo Eruption formed distinctive terraces along the river in Hamilton, widespread flood deposits elsewhere, particularly north of the Taupiri Gap, and blocked the outlet of many tributary streams. In many places these deposits are coarse pumice gravels, elsewhere they comprise reworked sands and gravels eroded from the Hinuera Formation. Similar colluvial materials are found in the floors of the narrow adjoining the Waikato River. These materials are very young, including modern deposits that are still forming today. They are typically highly variable materials.

Figure 6 gives an overview of the geomorphology and materials of the Hamilton Basin.

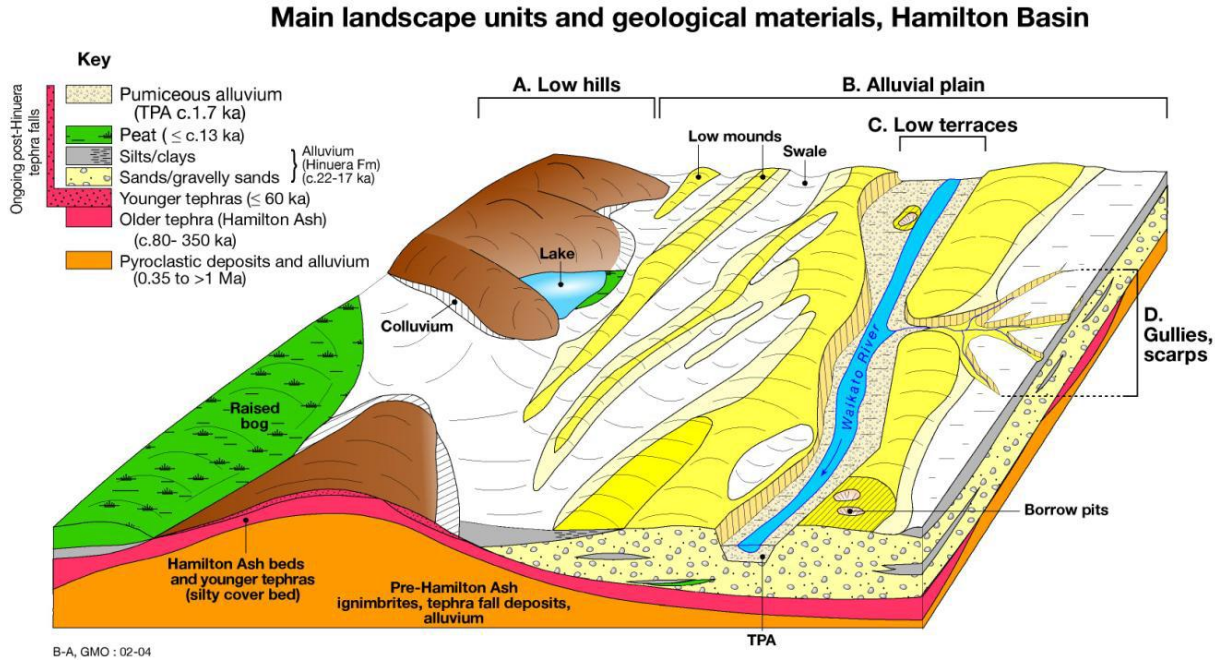


Figure 6. From Lowe, 2010.

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