GEOSCIENCES 09

Annual Conference
Oamaru, NZ

FIELD TRIP 1

GOLD IN CENTRAL OTAGO

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Leader: Dave Craw

Geology Dept, University of Otago

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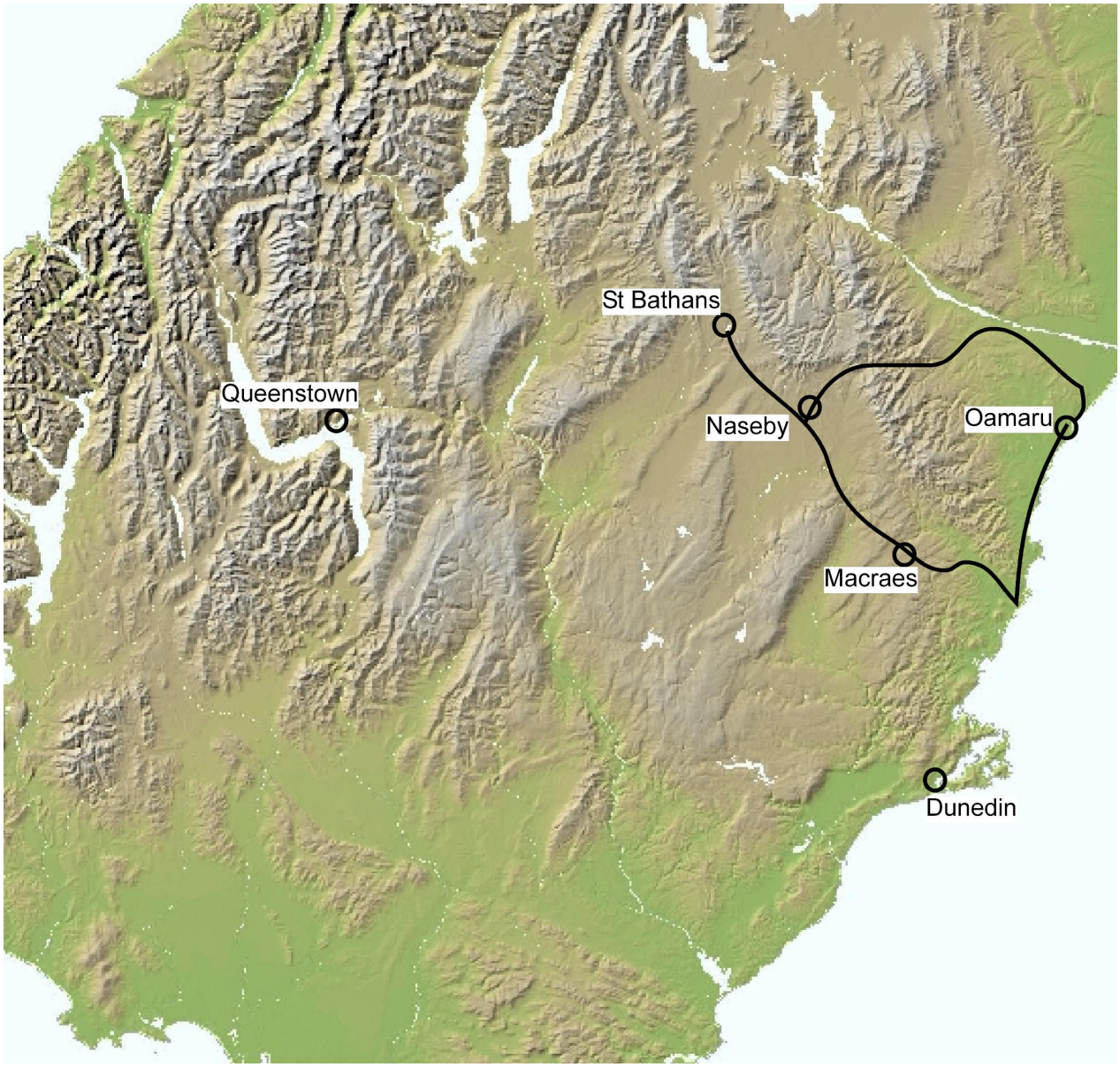
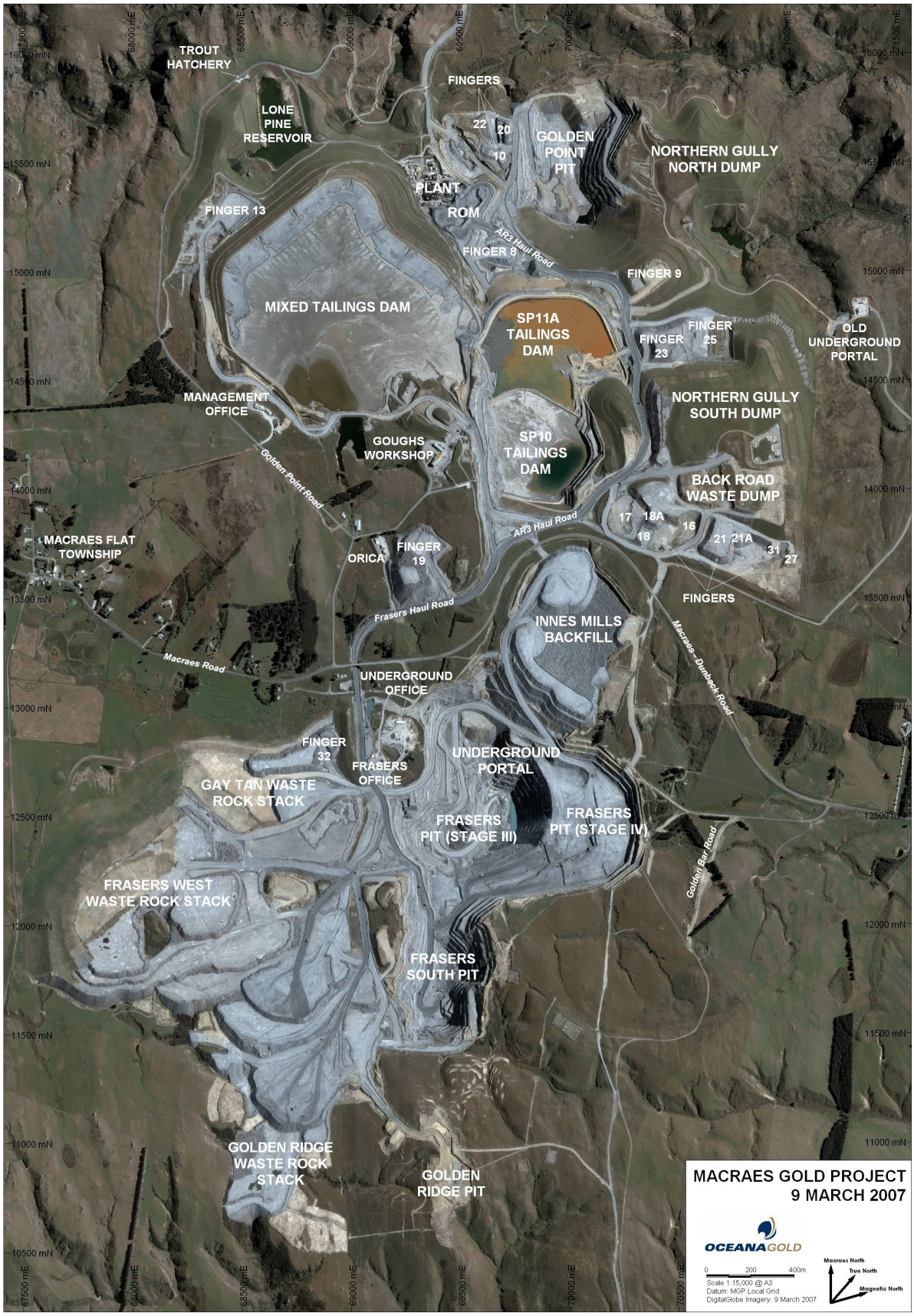
List of contents

This field trip guide consists of a portfolio of papers and information sheets that are related to the trip. (Note: reprints of papers are not included in this volume but will be given out on the trip). The exact itinerary will be subject to weather, time, and travel constraints. The information that is presented here that may be of interest to trip participants, but there is no guarantee that any or all of these things will be visited or visible. Some of the published information on the Macraes mine site is now out of date because of subsequent expansion of pits and production capacity, and updated information will be provided where possible during the day.

 The route maps were derived from Geographx.co.nz.

Field trip route




TROUT HATCHERY
FINGERS
LONE PINE RESERVOIR
22
20
10
GOLDEN POINT PIT
NORTHERN GULLY NORTH DUMP
PLANT
ROM
FINGER 13
AR3 Haul Road
FINGER 8
FINGER 9
MIXED TAILINGS DAM
SP11A TAILINGS DAM
FINGER 23
FINGER 25
OLD UNDERGROUND PORTAL
MANAGEMENT OFFICE
NORTHERN GULLY SOUTH DUMP
GOUGHS WORKSHOP
Golden Point Road
SP10 TAILINGS DAM
BACK ROAD WASTE DUMP
17
18A
18
16
21
21A
31
27
AR3 Haul Road
MACRAES FLAT TOWNSHIP
ORICA
FINGER 19
FINGERS
Frasers Haul Road
INNES MILLS BACKFILL
Macraes - Dunback Road
Macraes Road
UNDERGROUND OFFICE
FINGER 32
FRASERS OFFICE
UNDERGROUND PORTAL
GAY TAN WASTE ROCK STACK
FRASERS PIT (STAGE III)
FRASERS PIT (STAGE IV)
Golden Bar Road
FRASERS WEST WASTE ROCK STACK
FRASERS SOUTH PIT
GOLDEN RIDGE WASTE ROCK STACK
GOLDEN RIDGE PIT
MACRAES GOLD PROJECT
9 MARCH 2007
OCEANAGOLD
0 200 400m
Scale 1:15,000 @ A3
Datum: MGP Local Grid
DigitalGlobe Imagery: 9 March 2007
Macraes North
True North
Magnetic North
Created by: H. Petry 20070510 Workspace: M_A3_SiteSatelliteMGPG_20070313.wor

Route Guide

When we leave Oamaru, we will follow SH 1 along the coast to Palmerston. The road is on Tertiary marine sediments for most of the way, then on Cretaceous nonmarine sediments near Palmerston. Prominent hills near Palmerston have remnants of Miocene alkaline volcanic rocks on their tops.

We turn inland from Palmerston on SH 85, and follow the Waihemo Fault Zone to Dunback. This fault zone separates weakly cleaved greywacke (to northeast) from pervasively foliated schist (to southwest). The fault zone has predominantly normal offset (Cretaceous), but late Cenozoic reversal has caused development of the prominent scarp of the Kakanui Range (up to 2 km high) formed by uplift of the low grade rocks on the NE side.

If the weather is fine, we will drive up Stoneburn Road (turn left just before Dunback). From the junction with Golden Bar Road, we will be on the low-relief regional unconformity on top of the schist basement. The schist and unconformity will dominate our views for most of the day. The Mesozoic Otago Schist metamorphic belt is dominated by metasedimentary rocks. There is a strongly-developed foliation which is shallow-dipping. This foliation and its effects on landforms are visible out the van windows all the way, especially as tors at the unconformity surface.

The flat unconformity surface is a combination of: a low relief nonmarine unconformity between schist and channelized quartz gravels (Cretaceous to Eocene); and the wave-cut marine Waipounamu Erosion Surface. Remnants of cemented quartz gravels from channels on the unconformity are scattered on many hillsides that we will pass during the day.

As we drive along Golden Bar Road, we will be following the Hyde-Macraes Shear Zone, which is a major regional structure to the southwest of the road. The Macraes mine is being developed in the shear zone (up to 250 m thick) that is parallel to the regional foliation, and dips gently northeast. The shear zone is cut off below by a major low-angle Cretaceous normal fault that juxtaposes upper greenschist facies rocks (to the southwest) against lower greenschist facies rocks (to the northeast).

At the mine, mineralised shear zone rocks are difficult to distinguish from unmineralised host schist by the casual observer. Some of the highest gold grades occur in black graphitic shears (up to 5 m thick), and these dark rocks are the best indicators of mineralised zones when viewing pit walls. Whether or not these are visible from our viewing site depends on light angle and dampness of the pit walls; it is an extremely subtle distinction. More details of mineralised rocks are contained in attached papers.

The Macraes site was first mined in the 19th century in underground tunnels, some of which are still preserved near the modern mine site. Tunnels are visible, but not accessible, from the historic mineral processing site at Deep Dell. This Golden Point historic reserve is administered by Department of Conservation. A working stamper battery (not operating when we visit) can be viewed at the site.

Beyond Macraes, we drive over schist hills to Hyde. The Hyde-Macraes Shear Zone is to the northeast of the road all the way to Hyde, where the shear zone is covered by remnants of Tertiary sediments and volcanic rocks. We join SH 87, which takes us over the Tertiary rocks into

the Maniototo basin, where we rejoin SH 85. This road continues to run parallel to the Waihemo Fault Zone, now as a related structure, the Hawkdun Fault Zone. The high scarp of this fault zone dominates the view to the northeast, where it has uplifted greywacke ranges. The fault zone along which we are driving represents an important structural boundary in central Otago. Most of central Otago is dominated by broad northeast-trending folds of the schist basement, regional unconformity, and overlying Tertiary sediments. The ranges to our left (southwest) are all antiformal ridges separated by synformal basins. In contrast, the high scarps to the right (northeast) have a northwest strike, perpendicular to the folded ranges. This is Graeme Sydney country, along the famous Otago Central Rail Trail.

We leave SH 87 where it turns from this structural zone to run southwest down the Manuherikia valley. We continue to drive parallel to the Hawkdun Fault Zone, which cuts Miocene fluviolacustrine sediments (exposed in stream banks) and Pliocene molasse conglomerates (brown cliffs). St Bathans and Blue Lake are the site of a historic alluvial gold mine. The mine followed gold-rich zones near the base of channelized Miocene quartz gravels, cut into the regional unconformity/Waipounamu Erosion Surface. Remnants of the quartz gravels and underlying unconformity are exposed around the lake.

From St Bathans, we return to SH 85 and retrace our earlier route to the Maniototo basin and a turnoff to the left (northeast) to Naseby. The Naseby alluvial goldfield was developed in Pliocene molasse deposits, the Maniototo Conglomerate, formed as alluvial fans as the greywacke ranges rose to the northeast. The gold was derived from erosion of the auriferous quartz gravels that rested on the regional unconformity. Abundant boulders of cemented quartz gravels occur within the sediments at Naseby, and in the front gardens of most of the inhabitants.

Beyond Naseby, we follow a complex faulted zone to Dansey Pass. The faulted zone has disrupted the basement and Tertiary rocks with a northerly strike, at a high angle to the northwest-striking Waihemo-Hawkdun fault system. This faulted zone hosts the Cretaceous nonmarine Kyeburn Formation, a >3 km thick pile of immature angular conglomerate ("breccia") formed when the faults were initiated in the mid-Cretaceous. This deposit forms the pink cliffs along the Kye Burn as we drive north.

Gold workings in this area are at two principal unconformities:

1. The regional unconformity on basement and Kyeburn Formations, where channels of quartz gravels contained placer gold.
2. Where Quaternary gravels unconformably overlie older rocks. The gold was recycled into the Quaternary gravels during erosion of a range of older rocks. This unconformity was called the "Maori Bottom" historically.

Beyond Kyeburn, we follow schist gorges that have been extensively worked for gold in the active stream and on strath terraces. We cross Dansey Pass and descend through steep greywacke gorges to the Tertiary sequence of the Waitaki valley. Mid-Tertiary limestone ("Oamaru Stone") and basalt caps dominate the scenery as we drive back to Oamaru.

Geomorphological features of central Otago

Quaternary antiforms (ridges) and synforms (basins) of schist foliation, regional unconformities, and Tertiary sediments, have a northeast trend. The folds become tighter and ridges more dissected towards the west, where faults (along range margins) begin to dominate. Greywacke ranges in the northeast corner of the map are being uplifted along northwest-striking fault zones. The field trip mainly follows the boundary between these different structural domains.