Ministero dell'Istruzione, dell'Università e della Ricerca
Programma Nazionale di Ricerche in Antartide

ANTARCTIC GEOLOGICAL 1:250,000 MAP SERIES

SEQUENCE HILLS QUADRANGLE (VICTORIA LAND)

2012

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GIGAMAP
GERMAN-ITALIAN GEOLOGICAL ANTARCTIC MAP PROGRAM
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Museo Nazionale dell'Antartide
Sezione di Scienze della Terra - Siena (Italy)

EXPLANATION

m — Scree, glacial drift and moraine (m). Quaternary.

POST-ROSS MAGMATISM AND SEDIMENTATION

FERRAR VOLCANIC SUITE

Fd — FERRAR DOLERITE (Fd)
Tholeiitic dolerite sills and minor dykes, usually intruded in the sedimentary sequence of the Beacon Supergroup, immediately above the pre-Beacon peneplain. Black lines (omitted in the cross sections): major lenses and seams (meanly some ten metres thick) of Section Peak Formation sandstones forming sandwich type interlayers within the Ferrar Dolerite sills. A K/Ar age of 174±10 Ma has been reported from Archambault Ridge (Mount Murchison quadrangle).

BEACON SUPERGROUP

Sf — SECTION PEAK FORMATION (Sf)
Mainly fluviatile, cross-bedded, coarse- to medium-grained sandstone with a feldspathic to quartzose composition. Minor intercalations of conglomerate, black shale, carbonaceous or noncarbonaceous silty mudstone and minor coal occur as well. A Middle to Late Triassic age is inferrable by the presence of *Dicroidium odontopteroides* at Vulcan Hills (Mount Murchison quadrangle) and *Dicroidium zuberi* and *Dicroidium odontopteroides* at Benson Knob (Mount Joyce quadrangle). In this quadrangle, at the Section Peak locality, an Early Jurassic age based on palynomorphs has been obtained.

TERRANES AND UNITS OF THE ROSS OROGEN

WILSON TERRANE

GRANITE HARBOUR IGNEOUS COMPLEX

GHgr — GRANITE HARBOUR GRANODIORITE AND GRANITE (GHgr)
Syn-to post-kynematic biotite granite, granodiorite and tonalite intruded in the Wilson metamorphic complex before 480±20 Ma (cooling ages).

GHt — GRANITE HARBOUR TONALITE (GHt)
Gabbro, tonalite, diorite and granodiorite suite affected by a more developed foliation. An age of 505.0±8.3 Ma has been obtained from samples south of Whitcomb Ridge (Mount Murchison quadrangle).

WILSON METAMORPHIC COMPLEX

Wg — GREENSCHIST FACIES METASEDIMENTS (Wg)
Metasandstone, slate, phillyte and metalimestone, often contact metamorphosed. The age is unknow, but a Precambrian-Lower Cambrian age is inferred. Local name: Priestley Formation.

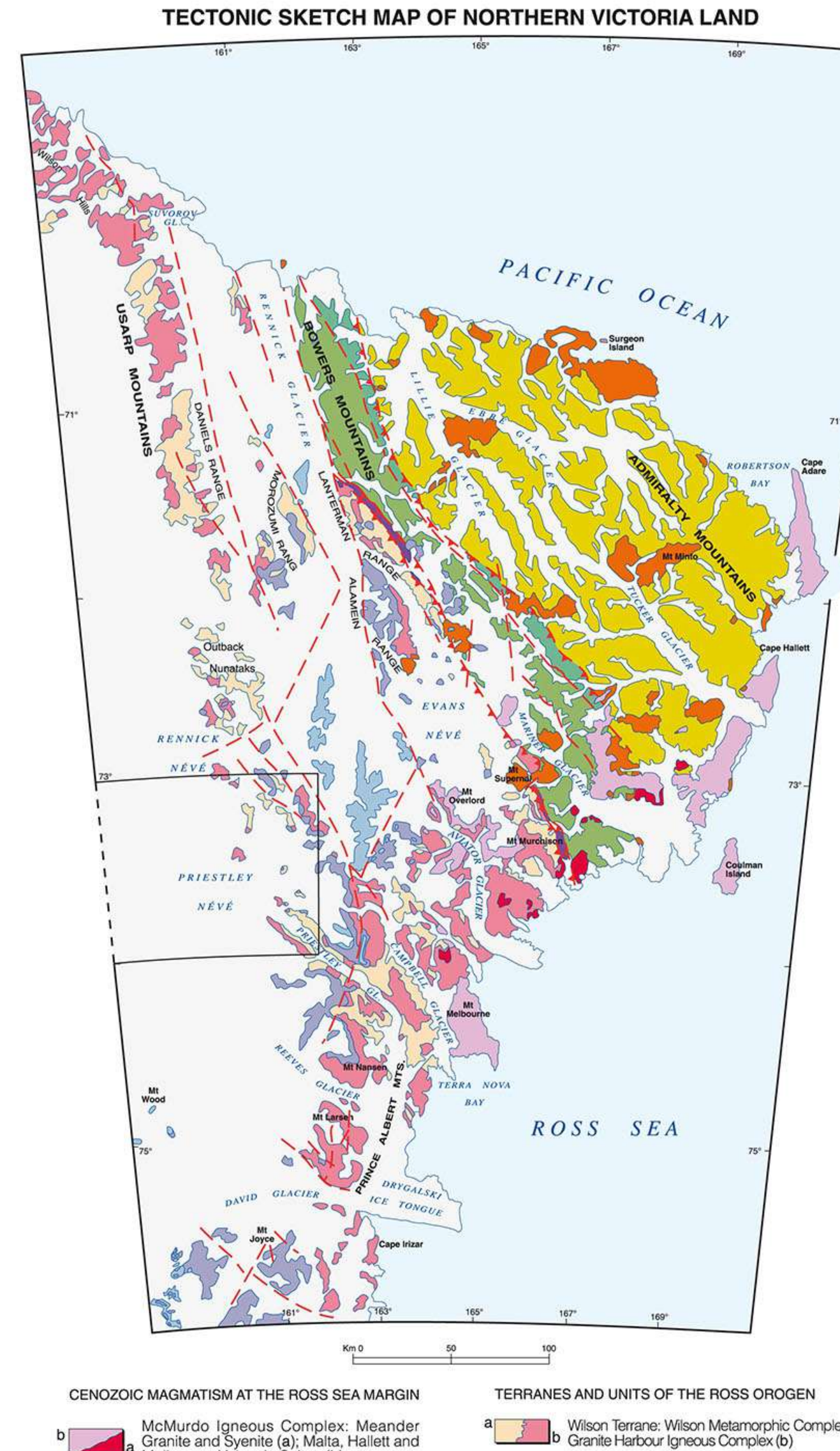
Wa, mb — AMPHIBOLITE FACIES METASEDIMENTS (Wa)
Fine to medium-grained biotite schist with minor intercalations of quartz-biotite metasandstone; major marble lenses (mb) occur in the northeastern slope of Barren Bluff (Sequence Hills).
Biotite cooling ages indicate that metamorphism is older than 480 Ma. Local name: Rennick Schist.

Wmg — MIGMATITE GNEISS (Wmg)
Stromatic migmatite with minor agmatitic varieties, hornblende gneiss including some small and irregular amphibolite layers, and calc-silicate horizons alternating with fine-grained biotite gneiss. Biotite cooling ages around 475-480 Ma.

SYMBOLS

- Geological boundary.
- 12 Bedding
- 30 a, b Regional schistosity and cleavage, (a) inclined, (b) vertical.
- 30 a, b Magmatic fluidality, (a) inclined, (b) vertical.
- 26 a, b Mineral and stretching lineation, (a) plunging, (b) horizontal.
- 30 a, b Fold axis, (a) plunging, (b) horizontal.
- 26 Crenulation fold axis.
- Fault; ticks (on the downthrown side) or arrows where the sense of motion is known.
- Fossil plants and palynomorphs

TECTONIC SKETCH MAP OF NORTHERN VICTORIA LAND

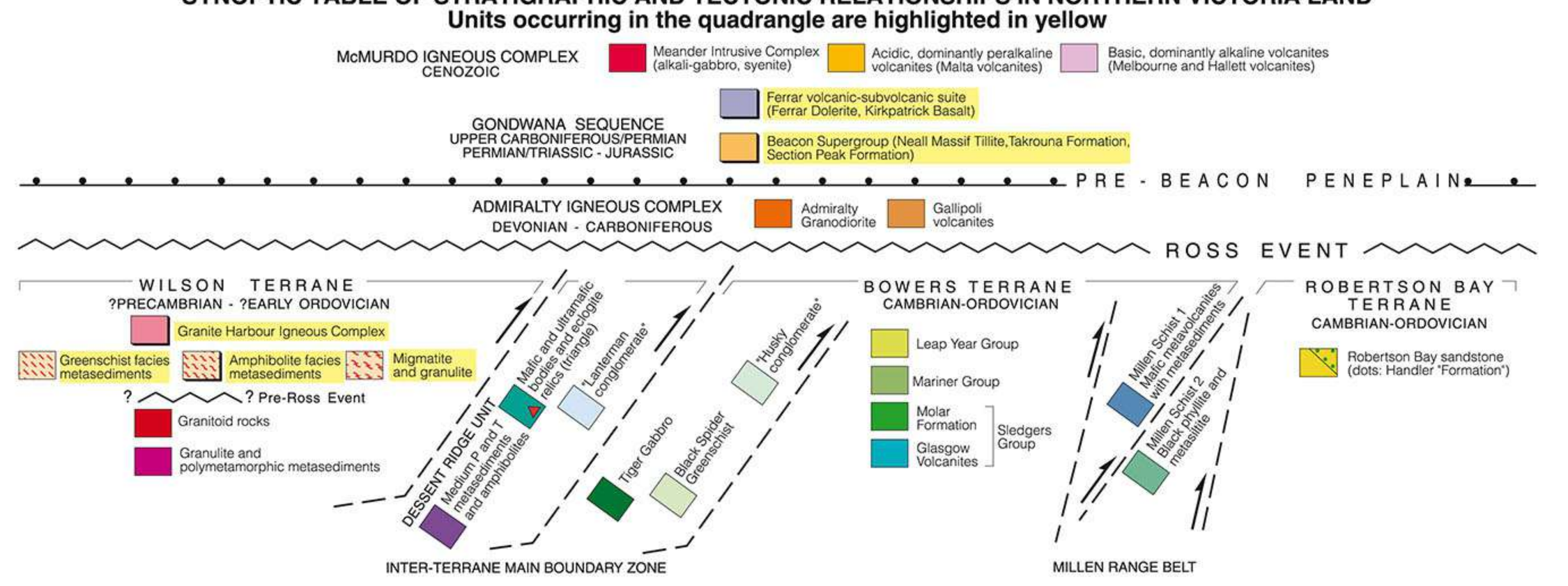


CENOZOIC MAGMATISM AT THE ROSS SEA MARGIN
- a/b McMurdo Igneous Complex: Meander Granite and Syenite (a); Malta, Hallett and Melbourne Volcanic Suites (b)

POST-ROSS MAGMATISM AND SEDIMENTATION
- a/b Kirkpatrick Basalt (a); Ferrar Dolerite and Beacon Supergroup (b)
- Admiralty Igneous Complex
- Thrusts
- Faults

TERRANES AND UNITS OF THE ROSS OROGEN
- a/b Wilson Terrane: Wilson Metamorphic Complex (a); Granite Harbour Igneous Complex (b)
- Dessent Ridge Unit in the Mountaineer Range and possible correlatives at the eastern margin of the Lanterman Range
- Bowers Terrane
- Millen Schist
- Robertson Bay Terrane

SYNOPTIC TABLE OF STRATIGRAPHIC AND TECTONIC RELATIONSHIPS IN NORTHERN VICTORIA LAND
Units occurring in the quadrangle are highlighted in yellow



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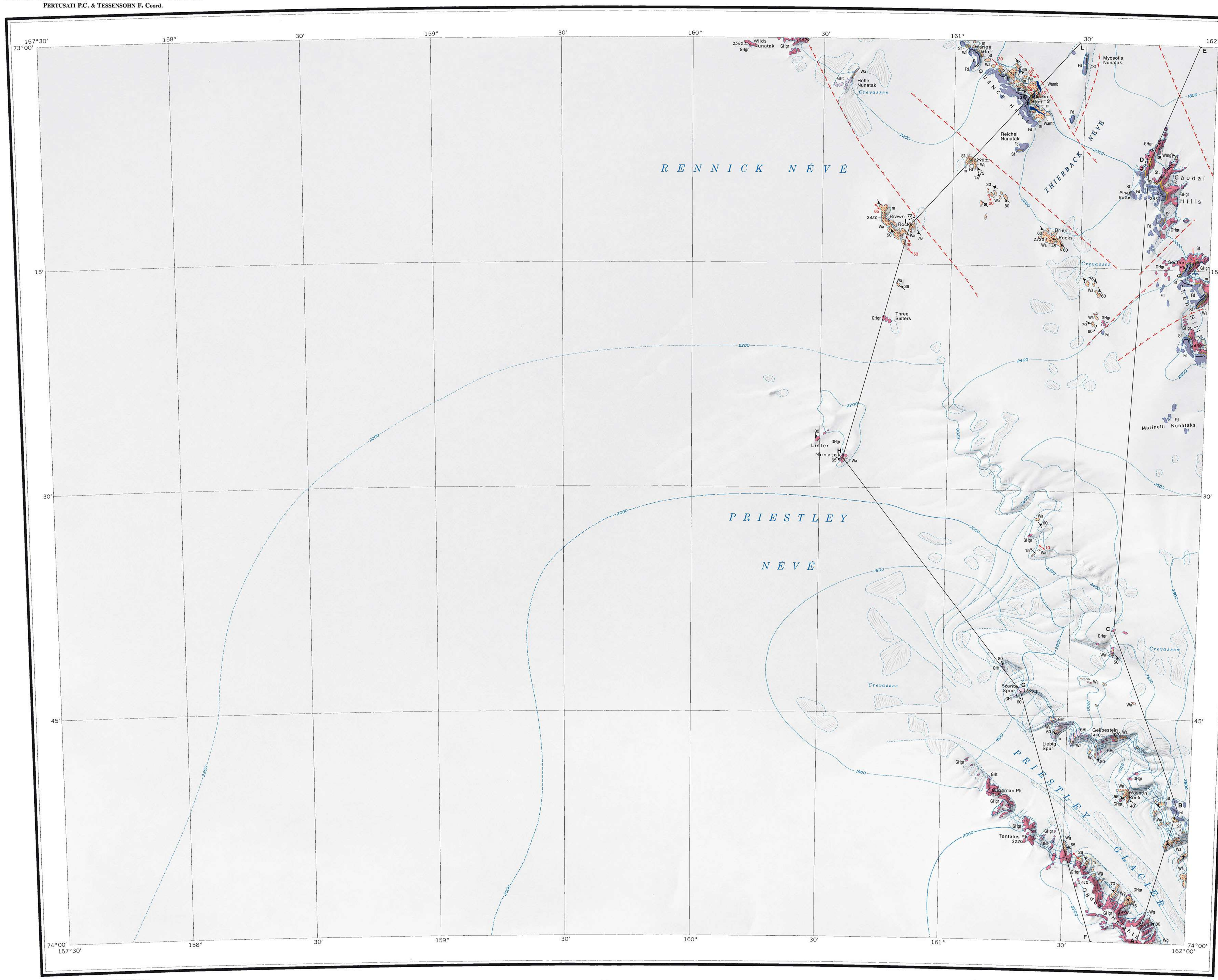
Computer Graphic and GIS by CGT Centro di Geotecnologie - Department of Earth Sciences University of Siena - Drawn by D.Graziosi



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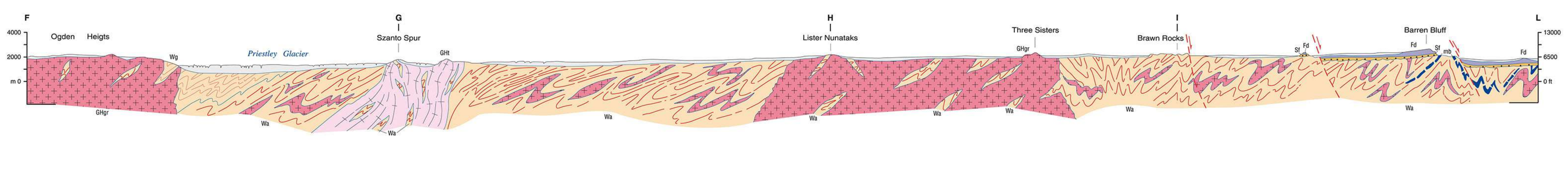
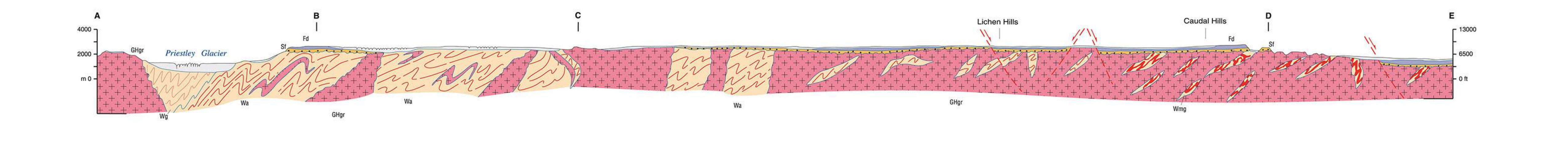
SCALE 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometres

Lambert Conformal Conic Projection - Standard Parallels 72°40' and 75° 20' - Contour Interval 200 Meters - Datum is mean sea level





Prestampa e stampa: LITOGRAFIA ARTISTICA CARTOGRAFICA - Firenze

GEOLOGICAL OUTLINES

PREVIOUS WORK

The first geological informations concerning the surrounding area of the Sequence Hills can be attributed to David, Mawson (geologists) and MacKay (physician) who crossed the Reeves Glacier area on their journey to the South Magnetic Pole during Shackleton's British Antarctic Expedition 1907-09. They crossed the Prince Albert Mountains through Backstairs Passage and Larsen Glaciers (David, 1909). On the Mount Nansen, Eisenhower Range, they reported the presence of sediments actually included in the Beacon Group (Gair 1964). Weihaupt (1961) described the Welcome Mountains, just North of the Sequence Hills quadrangle, as consisting of quartz-feldspar schists and gneisses intruded by granitic rocks. The geological results of the New Zealand Geological and Survey Antarctic Expedition of 1962/63 (northern party) undertaken along the Mariner Glacier to the south and the upper Campbell and Rennick Glaciers to the north with sampling of the rocks between Vantage and Sequence Hills were published by Gair (1964). A Geological map at scale 1:1.000.000 and geological observations of the same area have been later published by Gair (1967).
The sediments on top of the metamorphic basement, interpreted as beds within the Kirkpatric basalts formation (Ferrar Group), were studied by Gair et al. (1965). From palynological studies by Norris (1965) the arenitic sediments at Section Peak in the Lichen Hills were assigned to an Early Jurassic age. Further reconnaissance programs were undertaken during the 1981/82 USA-New Zealand-Australia joint International expedition. The Beacon cover rocks in the Vantage and Caudal Hills and at Roberts Butte were visited by Collinson & Kemp (1983), who collected paleocurrent data. Collinson et al. (1986) reinterpteted the basalts as dolerite sills and established the sedimentary strata as a new formation, the Section Peak Formation, within the Victoria Group. They used the same Section Peak locality of Gair et al. (1965) as the type-section, however in the description of the new formation they inferred a Late Triassic age from the palynomorph assemblages. Grew and Sandiford (1982) worked on Sequence Hills and Elliot, Siders, Faure & Taylor (1982) studied the Ferrar Dolerite in the Lichen, Vantage and Exposure Hills.
The detailed geological data collected by German Geologists during GANOVEX IV (1984/85) expedition on the western border of the transantartic mountains between the Outback Nunataks and Reeves Glacier, were published with schematic geological map in 1989 by Roland, Olesh & Schubert. The Italian research group published in 1988 a geological map at scale 1:500.000 encompassing the area of the Sequence Hills quadrangle (Carmignani et al., 1987). In this map the Priestley Schist of Roland et al. (1989) is subdivided in the low-grade Priestley Formation (sensu Skinner 1983) and in the amphibolite facies Priestley Schist equivalent of Rennick Schist. In 1989 the Reconnaissence geological map of the Welcome Mountain quadrangle (just to the North of Sequence Hills) at 1:250.000 scale compiled by Stump was printed. More recent works related to the paleozoic basament and Meso-Cenozoic cover sequence are the following: Musumeci et al., (2006), Bomfleur et al., (2007), Schöner et al., (2007), Faure & Mensing (2010), Goodge & Fanning (2010), Bomfleur et al., (2011), Schöner et al., (2011).

SHORT DESCRIPTION OF GEOLOGY

The Sequence Hills quadrangle encompasses an early Paleozoic basement (Ross Orogen) and a prevailing flat-lying cover spanning from Permian-Triassic to Quaternary time with large stratigraphic gaps. The basement consists of the Wilson Terrane (WT) including low-medium to high-grade metamorphic rocks, intruded by large bodies of Late Cambrian granites. After the Ross Orogeny the area underwent uplift and erosion. After the Admiralty-Gallipoli magmatic event (occurring in the nearby Freyberg Mountains quadrangle) the area was newly uplifted and eroded. On the resulting peneplain surface the Carboniferous-Permian Tillite (Neall Massif Tillite) of Gondwanian pertinence and subsequent Section Peak Formation (Beacon Supergroup) was deposited, and in turn was covered by large flows of the Jurassic Kirkpatrick Basalts. The coeval Jurassic Ferrar Dolerite formed sills chiefly along the basal Beacon horizon. There are no existing records of the youngest event in the Sequence Hills quadrangle consisting on the emplacement of Meander alkali-granite and syenite and of Melbourne alkali-volcanic suite, which pertains to the Cenozoic McMurdo igneous complex.

LITHOSTRATIGRAPHY

WILSON TERRANE
Metamorphic Complex
Greenschist facies metasediments (Wg) (local name: Priestley Formation) consist of metasandstone, slate, phyllite and metalimestone, often contact metamorphosed, that crop out along the northwestern side of Priestley Gl. at the foot of the slope of the Ogden Heigth area and farther South along the western side of the Priesley Glacier up to the O'Kane Canyon area. Major metalimestone lenses occur at north of Mt. Baxter (the last two localities are in the Mount Melbourne quadrangle). This Formation has been correlated in Antarctica with metasediments cropping on Mount Murray near Mawson Glacier (Ricker, 1964) and in Oates Land (some 600 km along to strike to NW) with similar outcrops corresponding partially to the Berg Group of Klimof & Soloviev, in Ravik et al. (1968). Outside Antarctica the Formation is considered probably connected with Kanmantoo Basin (Australia). The Pristley Formation is interpreted to be the result of deposition in a sinking foredeep basin at the Pacific border of Gondwana Land filled by siliciclastic to calcareous turbidity currents probably derived from erosion of the East Antartic Craton and its marginal shelf (Casnedi & Pertusati, 1991). These rocks are affected by a low-grade regional metamorphism (chlorite zone) which were extensively overprinted by contact metamorphism (by Cambrian- Ordovician plutons), ranging in metamorphic grade from the albite-epidote-hornfels facies to the pyroxene-hornfels facies. Pressure estimates for the hornblende-hornfels facies are between 2 and 3Kb.
Amphibolite facies metasediments (Wa) (local name: Pristley Schist-Rennick Schist, respectively South and North of Rennick Gl - Campbell Gl divide in the map of Roland et al., 1989) are fine to medium grained biotite-micaschist and quartz-biotite paragneiss. They are mainly exposed along north eastern side of the Upper Priestly Glacier and northward up to Sequence Hills. Along the Priestly Glacier they crop out within an elongated belt with an intermediate structural position between the low-grade and the high-grade complexes. The lithological association of this complex tipically consists of dominant paragneisses, quartzites and quartzitic schists and minor granodioritic orthogneisses, calc-silicates rocks and amphibolites. The metamorphic parageneses observed in this complex pertain to the upper part of the amphibolite facies of relatively low-pressure metamorphism. Temperature and pressure conditions have been constrained by mineral compatibilities between 650 - 730°C and nearly 5Kb respectively.
The most common mineral assemblage of metapelites is quartz-plagioclase-K-Feldspar-muscovite-biotite-cordierite-garnet-sillimanite/fibrolite. Accessories are apatite, tourmaline, zircon and opaques.In the more basic material and calcsilicate the mineral assemblage is 1) green-brown horneblende-plagioclase-quartz-sphene ± diopside ± biotite 2) diopsidic clinopiroxene-plagioclase-quartz-epidote (Roland et al., 1989).
Migmatite gneisses (Wmg) consist of stromatic migmatite with minor agmatitic varieties, hornblende gneiss including some small and irregular amphibolite layers, and calc-silicate horizons alternating with fine-grained biotite gneiss. Migmatite gneisses occurs in scattered outcrops floating in the granitoids at Caudal Hills near the tip of Folk and Moore Ridges. The attribution of these outcrops to migmatite gneiss is not certain for extensive overprinting of contact metamorphism due to intrusion of the cambro-ordovician granitoids.
The protoliths of all the metasediments are from a very thick sequence of fine-to medium-grained siliciclastic sediments with subordinate interlayered carbonate rocks (Precambrian-? Cambrian) that underwent metamorphic re-equilibration at different metamorphic grades during the Ross Orogeny (Casnedi & Pertusati, 1989; Castelli et al., 1997; Lombardo et al., 1987; Skinner, 1989).
The structural evolution was coupled with a high-temperature/low-pressure synkinematic metamorphism, which in the monometamorphic complex is prograde from greenschist (chlorite-biotite zone) in the Priestley Formation to amphibolite facies with development of migmatites (garnet - cordierite - K-feldspar zone) in the Priestley Schists. The prograde transition from andalusite to sillimanite-bearing assemblages defines an anticlockwise PT path and the occurrence of kyanite - quartz-bearing veins is consistent with a nearly isobaric retrograde evolution (Palmeri et al., 1994). According to Skinner and Estrada (2002) the growth of kyanite might be related to local overpressure occurring within fluid-filled quartz veins. During the Ross-orogeny low pressure/high temperature metamorphism, under amphibolite facies condition (5 kbar, 600°C) developed. The estimated metamorphic conditions for the monometamorphic complex range from P<2.5 kbar and T = 300 - 450°C in the chlorite-biotite zone to P = 4.5 kbar and T = 700 -750°C in the garnet - cordierite - K-feldspar zone, with a corresponding geothermal gradient of 45 - 55°C/km (Talarico et al., 1992). The pattern of isograds and the distribution of metamorphic zones in the Sequence Hills, are nearly parallel to the structural trend, with the metamorphic grade increasing across strike. To the east of the Caudal Hills area the metamorphic grade increases along and across strike with a dome-like arrangement of isograds characterised by medium and high grade metamorphic rocks contouring a zone of low grade rocks extending from Mt. New Zealand (Mt Melbourne quadrangle) to the southern corner of this quadrangle.

Granite Harbour Igneous Complex
The geological researches and reconnaissance mapping of North-Central Victoria Land, summarized by Gair et al. (1969) and Nathan & Skinner (1972), showed that three Batholiths crop out in this region: 1) the northern dominantly granitic-granodioritic, Campbell-Aviator Batholith (Nathan, 1971) between the Campbell Glacier and Mountaneer Range; 2) the central, strongly composite, Terranova Batholith comprising the Plutonic suites exposed at Terranova Bay and in the Deep Freeze Range (Skinner1972, 1983b,c). The composition of these plutons ranges from syenogranite to quartz-monzonite but also mafic rocks (quartz-diorite and gabbro) are locally abundant. Ultramafic Ol-Opx occur in the mafic Boomerang pluton (Skinner 1972); 3) the much larger South Victoria Land Bathotlith cropping out between Priestley and David Glaciers and farther S well beyond the mapped area. In the Eisenhower Range and farther South this batholith is characterized by the association of foliated syntectonic Larsen granodiorite with post-tectonic granite. The three batholiths represent a tipically calc-alkaline orogenic suite and the dominant rock type is metaluminous biotite granite and granodiorite.
Borg et al. (1987) and Kleinschmidt et al. (1987) distinguished in WT two parallel belts of granitoids :1) an eastern I-type belt adjacent to the boundary with Bowers Terrane and mostly confined to the medium pressure metamorphic rocks; 2) A western S-type belt occurring mostly in the low-pressure metamorphic rocks. The spatial distribution of the granitoids distinguished in terms of I and S-types is debatable. Taking into account the more complex distribution of magmatic rocks, Biagini et al. (1991) provided a more detailed picture of the intrusions in the area from Priestley Glacier to the Northeastern Aviator Glacier. In this area, a belt of peraluminous granites has been distinguished within the metaluminous granitoids of the Campbell-Aviator Batholith. This belt broadly running NW-SE from Tinker Glacier to divide of Campbell-Rennik Glaciers and farther North in the Western shoulder of Rennik Glacier, consists of syn-to post-kinematic peraluminous intrusions coeval with the metaluminous association.
A pure crustal origin (partial melting of metasedimentary and - or felsic metaigneus rocks) is suggested for the peraluminous association.
The granitoids cropping out in the Sequence Hills quadrangle along the western side of the Rennik Glaciers belong to the group of peraluminous post kinematics intrusions. Inside this group a further subdivision has been proposed (Biagini et al., 1991a, 1991b):
a) Tinker type granite (TTG) constituted mostly by strongly peraluminous medium grained granodiorites and monzogranites characterized by Al-rich biotite ± muscovite ± garnet and by metasedimentary inclusions, high K_2O/Na_2O and Rb/Sr ratio;
b) Archambault type granite (ATG) constituted by moderate peraluminous monzogranites characterized by Al-rich biotite ± muscovite and by occurrence of microgranular mafic inclusions, low K_2O/Na_2O and Rb /Sr ratios.
Granite Harbour Granodiorite and Granite (GHgr). The intrusives cropping out along western shoulder of Rennik Glacier belong to Archambault type granite (ATG: Biagini et al., 1990) and are constituted by generally massive to coarse grained monzogranite to granodiorite sometimes with K-feldspar megachryst. Toward N they extend to the Frontier Mountains, Outback Nunataks, Daniels Range up to Pacific coast. From south to the north the plutons loose the continuity and locally show abundant xenolith, usually W or SW dipping, ranging in size from few centimeters up to tens of meters. This situation is well exposed in the eastern tip of the ridges of Caudal Hills, Hofle Nunatak and Wilds Nunataks were an impressive number of veins and irregular bodies cut the metamorphic rocks; sometimes lit-par-lit structures are developed. Aplites and tourmaline pegmatites intrude both metasediments and granites. Some aplite veins strongly folded with metasediments or stretched and boudinaged along regional schistosity could be interpreted as an older aplite generation pre Granite Harbour Intrusives (Roland et al., 1989).
The isolated ouctrops of Lister Nunatak are constituted by Pristley-Rennick Schists crossed by a network of sills and veins and cut by intrusives. The intrusives are constituted by garnet-bearing grano-diorite containing microgranular mafic inclusion.
Granite Harbour Tonalite, Diorite, Gabbro (GHt). These rocks occur in two main outcrops. The northernmost isolated and situated south east of the Frontier Mountains at Hofle Nunatak is locally foliated and belong to the tonalite field (Roland et al., 1989). The southernmost outcrops occur along the easthern side of the Upper Priestly Glacier in the Geipelstein and Liebig Spur area. This intrusion plots in quartz-gabbro, gabbro-diorite and tonalite field. It is locally strongly foliated and contains numerous sedimentary xenoliths deriving from surrounding Rennick Schist. These rocks are characterized by pronounced stretching and mineral lineations and by a SW dipping foliation, with magmatic to high-temperature solid-state deformation features pointing out a synkinematic emplacement (Musumeci and Pertusati 2000). All the intrusions are cut by tourmaline pegmatites locally some meters thick and minor aplites broadly striking NW-SE and dipping to the west.
The Rb/Sr whole rock-biotite isochron for the samples collected from gabbrodiorite body west of spot height 2440 m gave an age of 472±14 Ma (Borsi et al., 1989).

BEACON SUPERGROUP
The base of the Beacon Supergroup is represented by a remarkable peneplain surface which is equivalent to, but younger than, the Kukri Peneplain as defined in the Dry Valleys (Barrett et al., 1986). Above this surface the clastic Beacon deposits unconformably rest on many lithotypes of the underlying basement. The Beacon Supergroup rocks occurring in this quadrangle belong to the Section Peak Formation (Collinson et al., 1986).

Section Peak Formation
This clastic formation (Sf) forms a 30-50 m-thick sequence of arkosic sediments which lie above the peneplaned surface of the Early Paleozoic WT and intruded at different levels by the Ferrar Dolerite. The Section Peak Formation is well exposed in Lichen, Caudal, Sequence Hills and farther North up to Morozumi Range. Minor outcrops occur to the south along the eastern side of high Priestely Glacier. Farther south it is extensively exposed in the Deep Freeze Range and Eisenhower Range. The recent founding of *Dicroidium odontopteroides* at the Vulcan Hills, Mount Murchison quadrangle, (Tessensohn & Mädler, 1987) confirms the already known Middle to Late Triassic age.
The sedimentary strata at Section Peak in the Lichen Hills were first sampled and studied by Gair et al. (1965), and from palynological studies by Norris (1965) they were assigned an Early Jurassic age. Subsequently Collinson et al. (1986) in the same outcrops established a new formation: the Section Peak Formation attributed to the Late Triassic age. Casnedi et al., 1994; Casnedi & Di Giulio (1999); Di Giulio et al., 1997 attributed a Middle Jurassic age to the Section Peak Formation on consideration that some igneous layers, interpreted by Collinson et al., 1968 as dolerite intrusions, represent basaltic flows (171±5 Ma - K/Ar, Skinner Ridge) emplaced during the deposition of the Section Peak Formation. This attribution to the Jurassic age is indirect and supported by the hypothesis of pene-contemporaneity of basaltic flows and deposition of Beacon sandstone. A further Italian Antartic expedition sampled again the sedimentary strata intruded by Ferrar Dolerite in the same section studied by Norris (1965). The samples yelded a palynoflora with the presence of *Corollina torosa* supporting an Early Giurassic age. These results (Pertusati et al., 2006) confirm Norris's (1965) previous age assessment reaffirming that the Section Peak Formation and consequently the Beacon Supergroup extends into Early Jurassic. Bomfleur et al., 2007, Bomfleur et al., 2011 and Schöner et al., 2011 confirm the Jurassic age of upper part of the Section Peak Formation. Moreover detrital zircon ages suggest that the deposition of the Section Peak Formation continued until the Early-Middle Jurassic (Goodge & Fanning 2010).

FERRAR VOLCANIC SUITE
Ferrar Dolerite
The Ferrar Dolerite (Fd) consists of tholeiitic dolerite sills and minor dykes, usually emplaced at different levels; moreover the sills are very thick (some tens of meters) and form cliffs with intersecting typical vertical cooling fractures that produce spectacular columnar joint. In this quadrangle several meter-thick lenses of sandstone belonging to the Section Peak Formation interlayered with sills characterize the Ferrar Dolerite. Chilled margin can be observed at the contact with host rocks that sometime show evidence of thermometamorphic effect. A K/Ar age of 174± 10 Ma has been reported for these rocks from the Mount Murchison quadrangle (Brotzu et al., 1989).

TECTONICS

ROSS TECTONICS

WILSON TERRANE
The distinctive structural lineaments of the Ross Orogeny in this region are NW-SE trending upright folds with well-developed axial planar cleavages and upthrusts, whereas nappe structures are not observed. Structural evolution occurred through a progressive deformation with two major D1 and D2 deformation phases (Carmignani et al., 1987; Casnedi & Pertusati 1989: Musumeci & Pertusati 2000). The D1 structures, deforming the sedimentary layering, are recognisable only in the lowest grade metamorphic rocks, such as the Priestley Formation cropping out along the northwestern edge of the Priestley Glacier - Ogden Heigth area and farther south in the Foolsmate Glacier, Mount New Zealand and at the head of the O'Kane Canyon (Mount Melbourne quadrangle), where they are represented by hectometers folds gently NE overturned and well expressed axial plane cleavage. The D2 structures are well-developed in medium-and high-grade metamorphic rocks of both the Priestley Schist and the migmatite gneiss, whereas in low-grade rocks they correspond to discrete and spaced shear bands and crenulation cleavage zones. The main structural features can be summarised as follows: (1) NW-SE trending tight to isoclinal upright F1 and F2 folds gently overturned toward NE. The fold axes plunge gently to moderately towards the NW or SE, (2) steeply dipping axial plane foliations, correspond to a slaty cleavage (S1) in low-grade metasediments (Priestley Formation) while S2 evolves from a crenulation cleavage to a well-developed foliation in medium-to high-grade metamorphic rocks (Priestley Schist and high-grade metamorphics); (3) oblique to down-dip mineral and stretching lineations. The former strike NW-SE and plunge gently to moderately toward NW or SE, the latter strike ENE-WSW and plunge moderately toward WSW; (4) NNW-SSE trending asymmetric F2 intrafoliar folds (centimetre to decimetre size) verging toward the NE with axes plunging steeply toward NNW or SSE, (5) NNW-SSE and NW-SE trending ductile and ductile-brittle shear zones and/or fault zones dipping steeply to moderately toward the SW or NE, which are coeval or partly postdate the S2 schistosity. In the Sequence Hills quadrangle the most of the intrusive rocks are emplaced within tectonic structures (thrust fault and strike-slip shear zone) and show magmatic to solid-state foliated fabrics and are locally strongly folded and streched. These features, are interpreted as evidence of synkinematic emplacement during the development of the D2 phase (Musumeci & Pertusati, 2000).

POST - ROSS TECTONICS

The most important and widespread feature related to the post-Ross tectonics is represented by the regional unconformity along the pre-Beacon peneplain surface. This surface is the only record which testifies the renewed post-Admiralty uplift and erosion of the Ross Orogen. This surface is magnificently exposed in the western side of the Rennick Glacier in the Sequence Hills quadrangle and in the Deep Freeze Range and Eisenhower Range farther south (in the last two localities the Beacon Sandstones lie locally on fluvio-glacial deposits of possible Carboniferous-Permian age and tentatively correlated with Neall Massif Tillite). The continuity of this mostly horizontal or weakly (2-3°) W-SW dipping surface is truncated by several normal faults. A main system mostly NW-SE striking and a minor system NE-SW striking. The vertical component of the throw of the main system is between 700 and 900 meters and more if the westerly dipping of the Kukri surface is constant. The vertical throw of a single fault can exceed 200 meters. In the minor system the vertical throw ranges from 200 to 400 meters. These systems of faults individuate well-defined flats at different altitudes corresponding to the vertical displacement of sub-Beacon peneplain. These systems of faults are part of "probably a complex graben" as already envisaged by Gair et al. (1969). Taking into account the faults bordering the eastern side of the Rennick Glacier, the graben should extends over a length of 600 km and is in between 30 and 70 km wide (Roland & Tessensohn, 1987). The deepest part of the graben is in correspondence of the axis of Rennick Glacier and due to East, in front of Sequence Hills, it is in correspondence of a subaerial Kirkpatrick basalts that form the Mesa Range. It is a general agreement that the origin of the Rennick graben is linked to the Mesozoic-Cenozoic tectonic evolution characterized by continental transcurrent faulting, which accommodates the transtensional movements between two symmetric areas of spreading, i.e. the SE Indian Ridge and the mid-Pacific (Salvini et al., 1995; Tessensohn, 1994). This led to the development of normal fault systems and basins, these latter interpreted as pull-apart structures (Tessensohn, 1994).
In the western side of Lanterman Range compressive tectonics (north west verging thrusts) is well evident: the basement overrides the cover rocks with a vertical displacement of 600m. In the southern area (Upper Priestley Glacier) compressive structures consisting of southwest verging fold and thrust affect the Beacon sandstones in Mount Melbourne quadrangle. To the South of Shafer Peak-Mt. Cavaney area, Paleozoic basement and the Section Peak Formation are deformed by NW-SE striking anticline and syncline gently overturned toward southwest. Moreover, at NW of Timber Peak, the basement crystalline rocks and sills of Ferrar Dolerite are thrust southwestward.
In the portion of Sequence Hills situated between Lanterman Range and Upper Priestley Glacier compressive structures could be present. These structures (such as basement onto the cover rocks) have not been clearly detected in the Sequence Hills. Conjugate reverse faults system striking NW-SE and cross cutting the basement has been observed. Only the structural style, the brittle behaviour of rocks with occurrence of cataclasites and direction of faults recall the reverse faults cutting the basemement and the cover rocks in the western side of Lanterman Range and in the Upper Priestley Glacier. However, although no certain geometric relationship was observed in the field between extensional and compressive structures, the last could be linked to the strike-slip motions active during the development of the pull-apart basins as proposed by Tessenshon (1994). The age of both compressional and extensional tectonics is not well constrained; it is post Ferrar Dolerite and Kirkpatrick Basalts emplacement.
Evidences of a more recent extensional tectonics of Cenozoic age, associated to the emplacement of McMurdo Igneous Complex and to the spreading of the Ross Sea, have not been detected.

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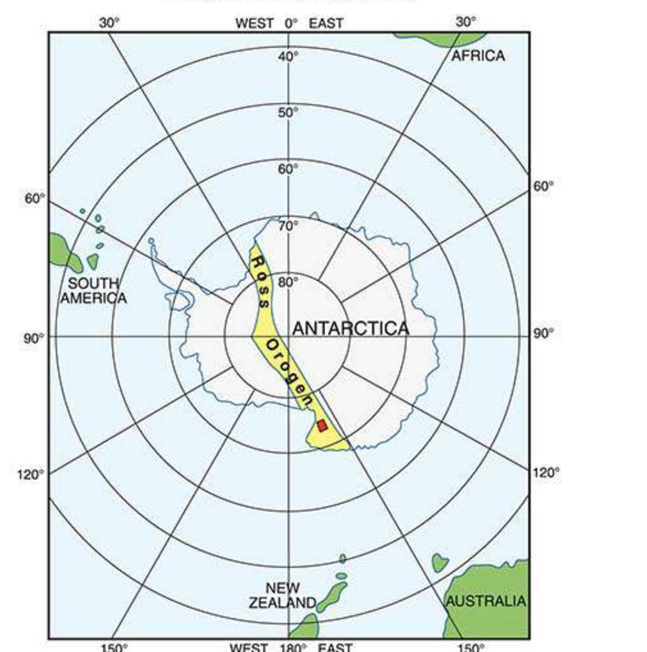
LOCATION DIAGRAM



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