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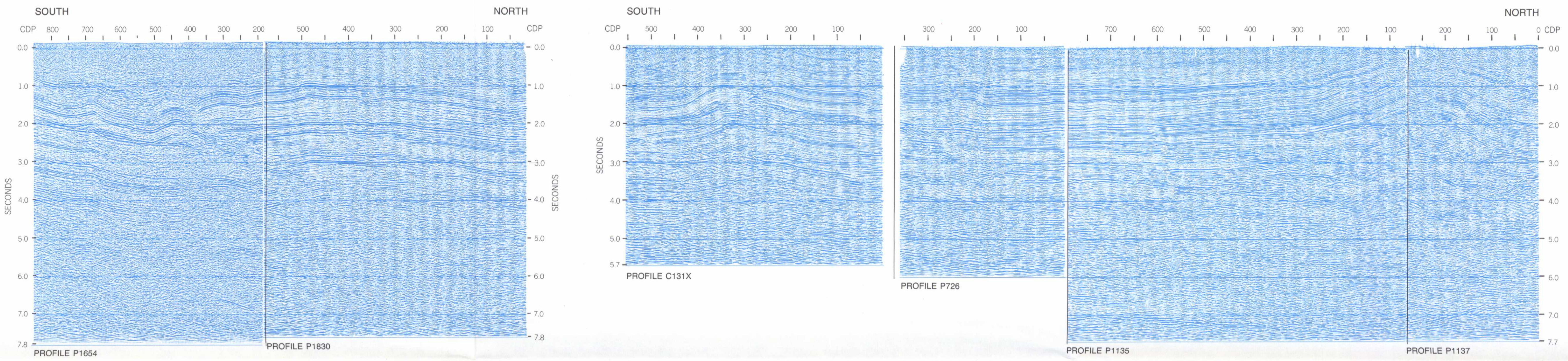
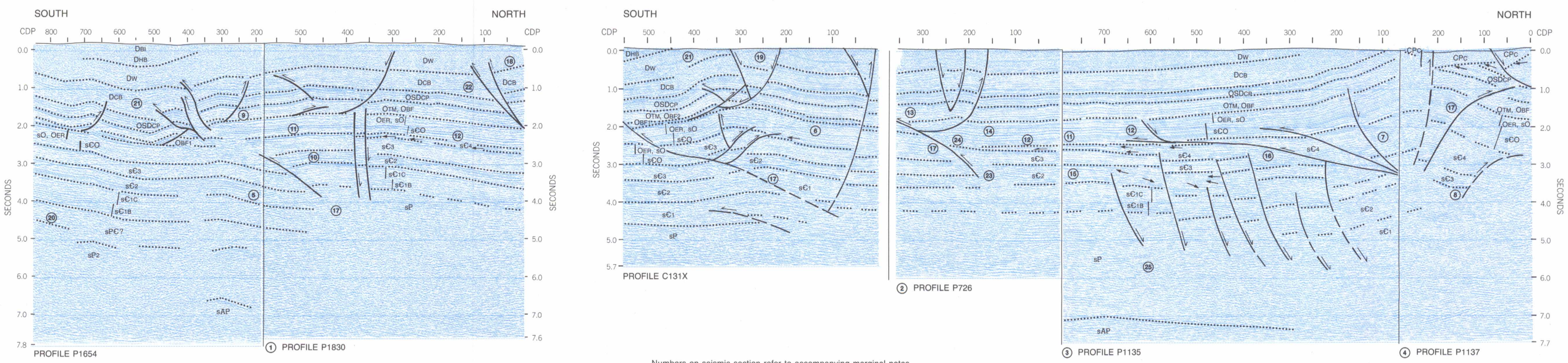
SEISMIC REFLECTION DATA

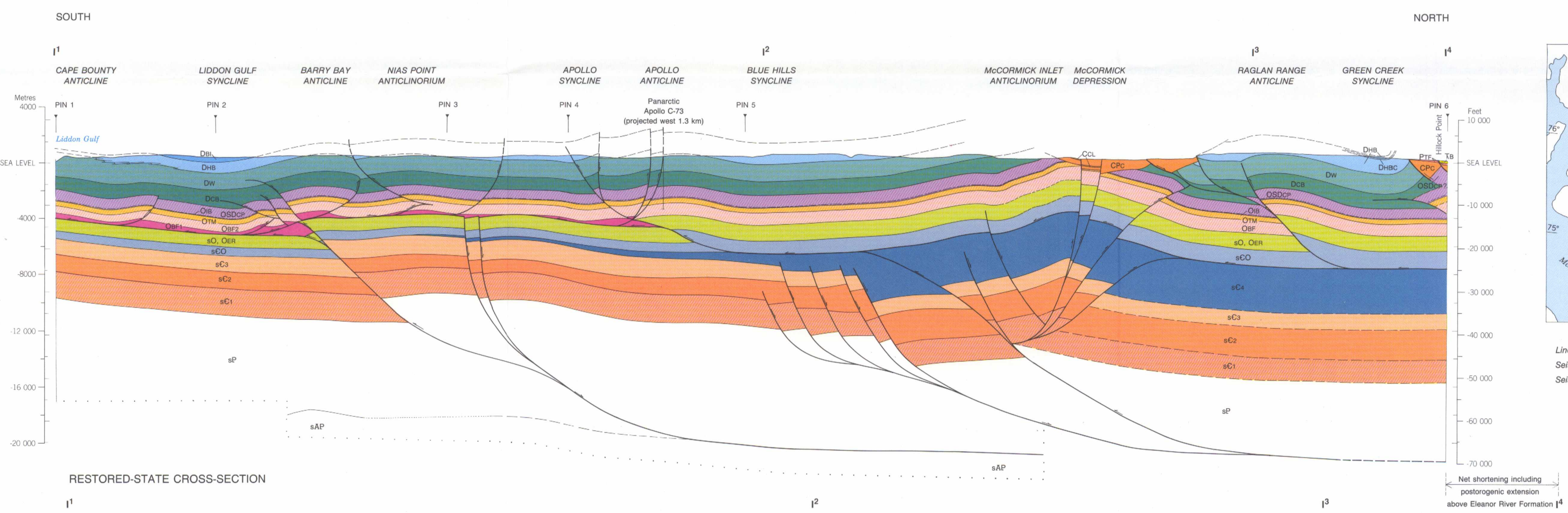


INTERPRETED SEISMIC DATA

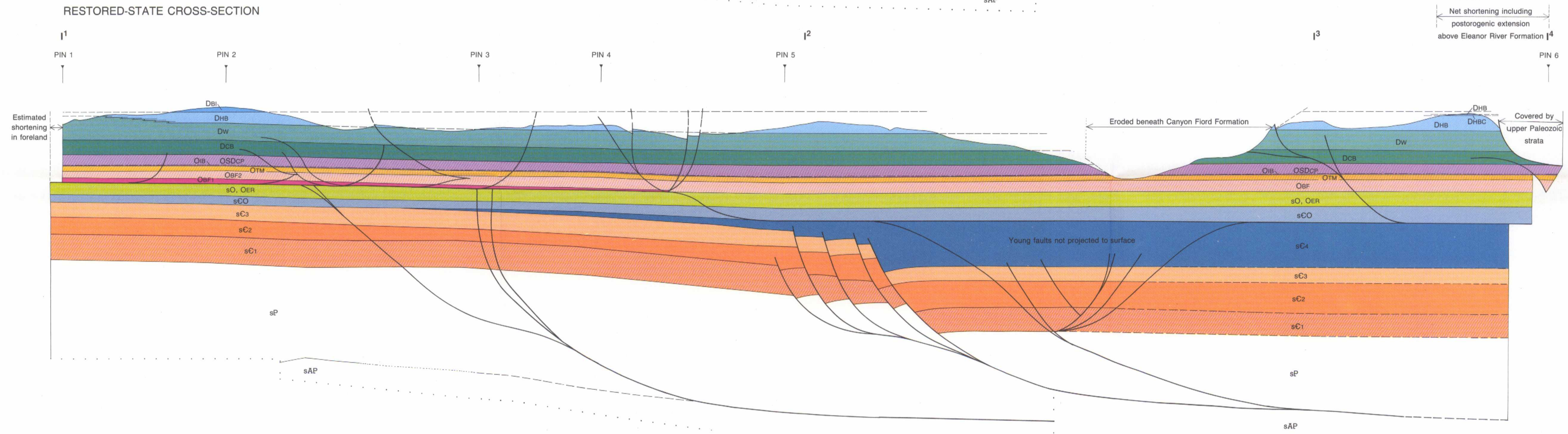


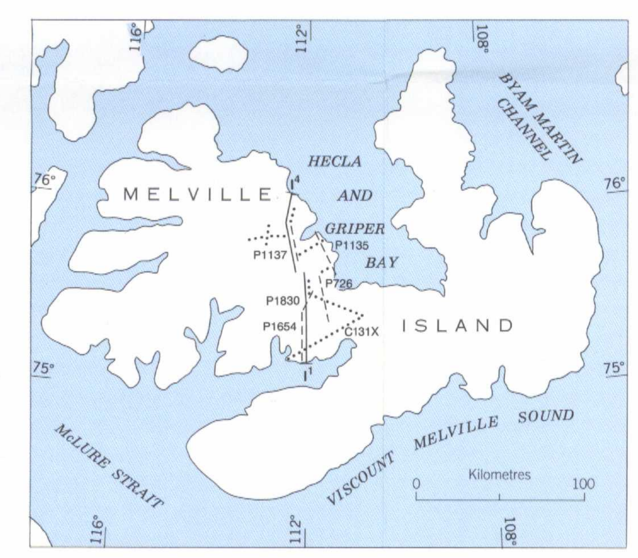
Numbers on seismic section refer to accompanying marginal notes

DEFORMED-STATE CROSS-SECTION



RESTORED-STATE CROSS-SECTION





Location of structure sections and seismic profiles

Line of structure section (with offset) . . . . . . I¹ — I⁴
Seismic reflection profile (displayed) . . . . . . - - - - -
Seismic reflection profile (consulted only) . . . .

NOTES TO ACCOMPANY SECTION I
(Seismic profiles P1654, P1830, C131X, P726, P1135, P1137)

Acquisition and processing

1. Profiles P1654 and P1830 do not intersect. Splice is made where the two lines are closest. CDP 580 on P1830 is 3.8 km east and on strike from CDP 180 of P1654.
2. Profiles C131X and P726 do not intersect. There is a gap of 1.2 km in the dip direction between the ends of each line.
3. Profiles P726 and P1135 do not intersect. Splice is made where the two lines are closest. CDP 790 of P1135 is 9.6 km east and on strike from CDP 0 of P726.
4. Profiles P1135 and P1137 do not intersect. Splice is made where the two lines are closest. CDP 285 of P1137 is 14.6 km west and on strike from CDP 65 of P1135.
5. Residual diffractions obscure the primary signal at and below 3000 ms on both P1654 (CDP 180 to 300) and P1830 (CDP 475 to 575).
6. Residual diffractions are common at the contact between the lower and upper Bay Fiord members (OBF1 and OBF2) between CDP 50 and 200 on C131X. This pattern is attributed to a gradual northwestward facies change of evaporites to carbonates with diffractions generated at the southern terminations of carbonate beds. This suggestion is supported by the observation that the competent OBF2 carbonate unit thickens progressively to the north as the evaporites of OBF1 thin to zero.
7. Residual diffractions mask some subhorizontal primary reflections below 1500 ms on P1135 (CDP 65 to 160).
8. Over-migration hyperbolae mask primary reflection segments below 3500 ms on most of P1137.

Seismic stratigraphic features

9. Rapid thickening of the upper Bay Fiord interval (OBF2) and a parallel thinning to zero of OBF1 occurs north of CDP 350 on P1654 (see also note 6).
10. Unit sЄ2 is interpreted as abruptly thinning north of the fault at 3200 ms, below CDP 525, P1830. A similar phenomenon is observed north of the fault at 3200 ms below CDP 250, C131X (see also note 23).
11. There is a dramatic increase in the occurrence of strong, semicontinuous internal reflections within unit sЄO north of CDP 250 on P726. This is accompanied by the appearance of a lowstand and transgressive unit at the base (sЄ4).
12. Onlap patterns at the base of unit sЄ4 indicate the existence of a sequence boundary above sЄ3 (CDP 75 to 300 on P1830, CDP 0 to 100 on P726, and CDP 525 to 700 on P1135). In the latter area, onlap and thickening of sЄ4 is paralleled by thinning (erosional truncation?) of the top of underlying unit sЄ3.
13. Impedence contrasts generated by the stratigraphic contact between carbonates of the upper Bay Fiord (OBF2) and evaporites of the lower Bay Fiord unit (OBF1) are absent in the subsurface north of the fault below CDP 325, P726. Disappearance of this reflector is attributed to replacement of the evaporites by carbonates across the fault.
14. There is a profound change in the seismic character of unit sO and the Eleanor River interval (OER) north of CDP 325 on P726. The upper reflection is substantially weakened (note 13), the unit thickens marginally, and strong, continuous, parallel reflections dominate the internal reflection pattern.
15. Unit sЄ2 contains northerly dipping sigmoidal clinoform reflections between CDP 710 and 400 on P1135. Onlap patterns have been identified at two locations on the upper surface of these clinoforms. This is taken to be evidence that southward, a sequence boundary may occur near the base of seismic unit sЄ3.
16. Unit sЄ4 thickens dramatically northward on P1135. Thickening is associated with extensional growth faults that terminate upward in this unit.

Structural features

17. Contraction faults, originating from below the Bay Fiord interval, are a typical feature of the seismic profiles of Section I. One of these faults, situated below CDP 150, P1135, steepens downward. The attitude of other faults and their depth to detachment is uncertain. The model favoured here is that most contraction faults steepen downward. Other models, that would flatten these faults into one of several possible intermediate detachment levels, are rejected because the growth faults (CDP 200 to 600, P1135), apparently active during deposition of unit sЄ4, are not offset by the contraction faults that affect units as young as the Hecla Bay Formation (DHB).
18. Reflectors above the base of the Bay Fiord Formation, north of CDP 85, P1830, are correlated into the Panarctic Apollo C–73 well, which is located 3.3 km to the north on the same structure.
19. A good example of repeated slip on a common detachment occurs beneath CDP 325 on C131X. Both thrusts and normal faults merge into the detachment at the base of the Bay Fiord evaporites (OBF1).
20. Tilt of the sub-sЄ1 reflector south of CDP 475, P1830, indicates involvement of Precambrian(?) seismic units in deformation related to tilting.
21. Apparent ductile behaviour of the Weatherall (DW) and Cape De Bray (DCB) Formations is implied by thickness variations within these units south of CDP 375 on P1654, and south of CDP 400 on C131X.
22. Minor folds, defined by the reflectors above the Thumb Mountain (OTM) and Cape Phillips (OSDCP) Formations below CDP 125 to 225, P1830, do not affect the reflector above the Eleanor River Formation (OER). These folds have developed near the northwestern limit of obvious slip on the sub-Bay Fiord (OBF1) detachment.
23. If the correlation is correct, the dramatic change in thickness of unit sЄ2 north of CDP 175 on P726 may be due to extensional growth faulting on a fracture that was subsequently reactivated as a reverse fault. It might also be possible to generate these patterns by a single phase of strike-slip faulting.
24. Divergence of reflectors and folding above the reflection at 2200 ms below CDP 225 on P726 is considered evidence for a local detachment near the base of unit sO.
25. Southerly dip of some deep reflections below 4800 ms (CDP 540 to 750) on P1135 is attributed to block rotation on listric extension faults that flatten downward into a detachment that must exist above a subhorizontal reflector at 7000–7300 ms.

Depth conversion

CPC: 3.7 km s^{-1}

DHB, DBI, DPI: 3.7 km s^{-1} (south)–3.8 km s^{-1} (north)

DCB, DW: 3.6 km s^{-1}

OSDCP: 4.5 km s^{-1} (south)–4.7 km s^{-1} (north)

OTM, OBF2: 6.4 km s^{-1} (south)–6.0 km s^{-1} (north)

OBF1: 5.3 km s^{-1}

sЄ1–OER: 5.7 km s^{-1}

below sЄ1: 6.2 km s^{-1}

Method of cross-section construction and restoration

Bed length measurement and balancing of the contacts above sЄ4, sЄO, OER, OBF1, OBF2, OTM, and OSDCP between adjacent pairs and sets of pin lines. Slip on the contact beneath OBF1 is assumed to be negligible north of Apollo Anticline.

Bed length measurement and balancing of the contacts above sP, sЄ1, sЄ2, and sЄ3 between adjacent pairs and sets of pin lines.

Bed length measurement of the contacts above DHB (or DW).

Area measurement and restoration of OBF1, DCB, DW, and DHB between pairs of adjacent pin lines. This method assumes that horizontal shortening of units OBF1, DCB–DPI is the same as that expressed by bed lengths of contacts above OBF1–OSDCP.

Results

Section length: 99.9 km
Postorogenic extension: 1.5 km
Pre-extension section length: 99.9 - 1.5 = 98.4 km

Bed length of OTM (this section): 106.9 km
Shortening of OTM (this section): 106.9 - 98.4 = 8.5 km (8.0%)
Estimated shortening in foreland*: 0.9 km
Total shortening of OTM from foreland: 8.5 + 0.9 = 9.4 km (5.8%)

Bed length of OER (this section): 106.8 km
Shortening of OER (this section): 106.8 - 98.4 = 8.4 km (7.9%)
Estimated shortening in foreland*: negligible
Total shortening of OER from foreland: 8.4 km

Deformed-state bed length of DHB (or DW): 105.2 km
Apparent shortening of DHB (this section): 105.2 - 98.4 = 6.8 km (6.5%)
Estimated apparent shortening in foreland*: 0.2 km
Total apparent shortening of DHB from foreland: 6.8 + 0.2 = 7.0 km (4.4%)

Range of assumed tectonic thickening of DW–DBI: 2–4%

*Foreland shortening is estimated from unmigrated seismic profiles of Dundas Peninsula.

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Geology by J.C. Harrison 1984, 1985 and 1987

Geological cartography by the Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada

Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

SECTION I
(MAP 1844A)

CAPE EDWARDS (ON LIDDON GULF) TO HECLA AND GRIPER BAY (NEAR HILLOCK POINT), MELVILLE ISLAND

DISTRICT OF FRANKLIN
NORTHWEST TERRITORIES
Scale 1:250 000

Kilometres
5 0 5 10

Section I
Sheet 11 of 12 (Map 1844A)
GSC Bulletin 472

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