base on a 1-meter breccia bed (at 171.55 meters) (see McKelvey, 1975, p. 41).

Unit II microfauna are correlated with the Pecten gravels of Wright Valley (Webb, 1972, 1974) and the Scallop Hill Formation of White Island. Correlation is also made with the uppermost part of the Miocene-Pliocene succession at DSDP hole 273A. A Pliocene age is adopted.

The uppermost microfaunal unit (III) extends between 153 and 0 meters in hole 10 and between 205 and 0 meters in hole 11. The uppermost part of the unit is also represented in holes 8 and 9. Large, diverse calcareous benthic foram faunas are characteristic of the lowermost and uppermost 20 meters of this thick sedimentary succession. The intervening interval is largely unfossiliferous. Microfaunas are *in situ* and represent quite shallow sites of deposition. No planktonic taxa have been recorded. In terms of McKelvey's (1975) lithological subdivision the oldest microfaunal unit III assemblage occurs in the lower part of his unit 4 (diamictites and pebbly sandstones) and the youngest in his unit 1 (pebbly coarse sandstones, conglomerates, and mudstone debris). The microfauna is closely related to present-day microfaunas. A Pleistocene age is adopted. The boundary between microfaunal units II and II coincides with thin breccia beds in both holes 10 and 11 (McKelvey, 1975, p. 40, 54).

Microfaunal studies on core from holes 8 to 11 further confirm the influence of marine incursions into the dry valleys in the late Cenozoic (Webb, 1972, 1974; Webb and Wrenn, 1975; Wrenn and Webb, in press). Whereas Wright Valley has revealed no evidence of marine invasion prior to the Pliocene, eastern Taylor Valley was clearly a fjord during the Miocene. Significant faunal and sedimentary hiatuses punctuate the late Cenozoic record in eastern Taylor Valley. These have been produced by the interaction of the tectonic uplift of the Transantarctic Mountains, fluctuations of sea level, and alterations of grounding and floating by the Ross Ice Shelf. The microfaunal record in hole 12 argues against marine penetration that far west in Taylor Valley, at least during the Pleistocene.

Well-documented sampling and biostratigraphic analysis has been immensely enhanced by access to Barrie McKelvey's excellent site logging and subsequent column preparation. This research was supported by National Science Foundation grant OPP 74-22894.

References

McKelvey, B. C. 1975. Preliminary site reports, DVDP sites 10 and 11, Taylor Valley. *Dry Valley Drilling Project Bulletin 5*. DeKalb, Northern Illinois University. 16-60.

McKelvey, B. C. In press. Cenozoic marine and terrestrial glacial sediment in Taylor Valley. *Dry Valley Drilling Project Bulletin 7*. DeKalb, Northern Illinois University.

Webb, P. N. 1972. Wright Fjord, Pliocene marine invasion of an antarctic dry valley. *Antarctic Journal of the U.S.*, VII(6): 227-234.

Webb, P. N. 1974. Micropaleontology, paleoecology, and correlation of the Pecten gravels, Wright Valley, Antarctica, and description of *Trochoelphidiella onyxi* n. gen., n. sp. *Journal of Foraminiferal Research*, 4(4): 189-199.

Webb, P. N., and J. H. Wrenn. 1975. Foraminifera from DVDP holes 8, 9, and 10, Taylor Valley. *Antarctic Journal of the U.S.*, X(4): 168-169.

Webb, P. N., and J. H. Wrenn. In press. Interpretation of foraminiferal assemblages from lower Taylor Valley (DVDP 8-12) (abstract). *Dry Valley Drilling Project Bulletin 7*. DeKalb, Northern Illinois University.

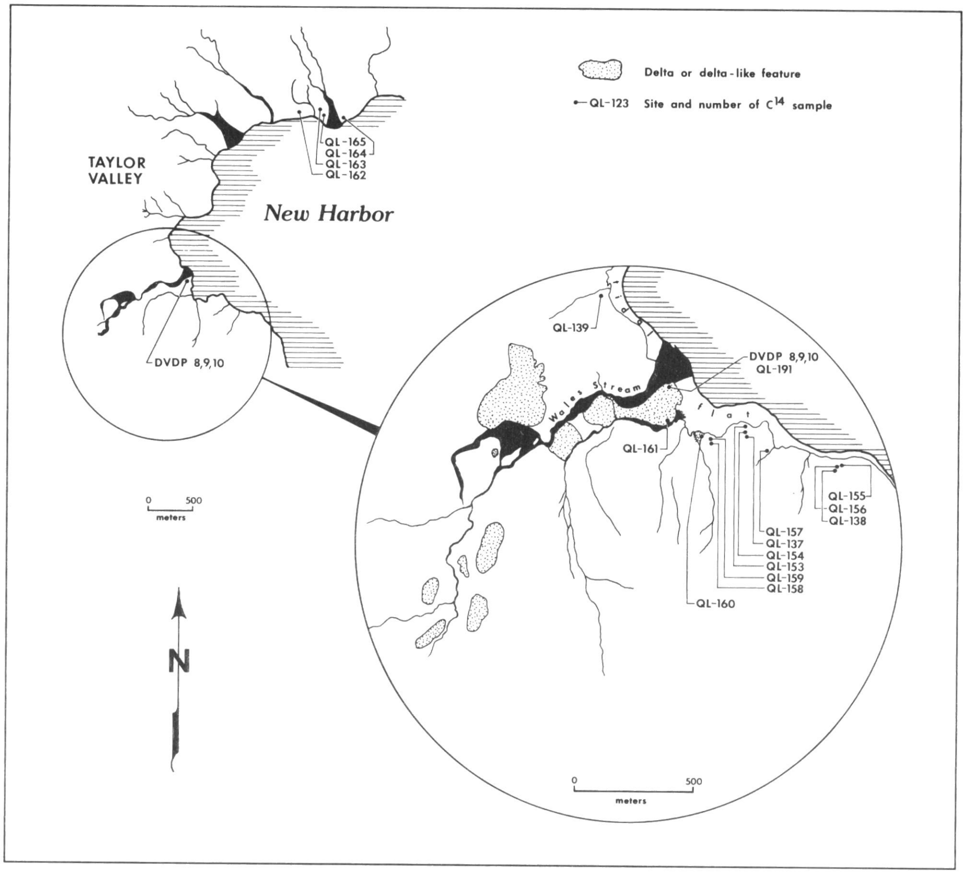
Carbon-14 dates of *Adamussium colbecki* (Mollusca) in Marine deposits at New Harbor, Taylor Valley

MINZE STUIVER
Quaternary Research Center
University of Washington
Seattle, Washington 98106

GEORGE H. DENTON *and* HAROLD W. BORNS, JR.
Institute for Quaternary Studies
Department of Geological Sciences
University of Maine, Orono
Orono, Maine 04473

Emerged fossil marine deposits occur at New Harbor, Taylor Valley, particularly near Dry Valley Drilling Project (DVDP) holes 8, 9, and 10, despite the absence of nearby well-defined emerged beaches (figure). These deposits yielded numerous carbon-14 samples of *Adamussium colbecki;* at all sample localities abundant valves were enclosed in the deposits and several were articulated. Further, a sample that consisted of fragments of *A. colbecki* was collected from holes 8 and 9.

Samples QL-160, QL-161, and QL-191 were collected from stratified sand deposits with minor amounts of gravel that lack associated glacial clasts and that compose delta-like features located at mouths of seaward-sloping stream valleys (figure). DVDP holes 8, 9, and 10 (all three holes are at 77°34′43″S. 163°30′43″E. and are located 1.9 meters above



Location and laboratory numbers of carbon-14 samples.

sea level) (Treves and McKelvey, 1975) were drilled on the surface of the most prominent of these features, situated at the mouth of Wales Stream. Core logs indicated that fossiliferous, stratified sand extends to at least 25 meters below the core tops (Chapman-Smith and Luckman, 1974; McKelvey, 1975). A shell sample of *A. colbecki,* collected by combining material from holes 8 and 9 from a depth of 23 to 24 meters below the core tops (21.1 to 22.1 meters below sea level), yielded an age of 6,670 ±220 carbon-14 years before present (QL-191). Further, a sample from a shell layer in the southern edge of this delta-like deposit at an altitude of 1.6 meters above high tide mark gave an age of 5,500 ±70 carbon-14 years before present (QL-161). If this latter date represents the general age of the uppermost sediments of the delta-like feature, then it follows that the fossiliferous sand in the upper 24 meters of the cores is Holocene in age and was deposited during an interval of about 1,200 years. We suspect that the surface of the delta-like feature was cut by Wales Stream from emerged shallow-water marine deposits, because other nearby carbon-14 samples show that emergence over the last 5,400 ±60 carbon-14 years before present was sufficient to place relative sea level above the delta-like feature during deposition of the uppermost 24 meters of sediments. Inland deltas along

Carbon-14 dates of *Adamussium colbecki* in marine deposits at New Harbor, Taylor Valley.

Laboratory number	Carbon-14 date* (yr. B.P.)	δ carbon-13, 0/00 (w.r.t. PDB)	Altitude** (m)
QL-164	5760 ±60	2.6	0.5
QL-160	5770 ±50	2.2	0.8
QL-155	5310 ±60	2.3	1.0
QL-153	5200 ±60	2.4	1.4
QL-161	5500 ±70	2.8	1.7
QL-159	5350 ±70	2.7	1.9
QL-156	5090 ±50	2.4	2.2
QL-165	4620 ±60	3.0	2.9
QL-154	5630 ±60	2.6	3.3
QL-158	5860 ±70	2.6	4.2
QL-157	6150 ±80	2.7	4.5
QL-139	5240 ±40	2.7	5.0
QL-162	5970 ±70	2.3	5.3
QL-137	6050 ±70	2.8	5.7
QL-138	5800 ±70	2.8	7.5
QL-163	5400 ±60	2.6	8.1
QL-191	6670 ±200	2.0	−21.1 to −22.1

*These dates are uncorrected for deficiency in carbon-14 in antarctic marine waters and hence they are too old. The correction factor that eventually will be applied to these dates will fall between 850 and 1,400 years.

**The altitude of all samples except QL-191 was surveyed from high-tide mark. The altitude of QL-191 was determined from core logs of Dry Valley Drilling Project holes 8 and 9 (Chapman-Smith and Luckman, 1974; Treves and McKelvey, 1975). Tidal range is on the order of 1 meter.

Wales Stream have not yielded samples of *A. colbecki.*

Samples QL-137, QL-138, QL-139, QL-153, QL-154, QL-155, QL-156, QL-157, QL-158, and QL-159 were collected near DVDP holes 8, 9, and 10; samples QL-162, QL-163, QL-164, and QL-165 were collected from the north shore of New Harbor (figure). All of these samples came from emerged, stratified sand-and-gravel deposits that possess irregular surface morphology and that commonly exhibit scattered internal and surficial glacial clasts. Except for their fossil content, these deposits generally cannot be differentiated readily from adjacent surficial glacial drift. Moreover, they were deposited contemporaneously with, and some occur adjacent to, the delta-like deposits described previously; this is shown not only by carbon-14 dates but by individual beds near sample site QL-160 that can be traced from a deposit with large glacial clasts into a delta-like deposit that lacks clasts.

None of the shell samples pinpoints an exact position of past relative sea level, because *A. colbecki* currently live on the floor of New Harbor at depths greater than 4 meters and are most common at about 25 meters (John Oliver, personal communication, 1975). However, the altitude and age of each sample affords a minimum value of emergence that has occurred since the date involved; actual emergence exceeded these minimum values, perhaps by substantial amounts. Hence, the table shows that emergence during the past 5,400 years has exceeded 8.1 meters.

In addition to providing values of emergence, the dates afford minimum ages for deglaciation of New Harbor. We therefore dated the large number of samples listed in the table to reduce the possibility of overlooking the oldest shells.

Our present explanation for fossil marine deposits at New Harbor involves the following events: During the youngest Ross Sea glaciation (Denton *et al.,* 1971), an ice tongue projected westward from McMurdo Sound into Taylor Valley nearly as far as Suess Glacier, damming an extensive lake in the valley. Deposition of numerous deltas and minor moraines accompanied ice recession and concomitant lake-level lowering. The inland deltas along Wales Stream were deposited into a remnant of this lake dammed between the retreating ice margin near McMurdo Sound and the high threshold of unconsolidated sediments between Commonwealth Glacier and New Harbor. Southward recession of the grounding line of Ross Sea ice into McMurdo Sound accompanied ice-tongue recession from Taylor Valley. Hence, fossil sediments in the delta-like deposit at the mouth of Wales Stream indicate that both events had occurred at New Harbor by 6,670 carbon-14 years before present (QL-157). Most of the recognized emergence, which exceeded 8.1 meters, occurred after 5,400 carbon-14 years before present (QL-163) without concurrent formation of emerged beaches; although direct evidence is lacking at New Harbor, considerable emergence probably predated 5,400 carbon-14 years before present. One explanation for the absence of emerged beaches is that the floating McMurdo Ice Shelf projected northward into New Harbor until very recently, so that the emerged marine deposits were uplifted from beneath the shelf margin. In this case, the glacial clasts were dropped into fossiliferous sediments accumulating beneath the shelf, except locally where streamwater melted indentations into the margin of the shelf and hence precluded clasts from being dropped into fossiliferous, stratified sand accumulating at these sites.

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References

Chapman-Smith, M., and P. G. Luckman. 1974. Late Cenozoic glacial sequence cored at New Harbor, Victoria Land, Antarctica (DVDP 8 and 9). In: *Dry Valley Drilling Project (DVDP) Bulletin 3.* DeKalb, Northern Illinois University. 120-147.

Denton, G. H., R. L. Armstrong, and M. Stuiver. 1971. The Late Cenozoic glacial history of Antarctica. In: *Late Cenozoic Ages* (Turekian, K. K., editor). New Haven, Yale University Press. 267-306.

McKelvey, B. C. 1974. Preliminary site reports, DVDP sites 10 and 11, Taylor Valley. In: *Dry Valley Drilling Project (DVDP) Bulletin 5.* DeKalb, Northern Illinois University. 16-60.

Treves, S. B., and B. C. McKelvey. 1975. Drilling in Antarctica, September-December, 1974. In: *Dry Valley Drilling Project (DVDP) Bulletin 5.* DeKalb, Northern Illinois University. 4-10.

Geothermal studies in the McMurdo Sound region

GERALD J. BUCHER *and* EDWARD R. DECKER
Department of Geology
The University of Wyoming
Laramie, Wyoming 82071

Field research during the 1975-1976 austral summer focused on measurements of temperature in Dry Valley Drilling Project (DVDP) drillholes. Mr.