IMAGE EVALUATION TEST TARGET (MT-3)

Photographic
Sciences
Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

**CIHM/ICMH
Microfiche
Series.**

**CIHM/ICMH
Collection de
microfiches.**

Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

© 1981

Technical and Bibliographic Notes/Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

- ☐ Coloured covers/
Couverture de couleur
- ☐ Covers damaged/
Couverture endommagée
- ☐ Covers restored and/or laminated/
Couverture restaurée et/ou pelliculée
- ☐ Cover title missing/
Le titre de couverture manque
- ☐ Coloured maps/
Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black)/
Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations/
Planches et/ou illustrations en couleur
- ☐ Bound with other material/
Relié avec d'autres documents
- ☒ Tight binding may cause shadows or distortion
along interior margin/
La reliure serrée peut causer de l'ombre ou de la
distortion le long de la marge intérieure
- ☐ Blank leaves added during restoration may
appear within the text. Whenever possible, these
have been omitted from filming/
Il se peut que certaines pages blanches ajoutées
lors d'une restauration apparaissent dans le texte,
mais, lorsque cela était possible, ces pages n'ont
pas été filmées.
- ☐ Additional comments:/
Commentaires supplémentaires:

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☐ Coloured pages/
Pages de couleur
- ☐ Pages damaged/
Pages endommagées
- ☐ Pages restored and/or laminated/
Pages restaurées et/ou pelliculées
- ☐ Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées
- ☐ Pages detached/
Pages détachées
- ☐ Showthrough/
Transparence
- ☒ Quality of print varies/
Qualité inégale de l'impression
- ☐ Includes supplementary material/
Comprend du matériel supplémentaire
- ☐ Only edition available/
Seule édition disponible
- ☐ Pages wholly or partially obscured by errata
slips, tissues, etc., have been refilmed to
ensure the best possible image/
Les pages totalement ou partiellement
obscurcies par un feuillet d'errata, une pelure,
etc., ont été filmées à nouveau de façon à
obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	14X	18X	22X	26X	30X
☐	☐	☐	☒	☐	☐
12X	16X	20X	24X	28X	32X

The copy filmed here has been reproduced thanks to the generosity of:

Library,
Geological Survey of Canada

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol → (meaning "CONTINUED"), or the symbol ▼ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:

L'exemplaire filmé fut reproduit grâce à la générosité de:

Bibliothèque,
Commission Géologique du Canada

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole → signifie "A SUIVRE", le symbole ▼ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.

ails
du
odifier
une
image

rrata
to

pelure,
n à

[Reprinted from the CANADIAN RECORD OF SCIENCE, January, 1889.]

NOTE ON *BALANUS HAMERI* IN THE PLEISTOCENE AT
RIVIÈRE BEAUDETTE, AND ON THE OCCURRENCE
OF PECULIAR VARIETIES OF *MYA ARENARIA* AND
M. TRUNCATA IN THE MODERN SEA AND IN THE
PLEISTOCENE.

BY SIR WILLIAM DAWSON, LL.D., F.R.S.

(1.) *Balanus Hamon.*

The fine species of *Balanus* above named, which is still living in somewhat deep water on our coasts, was first described as a Pleistocene fossil of Canada by Sir C. Lyell in his paper on "Fossils and Recent Shells collected by Capt. Bayfield."¹ Bayfield found it in the Pleistocene at Beaufort, near Quebec. It was subsequently found by me in the Pleistocene at Rivière du Loup, St. Nicholas, and Montreal.² From the loose attachment of its radial plates, it is

¹ Philos. Trans. 1859.

² "Notes on Post Pliocene of Canada." Canad. Nat. 1872.

usually found in fragments, but entire specimens occur attached to stones and boulders at R. du Loup.

B. Hameri is at present extensively distributed as a living species in the North Atlantic and the Arctic Sea. I have specimens collected by Mr. A. Downes of Halifax, Nova Scotia, in a living state, near Halifax harbour. As a Pleistocene fossil, it occurs at Uddevalla in Sweden, and was named by Linnaeus *Balanus Uddevalensis*. The name *B. Hameri*, given by Ascanius in 1767, is that now recognized. It has also been found in Pleistocene clays in Greenland (Spengler), and in the Pleistocene of Russia (Murchison).

The specimens now under consideration are interesting, as being found farther west than previously; River Beaudette being on the line of the Grand Trunk Railway, 34 miles west of Montreal, and the locality being near its entrance into Lake St. Francis. They are also interesting from their remarkable perfection and the large masses which they form, some of which contain as many as a dozen individuals attached to each other. The specimens were collected by Mr. A. W. McNown, of Rivière Beaudette, and by Mr. Stanton, C E., of Lancaster, and much credit is due to these gentlemen for their care in collecting and preserving these interesting fossils.

The animals seem to have been covered, when living, with an irruption of sand, for the opercular valves of many of them are still in place, and owing to a slight infiltration of calcareous matter, the radial plates and opercular valves have been cemented together, which accounts for their perfect preservation. It is to be observed, however, that the shells of *Balani* are composed of a remarkably dense and indestructible calcium carbonate, much less perishable than the shells of most mollusks.

The original attachments of the animals, so far as observed, have been on pebbles on the surface of clay, and as these afforded space only for one or two individuals, the young were obliged to attach themselves to the old in successive generations, forming most grotesque groups, which still remain entire.

YASSEL

YVVRUE JACQUOIS

ADAMAS 70

In the same deposits were found shells of *Saxicava Arctica*, *Tellina* (*Macoma*) *Groenlandica* and *Mya arenaria* of a small variety. These shells would indicate cold and not very deep water; and although *B. Hameri* is at present a deep-water species, it is probable that in cold water it lives, like some other species, nearer the surface than in the warmer seas.

The specimens were found in an excavation near the railway, and so far as appears from the descriptions, in beds which belong to the top of the Leda clay and base of the *Saxicava* sand, a position which is usually the most productive part of our Pleistocene deposits in fossil shells.

From a note and sketch kindly furnished to me by Mr. Stanton, it appears that the shells occur about 27 feet below the surface, and about 11 feet above the level of Lake St. Francis. The containing beds are clay and sand, and above these are alternations of clay, sand and gravel, the top being gravel, with boulders immediately under the surface soil. The position of the shells would thus appear to be in what I have called the Upper Leda clay, or the base of the *Saxicava* sand, and under the newer gravel and boulder deposit which often caps the latter.

(2.) *Species of Mya, and Varietal Forms.*

In my Notes on the Post Pliocene of Canada,¹ I have remarked on the small size, peculiar forms and comparative rarity of *Mya arenaria* in the Pleistocene, as compared with the modern Gulf and River St. Lawrence, and on the abundance of *Mya truncata*, and especially of the short variety (*M. Udevalensie*), while *Mya truncata* is comparatively rare in the modern waters of our coast, and the short variety especially so. I had last summer an opportunity at Little Metis to see both species and their different varieties living together in such a manner as to illustrate better the causes of the difference of the Pleistocene forms.

At the head of Little Metis Bay, where the water is shal-

¹ Canadian Naturalist, 1872.

low and warm, and the bottom is soft mud and sand, a large variety of *Mya arenaria* is very plentiful in the flats bare at low tide; so much so that the place is resorted to by fishermen from localities lower on the coast for bait. It sometimes attains the length of $4\frac{1}{2}$ inches, and has a thick, dense shell, without perceptible epidermis, and often with radiating bands. So far as I am aware, neither *Mya truncata* nor the peculiar variety of *M. arenaria* referred to below, occurs on this part of the coast.

I have not infrequently dredged *Mya truncata*, usually the long variety, but sometimes the short *Uddevalensis* variety, in deep water outside the bay, but have not seen it above low-water mark, though it occurs not far from this line; and, on the opposite side of the River St. Lawrence, I have found it at Tadoussac, where the water is still colder, close to low-water mark. I was not aware that *Mya arenaria* occurred on the comparatively steep and stony shore outside the bay, and it is certainly not found there inside of the low-water limit.

Last summer, however, after a heavy easterly gale, great numbers of *Mya arenaria*, in a living state, and a few specimens of *M. truncata*, were thrown up on the beach, and must have been derived from the mud disturbed by the breakers at no great distance outside of low-water mark, or on a slight bank a little further seaward. These shells were all of small or moderate size, somewhat round and flat in form, much wrinkled and covered with a thick brown epidermis which extended a little way beyond the posterior end of the shell, which was, however, rounded and not truncated, and destitute of the corneous tube of *M. truncata*. Still, many of the specimens might, at first sight have been mistaken for *M. truncata*, with the tube partly broken off. This enabled me, for the first time, to understand the remark of Fabricius, that in Greenland the two species are so similar, that but for the hinge and the tube they might be confounded. With these were thrown up specimens of *M. truncata*, which must have lived with the others, the inner limit of *M. truncata* probably overlap-

ping the outer limit of *M. arenaria*. The short or Uddevalensis variety of *truncata* was, however, very rare, only a few shells in a perfectly recent state having been found, and they probably lived in somewhat deeper and colder water than the others. The water, I may add, on this coast is so far affected by the Arctic current as to be quite cold, except near the shore and in shallow bays, and the species dredged in 10 to 15 fathoms are, in general, similar to those of the Labrador coast, belonging rather to the boreal than to the Acadian fauna. With the Myas were cast up shells of *Solen ensis*, var. *Americanus* of Carpenter, and of *Machaera Costata*, the latter sometimes of large size, though it is more abundant in the warmer water at the head of the bay, where *Purpura Lapillus*, a rare shell on this coast, also occurs on the reefs.

It is evident that though there is no passage from one species into the other, the long variety of *Mya truncata* represents the extreme limit of modification of that species for a shallow and warm-water habitat, while the small epidermis-clad variety of *M. arenaria* represents its extreme modification for deeper and colder water than usual; and along the coast at Metis these two varieties meet.

The coldness of the Pleistocene seas thus explains the occurrence, in the Upper Leda clay, of the peculiar small and epidermis-clad variety of *M. arenario* and of the short form of *Mya truncata*. The conditions in the colder parts of the River St. Lawrence approach in these respects to those of the Pleistocene, though they are no doubt more fully realized in the Arctic seas.

As I have remarked in my notes on the Post Pliocene, the brown wrinkled epidermis-clad variety of *M. arenaria* occurs plentifully along with *M. Uddevalensis* in the Upper Leda clay at Rivière du Loup.

From the accounts of Arctic collectors from Fabricius downwards, it would appear that in Greenland, as in Pleistocene Canada, *M. truncata* is very abundant, and occurs at low water in the sands, as *M. arenaria* does further south. It would seem also that it forms a large part of the food of

the walrus and other animals, and is much used by the inhabitants. It also appears that a small variety of *M. arenaria*, with brown epidermis, is most common in Greenland and occurs with *Mya truncata*, which is, however, more plentiful. The description given by Fabricius of *M. arenaria* obviously agrees with that of my small and brown variety from Metis.

It is interesting to note the companionship of these allied species in the North Atlantic throughout the Pleistocene and Modern periods, and their range of varietal forms applicable to each, according to the conditions to which they have been exposed, along with their continued specific distinctness, and the preference of each for certain kinds of environment, so that in some places one, and in others the other, predominates, while this relative predominance, as well as the prevalence of certain varietal forms, might no doubt be reversed by change of climate or of depth.

o in-
are-
and
more
rena-
rown

allied
ocene
as ap-
they
ecific
nds of
rs the
ce, as
ght no