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# Anomalous Quartz and Calcite Bodies in the Goldenville Formation, Taylor Head, Nova Scotia*

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## Introduction and Description

Anomalous, small bodies composed of quartz or calcite occur in metasedimentary rocks of the Goldenville Formation (Lower Paleozoic flysch) at Taylor Head, Nova Scotia (Fig. 1). The quartz bodies are generally harder than the enclosing rocks and therefore tend to stand out in relief on weathered surfaces, whereas the calcite bodies are generally softer and more readily weathered than the enclosing rocks. Examples of the quartz bodies are illustrated in Figure 2.

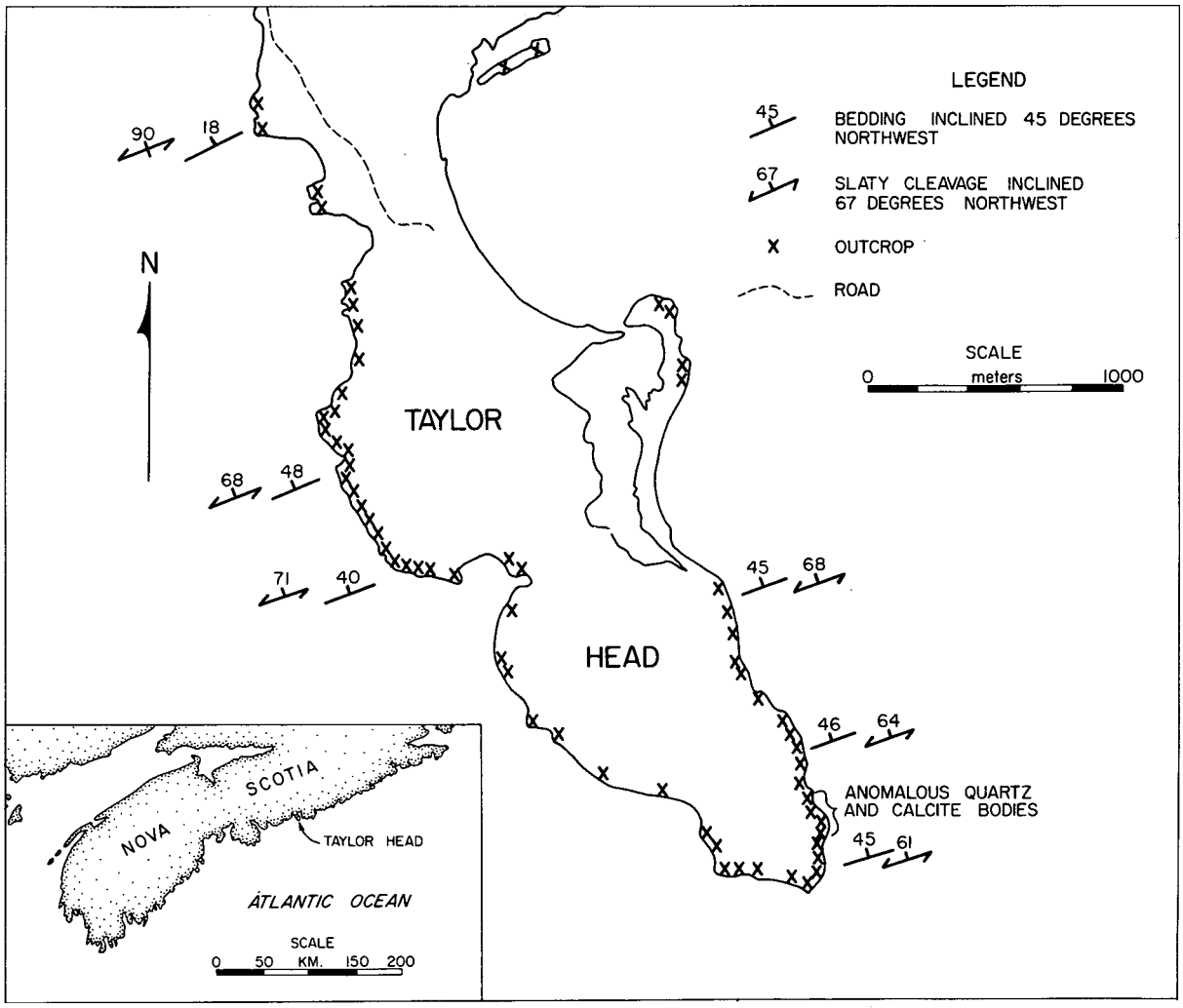


**Figure 1 - Outline map of Taylor Head showing outcrop localities (all outcrops are Goldenville Formation), zone of outcrop containing anamolous quartz and calcite bodies, and bedding and cleavage attitudes.**

* Manuscript received May 19, 1972.

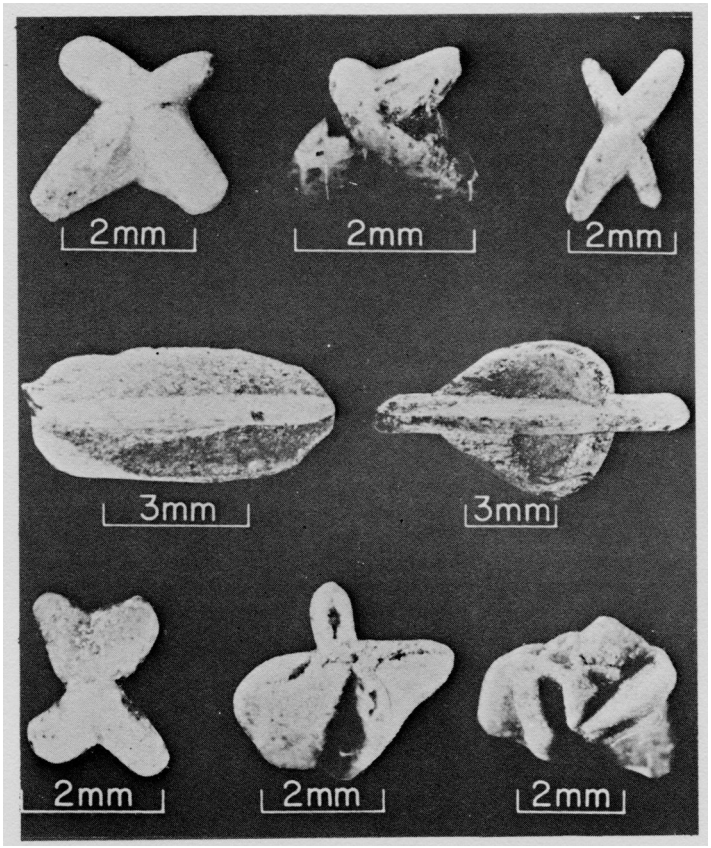


**Figure 2 - Anamolous quartz bodies, all but one of which are four-lobed forms; the body represented on the right side of the lower row is a complex of interpenetrating plates. Approximately half of the body represented in the centre of the lower row is missing; the cross-section displays internal cavities.**

In external form, the quartz and calcite bodies range from simple, generally elongate plates to irregular masses of interlocking plates. A majority of the bodies, however, are roughly similar in shape: these are discrete forms that range from about 2 mm to 20 mm in length and have the appearance of pods with three or, more commonly, four lobes. Exceptionally, masses of interlocking plates form mats which in outcrops appear laterally continuous parallel to the bedding.

Examinations of about 50 specimens with the aid of a binocular microscope (X7 to X30 magnification) indicate that the bodies are made up of aggregates of numerous small grains, that the central portions of the bodies are typically enriched in iron oxides, and that the bodies composed commonly have internal cavities. These observations suggest that the quartz and calcite grains may have developed in voids left by solution of the original components.

## Geological Setting

The rocks in which the bodies occur consist of alternating layers of sandstone and finer-grained beds (sandy siltstone, siltstone and slate). The sandstone beds range in thickness from about 1 cm to 12 m and the layers of fine-grained sediments vary from submacroscopic to about 5 m in thickness. Sedimentary structures generally associated with turbidity-current deposition, such as sharply defined lower bedding surfaces, gradational upper bedding surfaces, sole markings, intraformational mudstone inclusions, and laterally continuous bedding, are present in the majority of the sandstone beds and in many of the finer-grained beds.

The bodies occur more or less evenly distributed in fine-grained layers and in the upper portions of sandstone beds. They have been observed in a total of 24 sandstone - fine sediment couplets. A "couplet" here refers to a sandstone bed below and the finer-grained beds above (one or more) to the base of the next sandstone bed in upward succession. The couplets containing the bodies occur in groups of from two to six which are limited to and dispersed within a zone of outcrop consisting of 140 couplets in all. This zone represents a stratigraphic thickness of 150 metres and is located near the outer end of Taylor Head (Fig. 1). The bodies have not been observed in well exposed and carefully examined rocks at Taylor Head that lie stratigraphically above and below the zone, or in rocks of the Goldenville Formation in other areas.

The rocks have been affected by chlorite-grade, regional metamorphism. Slaty cleavage is well developed in the fine-grained rocks and tends to be slightly bent immediately adjacent to the bodies. Deformed sedimentary structures indicate appreciable internal strain in both the sandstone and the fine-grained rocks. The bodies have been flattened in the plane of the prevailing cleavage and markedly elongated parallel to the cleavage and approximately perpendicular to the bedding-cleavage intersection lineations. Bedding and cleavage attitudes are indicated in Figure 1.

## Discussion

The origin of the bodies is problematical. They are possibly trace fossils, although a search of the literature failed to reveal comparable forms of organic origin. An inorganic derivation is perhaps more probable. The bodies outwardly bear a resemblance to twinned gypsum crystals; the four-lobed pods superficially resemble gypsum rosettes. The quartz and calcite which constitute the bodies may therefore have developed as replacements of gypsum.

Gypsum may develop in submarine, silty and muddy sediments as a result of alternating reduction and oxidation of sulphur in the interstitial sea water (Pantin 1964, p. 46). Restricted circulation resulting in stagnant water and a reducing environment interrupted periodically by influxes of oxygenated water, by means of turbidity currents or indigeneous bottom currents, may have occurred locally and sporadically on the sea-floor during sedimentation of the Goldenville Formation. Some such mechanism could be invoked to explain the growth of gypsum crystals that subsequently were replaced by quartz and calcite in the rocks at Taylor Head.

Comments from readers who have observed similar forms in rocks from other areas would be appreciated.

## Acknowledgements

B.R. Pelletier and C.T. Schafer kindly reviewed the manuscript. A.D. Cosgrove drafted Figure 1 and J.R. Belanger photographed the illustrations in Figure 2.

## Reference

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