Maritime Sediments, Vol. 4, No. 1, April 1968, pp. 1 - 3. 

# Reports

## A Study of Sedimentary Structures in the Goldenville Formation, Eastern Nova Scotia*

I. McK. HARRIS
Grant Institute of Geology, University of Edinburgh, Scotland

P. E. SCHENK
Department of Geology, Dalhousie University, Halifax, N. S.

Progress Report

### Introduction

The Meguma Group (lower Paleozoic) of Nova Scotia consists of two formations: the basal Goldenville and the upper Halifax Formations. The definition of each formation is essentially by sand/shale ratio with sand dominant in the Goldenville and shale in the Halifax.

The Goldenville Formation underlies large parts of southern Nova Scotia and consists of at least 18, 000 feet of quartzite, greywacke and chloritic slate. Sedimentary structures in sandy and silty layers are frequently well displayed, particularly in coastal outcrops. The present study involves detailed sedimentological investigation of well-exposed partial sections which crop out on a number of islands and headlands in the eastern part of the province (Fig. 1).

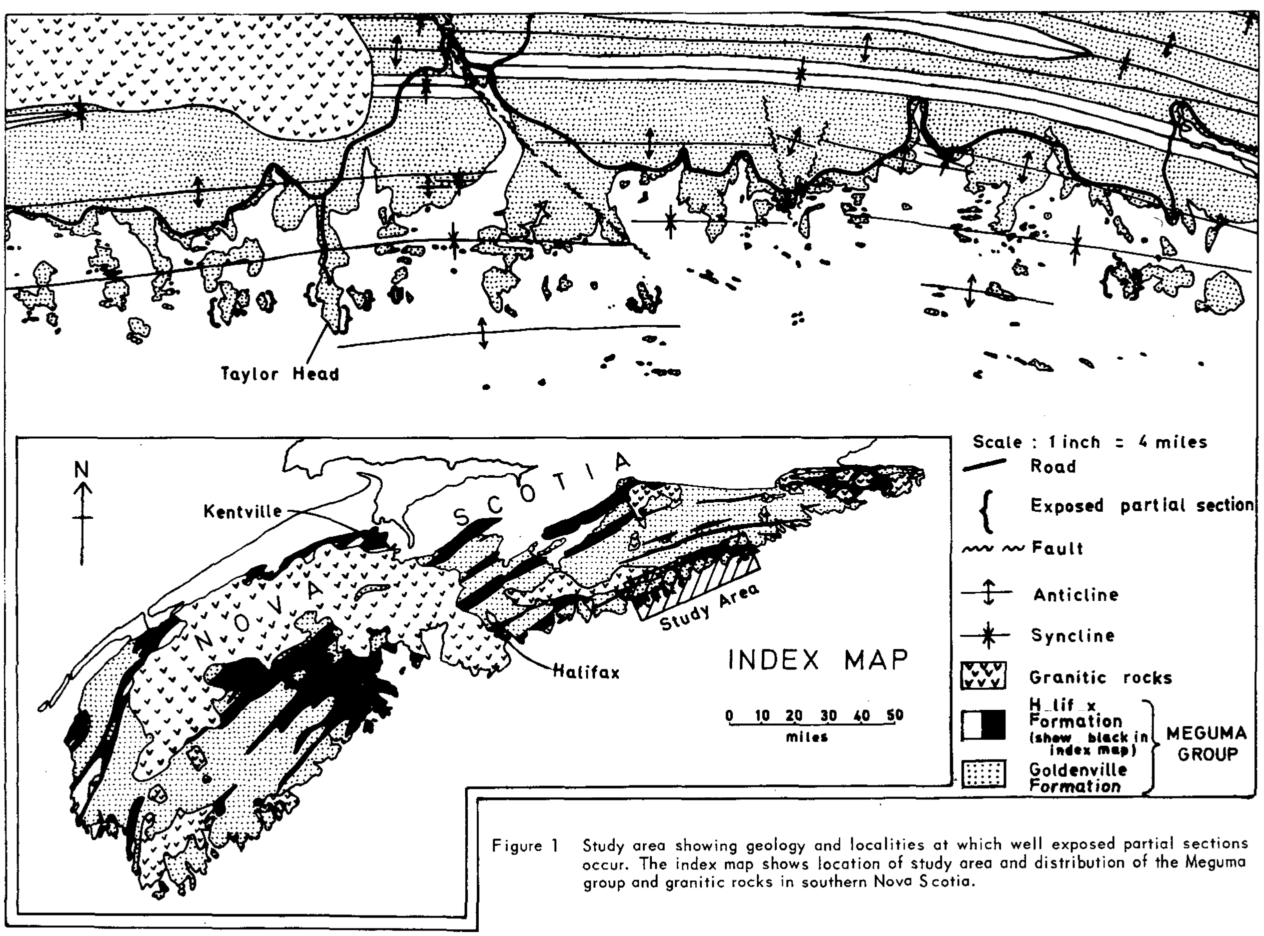


Figure 1 Study area showing geology and localities at which well exposed partial sections occur. The index map shows location of study area and distribution of the Meguma group and granitic rocks in southern Nova Scotia.

*Manuscript received February 23, 1968.

Until recently, very little research was done on the sedimentology of the Goldenville and conformably overlying Halifax Formations. To correct this, Campbell and Schenk (1967) initiated a regional, sedimentological-stratigraphical study of these rocks, which Schenk is presently continuing. The preliminary phase of this work involves systematic description of sedimentary features at outcrops selected on an approximate three-mile grid pattern over the Meguma outcrop area. At present, linear through quartic trend and residual maps are in preparation for these data. Arenite thin-sections of each outcrop are studied to determine composition and grain-size. The next phase of this work involves detailed bed-by-bed description of local sections. In collaboration with Schenk, Harris is undertaking such a detailed examination of southeastern Nova Scotia as a Ph. D. research project under E. K. Walton at the University of Edinburgh.

## Meguma Group

The upper part of the Meguma Group, the Halifax Formation, consists of at least 12, 000 feet of dark slate with quartzite and greywacke. The thickness of the underlying Goldenville Formation is unknown because older rocks have not been found in the outcrop area. Lithologically, the Meguma Group is similar to Early Paleozoic units which crop out in a wide belt along the Appalachian trend.

The group is generally considered to be lower Paleozoic in age, on the basis of poorly preserved Dictyonema flabelliforme (Eichwald) found in slates near Kentville (Fig. 1) which have been tentatively included in the Halifax Formation. An enigmatic fossil form, Astropolithon hindii (Dawson), is fairly widespread in the Goldenville Formation. "Worm" burrows are also present.

The rocks of the Meguma Group were folded into a northeast-striking fold belt and then intruded by large granite plutons in Late Devonian-Early Mississippian time (Fig. 1). Typically, the folds are large-scale, symmetrical, and gently plunging to the northeast and southwest. Northwest-trending sinistral faults offset the folds, with horizontal separations of up to one mile. Normal and reverse faults are numerous, but are generally small and have little influence on the regional structure. Slaty, axial-plane cleavage and low-grade, regional metamorphism (locally high-grade) have slightly obscured primary sedimentary structures and textures.

In general, the Meguma Group has a eugeosynclinal, flysch aspect. Sedimentary features commonly associated with turbidity-current deposition, such as graded bedding, sole markings, sharply defined bottom surfaces, foreset and convolute laminations, mudstone inclusions, and laterally continuous bedding are of widespread occurrence. Other characteristics, however, are somewhat atypical of flysch sedimentation, such as large-scale cross-stratification, relative uniformity of maximum grain-size in sandstone layers irrespective of bed-thickness, a general paucity of conglomeratic layers, the presence of current and wave ripple marks on many upper bedding surfaces, and the presence of quartzitic sandstone layers with less than ten percent matrix. Also, the upward transition of the arenaceous Goldenville Formation into the euxinic, principally argillaceous, Halifax Formation is the reverse of the usual flysch succession.

Well-exposed partial sections of the Meguma Group, each thousands of feet thick, occur on a number of coastal islands and headlands, as previously stated. In the area under discussion (Fig. 1), these exposed sections, all in the Goldenville Formation, are aligned in a general northeasterly direction, approximately parallel to the regional strike. The overall paleocurrent trend, as determined by Campbell (1966), is also nearly parallel to the regional strike in this area. These are factors which facilitate correlation of sedimentological data from section to section.

## Preliminary Observations

The detailed work completed in connection with this study has been concentrated at Taylor Head (Fig. 1). The remainder of the map area has been covered in a reconnaissance manner.

The Taylor Head section is a monotonous succession of fine- to medium-grained quartzose arenites containing varying proportions of feldspar grains and matrix material. The sandstones alternate with argillite (slate) and silty argillite. The arenite layers commonly grade into silty, argillaceous, fine sandstone and sandy siltstone at their upper surfaces. Grading is apparent in many silty, fine arenite strata, but is rarely evident in the thick-bedded, coarser-grained layers. Laterally continuous strata, abundant sole markings, foreset and convolute laminations, scour-and-fill structures, and mudstone inclusions indicate that turbidity currents appear to have been the principal agent of sediment transport and deposition.

Not all beds are continuous. Some argillite layers terminate laterally as a result of localized scouring and loading by the overlying sand during and immediately prior to deposition. Some layers, both argillite and arenite, pinch out as a consequence of primary slumping. Slumping, in fact, appears to have been a significant factor during sedimentation. Certain striations at the base, within, and at the top of many of the arenite layers are tentatively attributed to slump or creep effects.

Zones of arenite many feet thick, tentatively regarded as fluxo-turbidites, occur at several levels in the section. Cross-bedding and large channel-fill structures characteristic of high-energy conditions of sedimentation are well-developed in some of these zones. Argillite may be present in these areas in minor amounts, but is generally absent.

Many arenite layers display compound stratification; that is, each layer consists of a succession of strata which presumably represent separate pulses of the turbidity-current mechanism. Each pulse removed the upper, "fine" portion of the preceding bed with the layer. Multiple or compound stratification may be present but is undetected in most thick arenite layers, because of masking by the megascopically uniform grain-size distributions. Such distributions are due to a general absence of grading and a common consistency in maximum grain size in the "coarse fractions". The erosive capacity of turbidity currents may be invoked to explain an unusual development of multiple bedding observed at one locality. Several arenite layers, separated by interbeds of argillite, coalesce over a distance of several hundred feet to form a single, thick, uniform arenite layer. Ripple marks occur at the top of many of the sandstone layers and may reflect paleocurrent trends at high angles to linear sole marks at the base of the same layer.

The fossil Astropolithon hindii (Dawson) occurs commonly at the upper surfaces of and occasionally within the sandstones. The external shape of these forms (Campbell and Schenk, 1967, Fig. 2) is suggestive of "worm mounds". The "mounds" are commonly associated with vertical, tubular "worm shafts". Winding trails or burrows have been observed at the base of a single arenite layer.

Strongly developed fracture cleavage and, to a lesser extent, chloritization tend to obscure sedimentary structures in fine-grained beds. A slight fusing of quartz grains tends to mask internal structures in the arenites. Secondary lineations, abundant fractures, and other deformation effects and further complications.

In adjacent areas where metamorphism is higher, sedimentary structures are masked to a greater extent in coarse-grained strata, but are better preserved in the fine-grained layers, possibly due to sealing of the fracture cleavage.

## Concluding Comment

Harris commenced work on this study in the field season of 1967 and will complete the field work during the summer of 1968. Schenk began the preliminary phase during 1966 and will complete this and begin his detailed work in 1968. An operating grant to Schenk from the National Research Council of Canada supports field and laboratory work. The Nova Scotia Research Foundation is providing Harris with a monthly stipend during the field seasons, plus the use of their aerial photographs and library facilities. B. R. Pelletier at the Bedford Institute has made available numerous items of equipment for use in the field. The Nova Scotia Department of Mines and Dalhousie University have provided smaller items of equipment and various facilities.

## References cited

CAMPBELL, F.H.A., 1966, Paleocurrents and sedimentation of part of the Meguma Group (Lower Paleozoic) of Nova Scotia, Canada; unpub. M.Sc. thesis, Dalhousie University, 91 pp.

__________, SCHENK, P.E., 1967, Paleocurrent and basin analysis of the Meguma Group, Nova Scotia; Maritime Sediments, v. 3, no. 1, pp. 27-30.