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Pre-Carboniferous stratigraphy and structure in the Lawrencetown-Wolfville area, southern Nova Scotia

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INTRODUCTION

The Meguma terrane is the most outboard and largest tectonic element in the northern Appalachian orogen (Fig. 1). It forms a distinct tectonostratigraphic belt in southern mainland Nova Scotia and is characterized by a thick sequence of Early Cambrian to Early Ordovician metasandstone and slate of the Goldenville and Halifax groups. These units are unconformably overlain by slate, quartzite, and volcanic rocks of the Silurian to Early Devonian Rockville Notch Group.

The Goldenville, Halifax and Rockville Notch groups were deformed and regionally metamorphosed during the ca. 400-380 Ma Neoacadian Orogeny, and were intruded by late syntectonic to post-tectonic ca. 380-373 Ma granitoid rocks of the South Mountain Batholith and related plutons. Unconformably overlying the older units are Carboniferous clastic nonmarine and marine carbonate and evaporite rocks of the Horton and Windsor groups.

The northwestern margin of the Meguma terrane is unconformably overlain by Early Mesozoic sedimentary and volcanic rocks (Fig. 2, 3).

PURPOSE

A detailed (1:10 000 scale) bedrock-mapping project was initiated in 2008 by the Nova Scotia Department of Natural Resources to (1) produce a series of 1:50 000 scale geological bedrock maps of pre-Carboniferous stratified units in the Annapolis Valley (Annapolis and Kings counties), (2) describe and interpret the sedimentary, igneous, metamorphic and deformational history, and (3) comment on the economic potential of the area. This mapping, together with previous mapping projects (Fig. 2), have resulted in a major revision of the stratigraphy and tectonic setting of the Meguma terrane (White, 2010a, b).

We report here results from field mapping completed during the summers of 2008 and 2009 (White, 2010b) and subsequent follow-up work in 2010 to 2012 (White *et al*., 2012), and present a preliminary bedrock geology map and a proposed stratigraphy for the Annapolis Valley area, southern Nova Scotia (Figs. 2-4).

REFERENCES

Bouyx, E., Blaise, J., Brice, D., Degardin, J.M., Goujet, D., Gourvennec, R., Le Menn, J., Lardeux, H., Morzadec, P., and Paris, F., 1997. Biostratigraphie et paleobiogeographie du Siluro-Devonien de la zone de Meguma (Nouvelle-Ecosse, Canada); Canadian Journal of Earth Sciences, v. 34, p. 1295-1309.

Keppie, J.D. and Krogh, T.E., 2000. 440 Ma igneous activity in the Meguma Terrane, Nova Scotia, Canada: part of the Appalachian overstep sequence; American Journal of Science, v. 300, p. 528-538.

White, C.E., 2010a. Stratigraphy of the Lower Paleozoic Goldenville and Halifax groups in the western part of southern Nova Scotia; Atlantic Geology, v. 46, p. 136-154.

White, C.E., 2010b. Pre-Carboniferous bedrock geology of the Annapolis Valley area (NTS 21A/14, 15, and 16; 21H/01 and 02), southern Nova Scotia; *in* Mineral Resources Branch, Report of Activities 2009, (ed.) D.R. MacDonald; Nova Scotia Department of Natural Resources, Report ME 2010-1, p. 137-155.

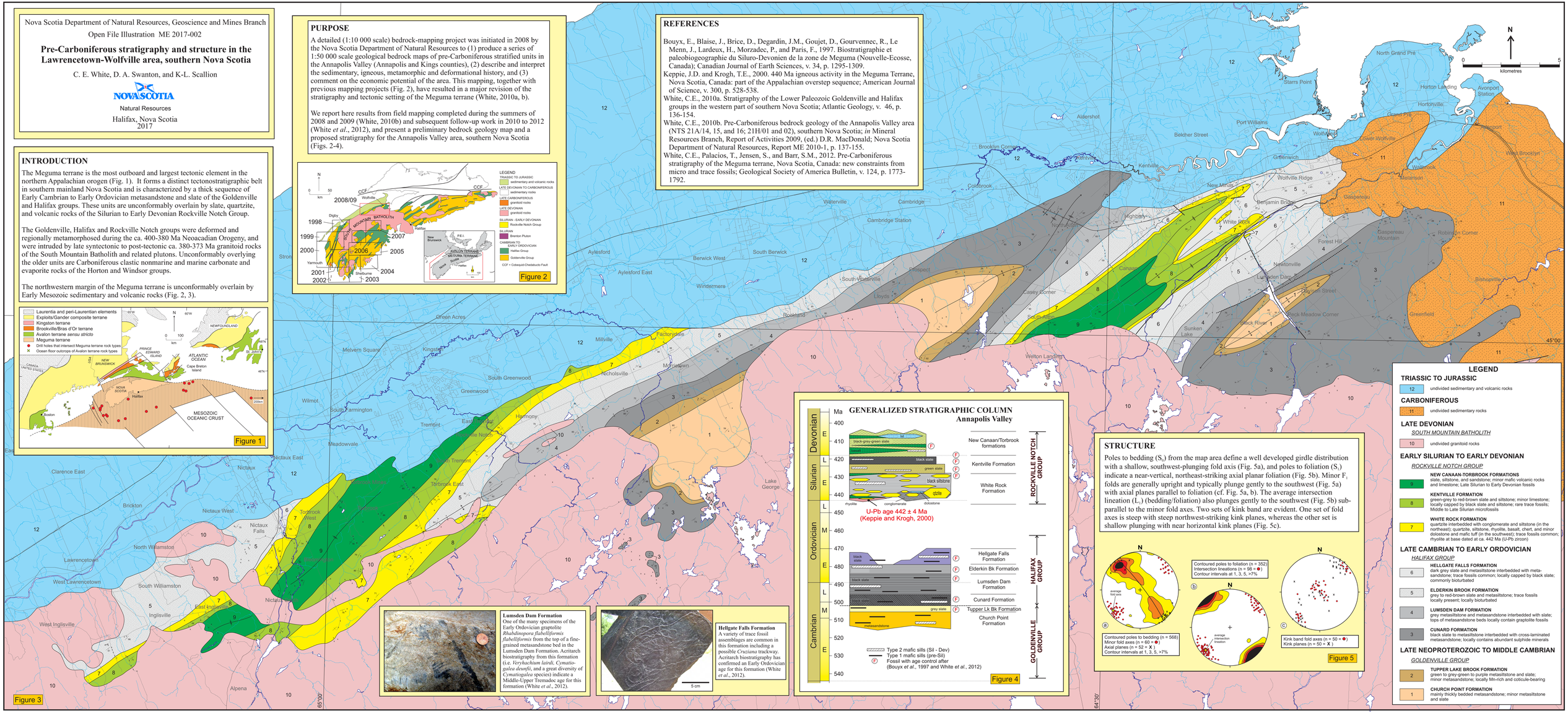
White, C.E., Palacios, T., Jensen, S., and Barr, S.M., 2012. Pre-Carboniferous stratigraphy of the Meguma terrane, Nova Scotia, Canada: new constraints from micro and trace fossils; Geological Society of America Bulletin, v. 124, p. 1773-1792.

Lumsden Dam Formation
One of the many specimens of the Early Ordovician graptolite *Rhabdinopora flabelliformis flabelliformis* from the top of a fine-grained metasandstone bed in the Lumsden Dam Formation. Acritarch biostratigraphy from this formation (i.e. *Veryhachium lairdi, Cymatiogalea deunffi*, and a great diversity of *Cymatiogalea* species) indicate a Middle-Upper Tremadoc age for this formation (White *et al*., 2012).

Hellgate Falls Formation
A variety of trace fossil assemblages are common in this formation including a possible *Cruziana* trackway. Acritarch biostratigraphy has confirmed an Early Ordovician age for this formation (White *et al*., 2012).

STRUCTURE

Poles to bedding (S_0) from the map area define a well developed girdle distribution with a shallow, southwest-plunging fold axis (Fig. 5a), and poles to foliation (S_1) indicate a near-vertical, northeast-striking axial planar foliation (Fig. 5b). Minor F_1 folds are generally upright and typically plunge gently to the southwest (Fig. 5a) with axial planes parallel to foliation (cf. Fig. 5a, b). The average intersection lineation (L_1) (bedding/foliation) also plunges gently to the southwest (Fig. 5b) sub-parallel to the minor fold axes. Two sets of kink band are evident. One set of fold axes is steep with steep northwest-striking kink planes, whereas the other set is shallow plunging with near horizontal kink planes (Fig. 5c).



LEGEND

TRIASSIC TO JURASSIC
12 — undivided sedimentary and volcanic rocks

CARBONIFEROUS
11 — undivided sedimentary rocks

LATE DEVONIAN
SOUTH MOUNTAIN BATHOLITH

10 — undivided granitoid rocks

EARLY SILURIAN TO EARLY DEVONIAN
ROCKVILLE NOTCH GROUP

9 — **NEW CANAAN-TORBROOK FORMATIONS** slate, siltstone, and sandstone; minor mafic volcanic rocks and limestone; Late Silurian to Early Devonian fossils

8 — **KENTVILLE FORMATION** green-grey to red-brown slate and siltstone; minor limestone; locally capped by black slate and siltstone; rare trace fossils; Middle to Late Silurian microfossils

7 — **WHITE ROCK FORMATION** quartzite interbedded with conglomerate and siltstone (in the northeast); quartzite, siltstone, rhyolite, basalt, chert, and minor dolostone and mafic tuff (in the southwest); trace fossils common; rhyolite at base dated at ca. 442 Ma (U-Pb zircon)

LATE CAMBRIAN TO EARLY ORDOVICIAN
HALIFAX GROUP

6 — **HELLGATE FALLS FORMATION** dark grey slate and metasiltstone interbedded with meta-sandstone; trace fossils common; locally capped by black slate; commonly bioturbated

5 — **ELDERKIN BROOK FORMATION** grey to red-brown slate and metasiltstone; trace fossils locally present; locally bioturbated

4 — **LUMSDEN DAM FORMATION** grey metasiltstone and metasandstone interbedded with slate; tops of metasandstone beds locally contain graptolite fossils

3 — **CUNARD FORMATION** black slate to metasiltstone interbedded with cross-laminated metasandstone; locally contains abundant sulphide minerals

LATE NEOPROTEROZOIC TO MIDDLE CAMBRIAN
GOLDENVILLE GROUP

2 — **TUPPER LAKE BROOK FORMATION** green to grey-green to purple metasiltstone and slate; minor metasandstone; locally Mn-rich and coticule-bearing

1 — **CHURCH POINT FORMATION** mainly thickly bedded metasandstone; minor metasiltstone and slate