

Geoscience 001 Field Trip Lab

The Salona and Coburn Formations

Materials:

Rock hammers, compasses, meter sticks, hand lenses, acid bottles, field notebooks.

Site:

We'll be looking at the road cut along the east side of Hwy 322 By-Pass (see the map for the location). This is a busy road, so stay well off the shoulder at all times and keep your wits about you. The exposure itself is very steep and you should avoid climbing up onto the face — you can see plenty from the ground level.

Background:

The Salona and overlying Coburn Formations represent the lower part (older) of the Upper Ordovician, about 458 to 450 Ma.

You should refer to the background material in last week's lab that discusses the kinds of things we generally want to know about sedimentary rocks.

An additional piece of background here concerns a few unusual layers within this sequence of strata; layers composed of altered volcanic ash (now in the form of bentonite, a clay mineral). These ashes occur over vast areas (see maps) and provide all kinds of useful information; they can be dated using radiometric techniques to tell us the age of the sedimentary rocks, and they allow precise correlations of strata across vast areas. This latter piece of information allows us to put together a precise regional (and larger) view of the paleogeography (the spatial relationships of different surface environments). These ashes also represent colossal eruptions that could potentially have a noticeable impact on the biota of the area where our rocks were forming. The Millbrig and Kinnekulle are identical in terms of their ages (454 Ma) and composition, which suggests that they come from the same volcano. The Millbrig ash represents an eruptive volume of around 1500 km³ — as large as the bigger eruptions from Yellowstone.

The presence of these ashes also suggests a change in the regional tectonics — a change in the type of plate boundary — with respect to the time period represented by the Axeman Fm., which has no ashes anywhere in it. The ashes in question here are similar in composition to those erupted from subduction-related volcanoes today. The patterns of contour lines of ash thickness, shown on the maps included at the end of this lab handout implies something about the proximity of these two land masses where the ashes are found today. Ash dispersal patterns typically form elongate ellipses, with the volcano located on the long axis, near one end of the ellipse (see the example from New Zealand). The direction of the long axis is a function of the wind direction during the eruption and these two continents need to be positioned so that the thickness patterns make sense — so that they could “point to” the same volcanic source, with neither too far away from the probable source.

Goals:

The goals here are to describe the lithologies that make up these formations and study their arrangement stratigraphically and to look for (and describe/document) clues that relate to the depositional environment. Be sure to get your eyes "tuned" to seeing the fossils in these rocks. One thing to consider here is what the vertical succession of lithologies might mean — what might have caused the changes you observe. Are there cycles of lithologies that repeat over time? Are there noticeable changes after (above) the biggest ash layer? How does the depositional environment of this time period contrast with that of the Axeman Fm.?

What to turn in:

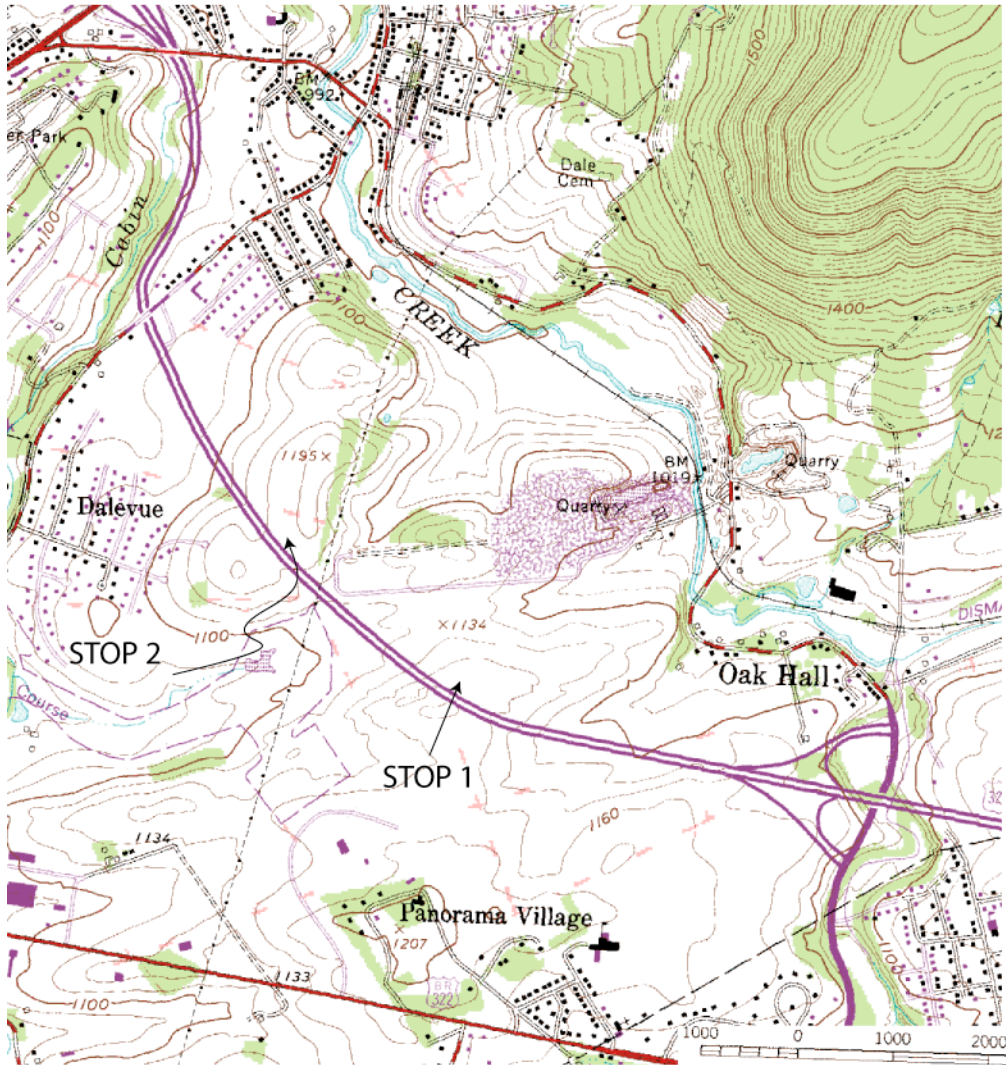
1. Each group of two should make a detailed stratigraphic column of a portion of the Salona that includes the thick ash layer; make another for the Coburn in the general area indicated by the TA. The stratigraphic columns should, as before, include information about bed thicknesses, bedding plane contacts (sharp, gradational, flat, undulatory, etc.), sedimentary structures, fossils or fragments of fossils, color, approximate particle size (clay, silt, fine sand, medium sand, coarse sand).

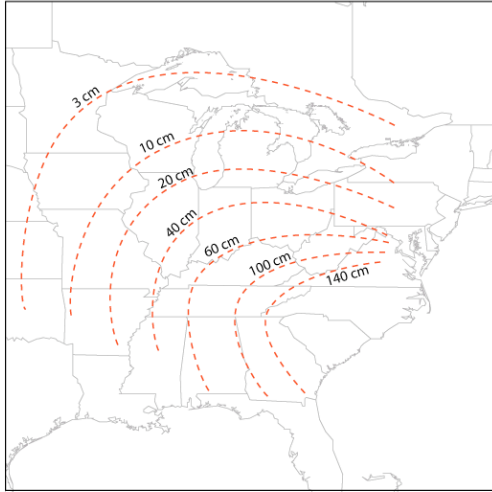
2. Each group should make a simple sketch map showing the North America (aka Laurentia) and the Northern Europe (aka Baltica) in their approximate positions at the time of the eruption of the Millbrig ash. The map should show the hypothetical plate boundary between these two plates (a very approximate location, also indicate what kind of plate boundary it is, using the standard symbols for plate boundaries we went over in class).

3. Each group will also write a few paragraphs summarizing your observations and interpretations (what was the depositional environment like? — what was going on here during this period of time, how might the water depth have been changing during this time, and how did the volcanic eruption affect the organisms living here?). Also, comment on the plate tectonic implications of the ash. Among other things, consider the motions between Northern Europe and North America must have happened between the time of the ash and the time of Pangea final formation (see page 423, Fig. 13.22b).

In addition, comment on the strikes and dips measured on this trip compared with the previous trip to the Axeman Formation — are they similar in strike and dip or different, and if different, what might that mean in terms of potential folds in this area?

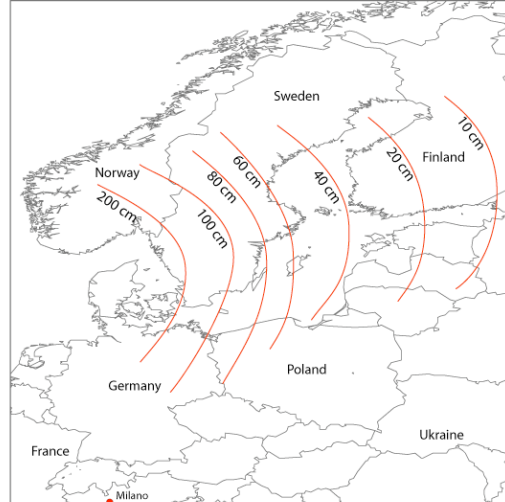
Map for Field Trip to the Salona and Coburn Formations





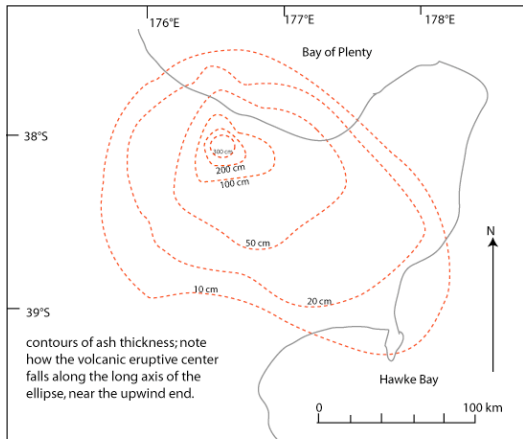
Maximum thickness contour map for the Millbrig bentonite in eastern North America. Contour values are in cm. The selected data are compiled from Kolata et al. (1987), Haynes (1992, 1994), Huff and Kolata (1990) and Huff (unpubl. field notes).

from Huff et al., (1996)



Maximum thickness contour map for the Kinnekulle bentonite (equivalent to the Millbrig) in northern Europe. from Huff et al., (1996)

Ash dispersal pattern from Rotorua Volcano, New Zealand



PANGAEA

256 Ma

