INVESTIGATIONS INTO THE GEOLOGY OF THE BONAVISTA PENINSULA

(NTS 2C/5, 6 and 11)

Andrea Mills

GEOLOGICAL SURVEY
NEWFOUNDLAND AND LABRADOR
Celebrating 150 years

Newfoundland Labrador
Natural Resources

Introduction

Regional (1:50 000 scale) bedrock mapping of the Bonavista Peninsula (2C/6 and 2C/11) in 2014 builds upon previous mapping by Normore (2010, 2011) and O'Brien and King (2002-2005) to produce a 1:50 000 scale bedrock geology map of the entire Bonavista Peninsula.

The Bonavista Peninsula is underlain mainly by Ediacaran siliciclastic rocks of the Musgravetown Group (upper, terrestrial sequence of the Love Cove – Connecting Point – Musgravetown groups, or west Avalon) and the Conception – St. John's – Signal Hill groups (east Avalon) (Figure 1). Stratigraphic and chronologic relations between these two successions remain to be defined. O'Brien and King (2002) suggest that the Rocky Harbour Formation (middle Musgravetown shallow marine siliciclastic rocks) conformably overlies the Bull Arm volcanic belt to the west but unconformably overlies deep marine rocks of the Conception Group to the east (Figure 1).

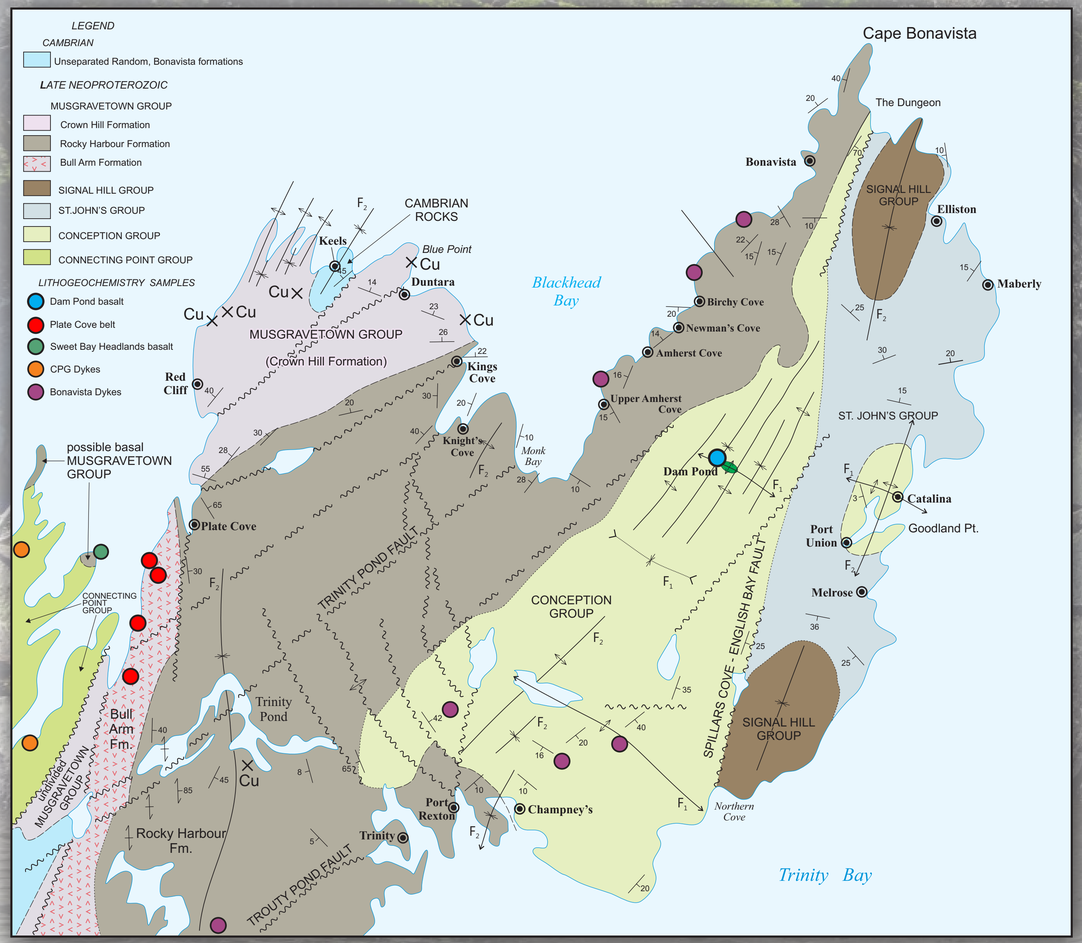

Figure 1. Simplified geological map of the Bonavista Peninsula showing the locations of lithogeochemical samples of mafic igneous rocks.

Plate 1. Sharp, irregular contact between basalt and overlying siliceous siltstone at Dam Pond.

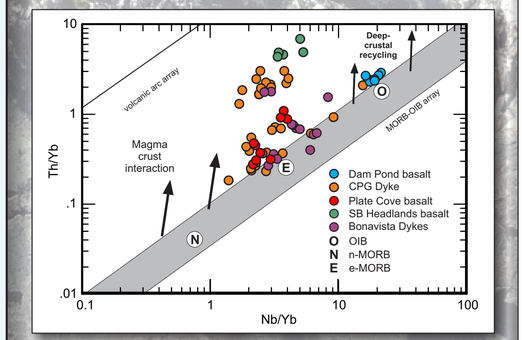

Figure 2. Nb/Yb versus Th/Yb diagram (after Pearce, 2008) for basaltic rocks of the Bonavista Peninsula.

Dam Pond Basalts

Normore (2010) mapped mafic volcanic rocks along the shores of a pond known locally as Dam Pond (Plate 1), halfway between Catalina and Upper Amherst Cove (Figure 1) and interpreted these rocks to be Bull Arm Formation (Musgravetown Group). However, these rocks are petrochemically distinct from the mafic volcanics that occur within the Plate Cove volcanic belt (Figure 2) and from the volcanic rocks preserved along the headlands of the Sweet Bay area, farther to the west. The basalts at Dam Pond occur in a structural dome, likely formed by the interference between a NW-trending, Precambrian anticline and a NNE-trending post-Cambrian (Acadian) anticline (Figure 1). Since other potential correlatives are significantly older (Love Cove, Harbour Main and Conception groups), the Dam Pond volcanic rocks may represent the deepest stratigraphic position exposed on the Bonavista Peninsula (Figure 3). They are overlain by flysch deposited in a deep marine environment, similar to that described for the Conception Group (Williams and King, 1979) and Connecting Point Group (Knight and O'Brien, 1988).

Basalt Chemistry

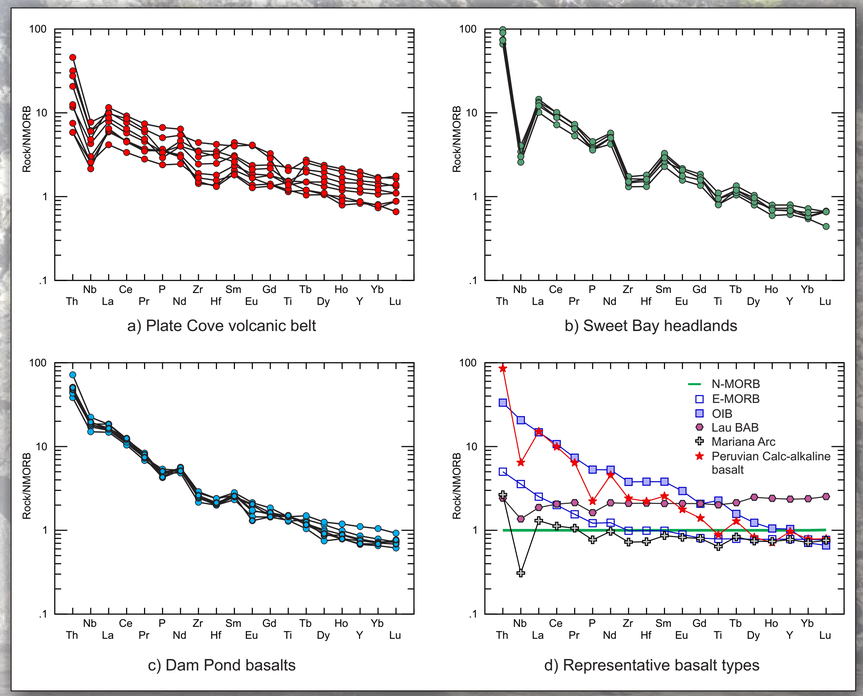

Figure 3. Extended REE diagrams of (a, b, c) mafic volcanic rocks from the Bonavista Peninsula, and d) representative basalts from different tectonic settings compiled from the literature.

The majority of the basaltic rocks of the Bonavista Peninsula were derived from enriched to strongly enriched mantle sources. Most dykes (with the exception of a few) have been contaminated by lithosphere. The Dam Pond basalts have Ocean Island basalt (OIB) compositions and are more enriched and alkalic than all other rocks. These are low degree partial melts showing minor lithospheric contamination. The Plate Cove volcanic rocks, Headlands basalts and dykes on the Bonavista Peninsula are all derived from less enriched mantle sources. The headlands basalts show the greatest lithospheric recycling. The majority of these rocks were likely derived in the asthenosphere at depths slightly deeper than ~60km (depth of NMORB production).