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ABSTRACTS

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Again this year, abstracts from the annual Atlantic Universities Geological Conference (AUGC) are published in Atlantic Geology. This provides a permanent record of the abstracts, and also focuses attention on the excellent quality of the presentations and posters and the interesting and varied geoscience that they cover. The abstracts are published with financial assistance from APICS.

THE EDITORS

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Coupling of salt dynamics and sedimentary basin evolution on passive margins: implications for offshore Nova Scotia hydrocarbon exploration

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The high economic risk in hydrocarbon exploration on the Scotian Slope, offshore Nova Scotia, is caused in part by the complex salt structures that have developed in this area. This study applies physical experiments with optical monitoring to develop new concepts for the interpretation of geological and geophysical data, and provide information for the hydrocarbon exploration in this area. The scaled analogue models, which use sand and silicon putty as sediments and salt, respectively, simulate gravity driven deformation on passive margins with mobile substratum. High-resolution optical monitoring techniques, with Particle Imaging Velocimetry (PIV) enable one to quantify the complete 3D deformation and surface flow in the experiments. A series of experiments is conducted to study the effects of (a) varying slope angle, (b) lateral variation of salt layer, (c) variations in thickness of salt layer, and (d) sediment propagation and aggradation on systems commonly observed on passive continental margins. The results of these experiments will provide insights in structural evolution of sedimentary basins over a mobile substratum and will improve the structural and seismic interpretation of the Scotian Slope salt diapir province.

Study of the capping shale of the Triassic Doig anomalously thick sand bodies in the area of the Wembley Field, Alberta

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The Triassic Doig Formation contains Anomalously Thick Sand Bodies (ATSBs), which are thick bodies of sand located as numerous fields surrounded by shale and capped by a distinct transgressive sand layer. The Doig shale and their sand cap on the east and west sides of the Wembley field are poorly understood in their relationships to the Doig Formation sand bodies and to the overlying Halfway Formation. The ATSBs have considerable thicknesses of fifty meters or more, while the capping sands outside of these bodies are of lesser thickness, closer to 10 m thick, with the overall Doig thickness being similar throughout the whole area. The facies relationship and depositional environment of the shales laterally equivalent to the ATSB are important to the overall understanding of the area.

A focused study on the Wembley ATSB used detailed photographs of the available core and matched them with the logs. The information obtained from these was used to create detailed cross sections throughout the area, structure maps and isopach maps, along with a variety of other maps. A study of the capping sands and the underlying Doig shales would improve the technical understanding of the area surrounding the Doig reservoir by means of core analysis and detailed photographs of contacts and both depositional and biological sedimentary features. Ichnology may play a role in helping to create a depositional model for the capping sands of the Doig shales and the related Doig thick sand bodies. This would benefit future models proposed for the ATSBs.

The Doig lithologies show considerable variation throughout the body, both interior and exterior. There is a need to understand the mechanics of the Doig bodies and surrounding areas before conclusions of depositional environments and interpretation of stratigraphic sequences can occur. The story of the Doig Formation is aided by the understanding of the depositional conditions of its shales and capping sand packages and their relationship to the ATSBs.

A study of the SP geophysical technique in a well-characterized field area

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The self potential (SP) method measures natural electrical potentials that exist in the ground which are due to charge separations generated by electrochemical processes. These potentials may arise in a number of ways; most or all involve water, and most are poorly understood. Electrochemical boundary potentials exist between two different materials in contact. Streaming potentials involve the physical separation of charges by flowing groundwater and bioelectrical potentials are associated with changes in vegetation. An important application for self potential is for mineral exploration, since massive ore bodies generate strong negative SP anomalies.

This project is an in-depth study of the self potential method on the MUN campus in a field NE of the Institute of Ocean Technology (IOT). This area is a good candidate for this investigation because it has been previously surveyed multiple times using a variety of geophysical techniques. Because of this work, the ground structure and the locations of anomalous bodies have already been determined. Through comparison of the self potential data with the data collected from other methods such as the EM 31 ground conductivity meter, and the ground penetrating radar the nature and source of the SP signal can be better understood.

The investigation is carried out using the departments SP system, which consists of (1) the induced polarization-self potential unit, a high impedance multimeter, (2) a pair of electrodes that consist of porous pots that have a cork top with a conducting copper cylinder in a saturated solution of $CuSO_4$ and (3) insulated wires. The study involved repeated measurements of key

profiles on different days, sometimes weeks apart to monitor which features are steady, which are transient, and which may always be present but may change in shape.

Morphology of a glacial outwash channel: catastrophic drainage or measured flow?

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Around the time of final deglaciation in northern Alberta, a large volume of meltwater escaped from what was glacial Lake Peace, draining northward to glacial Lake Hay. This meltwater channel was formed by both catastrophic breach events and by measured drainage. The shape of the channel as well as the stratigraphy support this as there are both well-sorted and poorly sorted units in sections along the meltwater channel, and photos of the channel suggest that there are areas where the flow of meltwater may have been impeded along the ice margin of the glacier. The potential for aggregate along this meltwater channel is especially important as oil and gas companies rely heavily on sand and gravel to build roads in the area. The local bedrock and glacial till in the area is very clay rich – further increasing the need for good aggregate deposits. A preliminary study of these deposits reveals a poorly sorted, rich sand and gravel deposit that can perhaps provide the resources needed to build good roads in the area.

Economic potential for gold in the glacial till of Nova Scotia

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Approximately 20,000 thousand years ago, during the last glacial maximum, continental ice sheets up to one kilometer thick covered the province of Nova Scotia. The advancing ice sheets removed large amounts of material from the tops of gold bearing anticlines and deposited that material in the form of glacial till. A recent discovery of an old adit in a well consolidated till deposit down ice of the Tangier gold district led to a previous investigation of the economic potential of the Tangier site. As a result of the work done in Tangier, a sluicing project was carried out in the summer of 2005 to evaluate three different sites in three different gold districts of Nova Scotia: Moose River, Lake Catcha, and Kemptville. Sampling methodology includes the sluicing of one bulk till sample from each site with a Long-Tom sluice. A separate head grade and tailings sample was taken and analyzed with bottle roll cyanidation with AAS finish from each site. The head sample was split to determine grain size concentrations of Au. Sluice concentrates were further concentrated with a Wifley Table for analysis with a scanning electron microscope. Final grade calculations will be worked back to establish a gold value per metric tonne.

The sedimentology and stratigraphy of the Mabou Group near Sussex, New Brunswick

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Mississippian sedimentary rocks, including those of the Mabou Group, were deposited in several component basins that constitute part of the Maritimes Basin in Atlantic Canada. Most of the work done on the Mabou Group has been from several Nova Scotia basins. The succession there is predominately grey, fine-grained rocks that gradually succumb to overlying red siltstone and sandstone. The facies interpretation is of an extensive, shallow lake at the base of the group, overlain by ephemeral lake and fluvial deposits. Very little research has been carried out on Mabou strata in New Brunswick, though it is understood that the reddish interval is much coarser grained and quite often conglomeratic suggesting a more alluvial setting.

The Mabou Group is found in the western part of the Moncton component basin in south-eastern New Brunswick, with limited, sporadic outcrops in the Sussex area. Earlier mapping indicates a complex distribution of conglomerate, sandstone, and mudstone units. Several boreholes have also been drilled through the succession in the area. East of Sussex, in the Penobsquis area, sandstone and mudstone at the base gradually grade up into conglomerate. To the south and south-west of Sussex however, conglomerate is almost directly underlain by marine strata of the Windsor Group. The Millstream #1 borehole, the main focus of this thesis, is located to the west of Sussex. It contains ~15m of mudstone, siltstone and sandstone at the base of the Mabou Group. Low-angle cross laminations and planar laminations can be found throughout these fine grained strata. Moving up-section, there is a broad coarsening into sandy to muddy conglomerate, likely of braid plain or alluvial fan origins. Rip-up clasts are observed. Intermittent intervals of red-brown sandstone are not uncommon and often contain cross-laminations as well as planar laminations. Short intervals of high angle, medium grained orange-brown sandstones may be interpreted as dune structures. Strata become sandier further up section. A distinct interval of highly porous, matrix free conglomerate ~500 m above the base of the Mabou Group (~930 m) in the Millstream #1 borehole may be of great help in correlating with boreholes to be logged further east. Petrography has also shown that there is change in cement type from ferroan dolomite to non-ferroan calcite at ~ 823 m moving up-section.

Porosity, permeability, and clay content and their effect on reservoir quality in the Cretaceous Bluesky Formation, Whitecourt Alberta

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Porosity, permeability, and clay content are common concerns when analyzing formations for reservoir quality in gas fields. The Cretaceous Bluesky Formation of Whitecourt Alberta is a typical example of a tight gas formation where permeability for the area is usually on the order of > 0.1 mD. The Bluesky strata has been interpreted in Whitecourt to be deposited during a large scale trangression and consists of three main depositional facies identifiable in well logs. The first is "Bluesky A" a regionally extensive shoreface deposit containing several ichnofacies characteristic of a shore face. The second is "Bluesky B", a barrier bar system that has the long axis of the bar trending NE-SW with the bars located primarily in the western portion of the study area. The final facies, "Bluesky C" is an estuarine deposit containing several metres of mud draped sand lenses and is also moderately bioturbated. The formation ranges in thickness from 1-4 metres in Facies A to 7-16 metres in facies B.

Samples taken from Bluesky cored wells will allow for thin section analysis to determine clay content and how it will be effected by facture designs and drilling fluid. Also thin section analysis will help determine why the Bluesky A facies is not homogenously porous an permeable through out the study area. With the same depositional environment it is expected that the cementation and porosity and permeability should be similar throughout Bluesky A. This is not the case however and it may be due to different conditions during burial or grain size difference and the growth of quartz crystals on smaller crystals with more growth surfaces.

Porosity and permeability data will be collected using the Accumap database as well as from the thin sections sampled from logged cores. This should allow comparison of the large database of previously collected data and the data from thin section analysis to see just what causes the change in porosity and permeability and determine if there is a regional trend and if it can be mapped. By mapping the high and low porosity and permeability areas it will be possible to target favourable drilling locations.

Geophysical survey of Cape St. Francis Sill

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In the summer of 2005 I conducted a series of geophysical surveys in order to determine the extent and distribution of a basaltic sill unit in the subsurface. The field area surveyed is located in the vicinity of Cape St. Francis, Newfoundland, and covers approximately 30,000 m². The main sill unit is a prominent conductive feature to the northeast of the field area as shown by some low-resolution airborne VLF surveys. This sill unit outcrops in a ridge 60m high and 300m long and has been the focus of other studies. However, in the present field area, outcropping is limited and the geometry is more complex. Therefore, the only practical way to examine the sill is through geophysical techniques. Under the supervision of Dr. Alison Leitch, the geophysical techniques used in this study were VLF (coupled with the transmitter signal from Cutler, Maine) and magnetics. Magnetic susceptibility readings were also taken to characterize the rock units. These methods were so chosen because the igneous rocks of the sill are relatively magnetic and were observed to be emplaced in between non-magnetic sandstone and pillow breccia layers. This is evident in the outcrops, which have been exposed. Other topics and issues which will be addressed include the effects of station spacing where geophysical readings are taken and reproducibility of the data collected. In addition, some proposed future work will include examination of thin sections of the sill rock in order to determine what minerals are present which cause the sill to be magnetic.

Stratigraphy, depositional setting, and volcanism of the Letete Formation, southwestern New Brunswick

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The Late Silurian Letete Formation, located on the Mascarene Peninsula of Passamaquoddy Bay, is part of the northeast trending Mascarene subbelt that is located in the southwest part of the Late Ordovician to Late Silurian Mascarene Group. It is bounded to the north by the St.George fault, which separates it from the shallowly southeast-dipping rocks of the Late Silurian Eastport Formation, and to the south by the Back Bay fault, separating it from the composite Proterozoic New River belt. The Letete Formation is thought to have been deposited in an extensional back-arc setting.

During June to August 2005 we conducted detailed mapping of the felsic tuffs and volcanic and sedimentary members of the Letete Formation, located in the upper to middle part of the Letete. The objective of the field work was to describe the stratigraphy of the Letete Formation in order to determine its depositional environment, paleotectonic setting, relationship to the Eastport Formation, and mineral potential. A ~4 km long section of coastline on the southwest coast of the Mascarene Peninsula, from McNichols Cove to Fraser Beach, was mapped on a bed-by-bed basis. This section includes the lower part of the Late Silurian Eastport formation to the north, a previously undivided zone of tuffs and intrusions, and the Early Silurian Letete Formation, comprising most of the southern part of the section.

Within the Letete we described an ~900 m thick, locally intruded and sheared sequence that youngs to the northwest based on cross bedding and pipe vesicles concentration at the base of flow margins. This sequence encompasses (from bottom to top) 134 m of bedded mafic hyaloclastite and pillow breccia, 378 m of mafic sheet flows and mafic tuffs, 49 m of mafic massive to flow-banded crystal-lapilli tuff, 155 m of interbedded and intercalated mafic and felsic tuffs and black shale, 143 m of massive to banded felsic crystal-lapilli tuff, and 44 m of interbedded mafic and felsic lapilli tuff with minor grey shales.

By defining a depositional framework for the Letete Formation, the results of this project will contribute to the ongoing effort to unravel the tectono-stratigraphic relationships between units of the Mascarene Group, and constrain the mineral potential of the Letete.

Geological setting of the Smith Option: an ophiolite-hosted Cu(-Zn) massive sulphide system, Bathurst Mining Camp, northeastern New Brunswick

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In an area of complex tectono-stratigraphy with numerous volcanic massive sulphide deposits at different stratigraphic positions such as the Bathurst Mining Camp (BMC), determining a deposit's local to regional geologic setting is fundamental to understanding its origin, and to formulating an appropriate exploration model. The Smith Option Cu-rich massive sulphide occurrence is unique in the Bathurst Mining Camp, because it is associated with a deformed ophiolitic mafic to ultramafic volcanic package (Sormany Formation) of the Middle Ordovician Fournier Group. It lies on the eastern limb of the Tetagouche Antiform, just east of the D1 thrust separating the California Lake Group from the Fournier Group. Following its discovery in 1968, geological, geochemical, magnetic, and electromagnetic surveys were conducted along with trenching, which revealed notable Cu grades, including a 0.6 m zone of 0.58% Cu. Further trenching was conducted in 1973 exposing chalcopyrite, bornite, malachite, and pyrite mineralization with assays up to 7.2% Cu over 0.3 m. The massive sulphides are predominantly hosted in chloritic schist and silicified basalts that are enclosed within locally magnetic mafic flows. Sixteen holes were drilled in the area, seven of which encountered considerable Cu, including 1.39% Cu over 2.7 m in a magnetite- and sphalerite-bearing sulphide exhalite (Fe-formation). However, an analysis of one of the schistose magnetite-pyritic sulphide zones in outcrop (23 cm chip sample) yielded 0.38 wt% Cu with 550 ppm Co and 990 ppb Hg, but only 200 ppm Zn, 20 ppm Pb, 5 ppm Ag, and 150 ppb Au.

Whole-rock geochemical analyses (n=27) from outcrop and selected drill holes indicate a zoning of the host volcanic sequence. The stratigraphically lowest rocks are ocean floor ultramafic basalts (picrite) with MgO up to 32.0 wt%, very low alkalis, and Cr up to 2100 ppm, whereas the stratigraphically highest rocks are within-plate tholeiitic basalts. N-MORB to EMORB compositions occur within the central part of the sequence with the overall FeOtotal/MgO ranging from 0.5 to 3.0, and TiO_2 contents of between 0.7 and 3.5 wt%. The immediate footwall and hanging wall volcanic rocks and host chloritic schists have NMORB characteristics, with low Cr (~ 100 ppm), Nb (~ 3 ppm), Ta (~ 0.13 ppm), Th (0.16 ppm), and La (3.2 to 5.2 ppm), with higher Yb (~ 2.0 to 3.1 ppm), and flat chondrite-normalized rare-earth-element patterns. This host rock chemistry is consistent with the Smith option being, an ophiolite-related, Cyprus-type VMS Cu deposit, unique to the BMC.

Comparison of Late Holocene and Pleistocene sedimentologic and oceanographic records in the Amundsen Gulf, Northwest Territories, Canada

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Analysis of surface sediment from two box cores from Canadian Arctic Shelf Exchange Study (CASES) stations 403B (59 m) and 415B (56 m) located in the Amundsen Gulf will expose the sedimentologic and oceanographic records of the area. Deep-sea Arctic benthic foraminiferal assemblages of the Late Holocene (403B) and Pleistocene (415B) will be compared to show differences in foraminifera between an environment of high sedimentation and an area of low sedimentation with glacial evidence. This contrast will provide insight into glacial records and arctic productivity.

Potential impacts on the Arctic ecosystem need to be explored, since the Arctic is most vulnerable to changes in climate. This study will add to the assessment of the effects that presently influence sea ice cover which are important in the understanding of the coastal shelf regions of the Arctic and its productivity

Magma evolution in the Pliocene – Pleistocene succession of Kos, South Aegean arc: petrographic evidence for magma mixing

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The island of Kos is the most easterly volcanic centre of the Pliocene-Quarternary South Aegean arc, related to the subduction of the African plate beneath the Aegean microplate. Pliocene and easly Pleistocene volcanism is represented by dacite flows and rhyolite domes. The mid Pleistocene Kefalos tuff

has abundant lithic clasts of magmatic rocks. The 0.16 Ma Kos Plateau Tuff, derived from andesite stratocone now subsided beneath the sea south of Kos, also has abundant lithic clasts.

Lavas, mafic enclaves from more felsic rocks, and lithic clasts from pyroclastic rocks have been examined by petrographic microscope and electron microprobe. The rocks examined range from andesite to rhyolite in composition. Plagioclase is commonly complexly zoned, with corroded and embayed cores, spongy cellular zones, and calcic spikes. Ovoidal quartz is mantled by clinopyroxene crystals and has trapped glass inclusions with a range of compositions. Complexly zoned clinopyroxene is in places overgrown by boxy cellular orthopyroxene. Andesite contains quenched accessory acicular apatite and glass inclusions are found in some plagioclase.

Sr and Nd-Sm isotope determination show mantle values in all rock types, from andesite to rhyolite. Andesite magma may have been generated by remelting crust underplated with mantle-derived magma during regional mafic plutonism in the Miocene. Episodic replenishment of a fractioning magma chamber would account for the observed mixing textures and the triggering of explosive eruptions.

Stratigraphic and depositional significance of bioclastic horizons within the Ben Nevis Formation (Lower Cretaceous), White Rose Field, Jeanne D'Arc Basin.

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The Ben Nevis Formation is a siliciclastic succession of Early Cretaceous age, deposited in a marine shoreface setting within the Jeanne D'Arc Rift Basin, offshore Newfoundland. The Formation contains intervals of calcareous bioclasts, which are the focus of this study, and the research aims to understand the depositional and stratigraphic significance of these bioclastic concentrations. The thesis intends to provide insight as to the magnitude, type and frequency of events responsible for deposition of bioclast layers, as well as to evaluate their possible lateral extent and use as stratigraphic marker beds. The latter is potentially useful to the oil and gas industry for subsurface correlations within the Ben Nevis sandstones. Furthermore, these bioclastic horizons are highly relevant to hydrocarbon reservoir quality because they commonly make up the core of calcareous cemented intervals.

Core samples of two wells from the White Rose Field have been studied, A-17 (129m) and B-07 4 (109m). The wells are separated by a distance of about 4km and have in common an estimated stratigraphic thickness of approximately 40m. Core descriptions are based on taphonomic characteristics (sorting, fragmentation, size, shape, abundance, etc.) as well as sedimentary and stratigraphic features (thickness, contacts, matrix, diagenesis, etc.). The data is presented in tabular format and used to make a number of plots keyed to depth (e.g. depth vs layer thickness) and cross-plots as graphical methods to find patterns of depositional and/or stratigraphic significance. Graphs of each well are compared to find common trends and to test correlation of given layers between wells.

Bioclast layers are categorized into four types based on proportions of bivalve shells to serpulid tubes. Layers commonly range in thickness from 1 to 45 cm, however, there are 2 layers of thickness > 2m near the base in the core of well B-07 4. Thickness of the layers may imply distance from source, the thicker layers being proximal, and thinner layers being more distal. Intervals between concentrations are generally barren, but occasionally contain dispersed bioclasts. Bivalves are commonly whole valves with minor fragmentation. Most bivalve shells are very thin relative to their length, and appear to have been affected by post-depositional dissolution. Conversely, serpulid tubes appear to be less affected by dissolution.. This is a study in progress, and currently focus is on attempting to identify and interpret small and large-scale trends of bioclast accumulation.

Weber sandstone compressibility and matrix studies to investigate the probability of fluid-withdrawal-related subsidence over the Mackenzie River gas fields

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The removal of pore-filling material from porous rock can result in the compaction and subsequent subsidence of the rock as compression pressures are increased on the grains to compensate for the removal of supporting pore-filling materials. This type of subsidence can occur as the result of groundwater, gas or oil withdrawal; there are many examples worldwide of it occurring. This thesis will focus on the current question of the possibility of subsidence in the Mackenzie River Gas fields, Yukon, by comparing the attributes of the Mackenzie River fields to case studies of subsidence in other areas, as well as lab-based compressibility and thin-section testing to gain an understanding of the likelihood of the Mackenzie River fields to undergo subsidence.

The Project will include background research into several examples of related case studies of similar subsidence, including instances such as the groundwater-removal-related subsidence in Venice, Italy, the subsidence of the Ekofisk offshore platform over the ConocoPhillips North Sea gas fields, and the oil field subsidence at Wilmington, California. This examination will highlight the types of fluid removed, age, characteristics and type of rock involved, and the amount and effects of the subsidence that occurred. All of this information will be compared to data on the Mackenzie River Gas fields.

Data will also be collected through the testing of Weber Sandstones to compare the compressibility of a sample's matrix to the compressibility of samples with included discontinuities. Matrix thin sections will also be used to study the grain-to-grain contacts within the samples, and data from all these tests will be compared to the conditions at the Mackenzie Gas Fields as well.

Paleoecology of the Early Cambrian fauna, Smith Point, Western Trinity Bay, Newfoundland

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The Early Cambrian Smith Point Limestone was studied at Harcourt, Western Trinity Bay, Newfoundland. It is composed of bedded red-nodular limestone, with persistent interbedded mud laminae that can be traced for up to seven meters. The Smith Point Limestone consists of the Fosters and Brigus formations of the Bonavista Group. These sediments have been interpreted as a lower energy environment overlying the high-energy tidal Random Formation. The Brigus Formation marks a diachronous onlap of the trilobite-bearing Lower Cambrian. Previous work has demonstrated a faunal turnover between these two formations, including extinction of many small shelly fossils, evolution of the first trilobites and first appearance datums of some molluscan taxa. The succession also yields some of the earliest known small shelled metazoans, known as the small shelly fauna. The current study identifies the context of paleoecology of those organisms during the Tommotian – Atdabanian Stages; a time of sedimentation and growth faulting in Avalonia.

Data acquisition included two days of field work, measuring section and collecting a total of twenty-five samples from beds throughout the succession. Samples were then digested in acid to remove carbonaceous material, followed by sieving and hand-picking of fossil samples, under a stereographic microscope. Rock samples were cut and processed for thin-sections.

Preliminary investigations reveal significant paleontologic and petrographic variations throughout the succession. Changes can be seen on a smaller-scale (i.e. bed-to-bed) and on a larger-scale (i.e. top to bottom through the entire sequence). These changes are in fossil abundance, taxonomy, and morphology and mineralogy. Moldic *Hyolithilus* appear to be dominant until the middle of the section, where phosphatic forms become dominant. Tommotiids are common, along with brachiopod shell fragments and whole shells of *Obolella* sp., *Micromitra phillipsii* and *Paterina* sp. Also, *Rushtonia*, *Torellella*, *Protohertzina* Protoconodonts, Hyoliths, and agglutinated foraminifera have been observed throughout the succession.

Petrographic and chemical variations through the Goldenville and Halifax formations, Bear River, High Head, and Broad River sections, southwestern Nova Scotia

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The Meguma terrane of southern Nova Scotia is the most outboard terrane of the northern Appalachian orogen. It is characterized by the Meguma Group, made up of the Late Proterozoic(?) – Cambrian Goldenville Formation which consists mainly of thickly bedded, massive metasandstone with minor interbedded metasiltstone and slate, and the conformably overlying Cambrian to Lower Ordovician Halifax Formation, composed mainly of slate with thin beds of metasiltstone and metasandstone. Although generally interpreted to have formed at a continental margin, whether that continent was Africa or some other peri-Gondwanan area is still debated.

Sedimentary rock geochemistry is a viable tool for regional correlation and provenance studies. During the summer of 2005, samples were collected from three relatively well exposed stratigraphic sections through the Goldenville and Halifax formations in the Bear River, High Head, and Broad River areas of the Meguma terrane. The purpose of this project is to compare petrographic and chemical data from these samples to look for systematic regional or stratigraphic variations in the Meguma Group. These data will be integrated with other available geological and geochronological data to interpret the depositional/tectonic setting and provenance of the sediments that now form the Meguma Group.

A total of 38 samples were collected, mainly metasiltstone and metasandstone but also including some slate samples. Twelve samples were collected over a section 12 000 m in stratigraphic thickness in the Bear River area, 13 samples over a section 7600 m in stratigraphic thickness in the High Head area, and 13 samples over a section 3200 m in stratigraphic thickness in the Broad River area. The Bear River section covers the upper part of the Goldenville Formation and all of the Halifax Formation, whereas the High Head section incorporates most of the Goldenville Formation and the lowest unit in the Halifax Formation. The Broad River section crosses the upper part of the Goldenville Formation and the lowest unit in the Halifax Formation. Documentation and interpretation of the petrography and chemistry of these samples will form the basis of the BSc honours thesis of the author.

Stratigraphy, geochemistry, petrography, and temporal evolution of the final stages of eruption at Rockeskyllerkopf, West Eifel volcanic field, Germany

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The Quaternary volcano Rockeskyllerkopf, in the West Eifel volcanic field, is a composite volcanic complex erupted on to dolomite of Devonian age, ~500 ± 100 ka BP. The eruption style evolved as interaction with ground and surface water decreased; from maar-like deposits to a scoria cone topped by a lava flow. The scoria cone is the focus of this study.

Within the upper most section of the Rockeskyll quarry,

the scoria cone and lava flow phase are well exposed in a near perfect radial cross section through the volcano. The scoria cone was erupted in three main stages: a) The initial crater wall building stage (~10 m thick) is characterized by poorly-layered to massive, subangular, welded, vesiculated lapilli, that average 1.25 cm in size. The middle five meters include a succession of coarsening upwards, ash to 6 cm lapilli, layers. b) The second stage (~14 m thick) exhibits well-developed, large scale layering, with the majority of the units containing lapilli up to 6 cm and bombs as large as 1m. The lapilli are rounded to subrounded and vesiculated, bombs range from vesiculated to weakly vesiculated and rounded to angular. c) The final stage of the crater wall formation (~12 m thick) is characterized by a reduction in lapilli size and finer layering. These deposits comprise ~2 cm sized vesiculated, rounded to subrounded lapilli, with sparse bombs up to 15 cm.

Overlying the crater wall deposits are crater fill deposits that disconformably overlie the layering in the wall. These fill deposits are up to 2.5 m thick and are composed of poorly layered and poorly sorted lapilli averaging 2 cm. Draped over the entire crater wall unit, from the bottom of the crater to the outer most exposure of the wall, are two welded scoria with ash layers. The next stage of eruption was dominated by effusive eruption producing spattered material including fragments with flow structures as well as bread crust bombs that filled and spilled over the crater wall.

The evolution of eruptive styles and materials produced, examined through detailed stratigraphic sections, will be correlated with geochemical and petrographical variations. This allows us to build up a picture of the textural and chemical evolution of the youngest deposits in the Rockeskyllerkopf volcano.

A study of the Manicouagan shear zone in the Grenville Province of eastern Quebec: metamorphism and structure in the footwall beneath the high pressure belt

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The Grenville Province is a deeply eroded continent-continent collisional orogen in which exposure of lower crustal deep roots of the orogen can be seen locally. Within this province, the Manicouagan shear zone in eastern Quebec is exposed for approximately 60 km along the shore of the Manicouagan reservoir and Mouchelagane River. The shear zone separates rocks from the underlying Archean basement and its Paleoproterozoic cover known as the Knob Lake Group, from the overlying High Pressure Belt. The underlying rocks in the footwall are known as the Gagnon terrane, which is a mid-crustal metamorphic fold and thrust belt.

Previous work has provided evidence of the metamorphic assemblages in the Manicouagan shear zone, where the shear zone is characterized by amphibolite-facies assemblages, which overprinted eclogite and granulite-facies in the base of the High Pressure Belt. Also, from previous work, a tectonic model for the formation of the fold-thrust belt has been developed, whereby NW-vergent cover-dominated thrusting is followed by deeper level thick skin thrusting, involving the Archean basement. This thrusting is thought to be out of sequence and occurred as a result of the emplacement of the HP Belt. Also, studies of the Gagnon terrane in the Manicouagan region show that a large unit of the thrust belt was back thrusted to the SW. In the field area NE-plunging lineations support SW directed back-thrusting during emplacement of the HP Belt.

The focus of this study is to document the structure and metamorphism of the footwall beneath the HP Belt. The footwall is imbricated into the thrust belt and is SW vergent, which is in contrast to the NW thrusting in the overlying HP Belt.

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