Mineralogical and petrographic characteristics of the Cenozoic and Upper Mesozoic reservoirs in Venture B-13 and Arcadia J-16 Wells, offshore Nova Scotia

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The Mississauga (Lower Cretaceous) and Mic Mac (Middle-Upper Jurassic) formations are reservoir rocks for hydrocarbons in the offshore Nova Scotia. Cores from both formations were studied in Venture B-13 and Arcadia J-16 boreholes respectively for their mineralogy and petrography. Clay mineralogy of cuttings from overlying Cenozoic formations in Venture B-13 borehole was also studied. The upper part of the Mississauga core consists of three units of oolitic-fossiliferous arenaceous limestone (total thickness of 5.81 m) alternating with shaly siltstone and oolitic-fossiliferous calcareous sandstone. The amount of oolites and fossils gradually decreases downward as the limestone turns to calcareous sandstone. The deeper intervals of the core are made up of alternating sandstone, siltstone and shale. Shale intervals become more common in the lower intervals. The alternating sandstone units have calcareous cement, but other cementing materials (e.g. microcrystalline silica - chert and/or clay) are not uncommon. Some units have high porosity / permeability with almost empty pore spaces. Mic Mac core comprises alternating sandstone, siltstone and shale. Mineralogically both Mississauga and Mic Mac sandstones are rich in quartz with minor amounts of feldspar and mica with sporadic occurrences of glauconite, chamosite, pyrite, iron oxides, bituminous material; accessory amounts of zircon, tourmaline, rutile and variable amounts of calcite, minor chert and clay as cementing material. Fluorescence microscopy confirms the existence of relict hydrocarbons in these sands. Sand grain size varies from fine to coarse and is generally poorly sorted and the grains are subrounded to angular in shape. QmFLt, QtFL, QmFK, QpLvmLsm triangular plots for the main constituents of these sandstones, i.e., quartz, feldspar and lithic fragments show that they are quartzarenites and/or

sub-arkoses and have craton interior continental block provenance. Mic Mac sands are more quartzitic, poorer in feldspar and rock fragments relative to those of Mississauga sands. The poor sorting and angular nature of the sand grains suggests the adjacent mainland lithologies dominated by Meguma Group and South Mountain Batholith as the most probable source for these sediments. Preliminary clay mineral studies of shales associated with sandstones over the Mesozoic and Cenozoic succession in Venture B-13 borehole show predominance of chlorite, illite, kaolinite, montmorillonite and mixed-layer clays pointing to the detrital origin for most of these clays with some contributions due to diagenetic effects. Montmorillonite and kaolinite decrease at deeper parts of the succession possibly due to their transformation to illite and chlorite respectively, perhaps associated to the build up of overpressures at a depth of 4500 m.