Detailed stratigraphy and porosity development in the Swan Hills Formation, west central Alberta, Canada

R. Troy McLaughlin
Department of Geology, Acadia University, Wolfville, Nova Scotia B0P 1X0, Canada

The Swan Hills Formation is a Devonian fringing reef system and is a major oil and gas reservoir in western Canada. It has been the focus of a number of studies but the association between particular facies and porosity development is still not well understood. In this study, the stratigraphy and porosity of a section of core from the Swan Hills Formation is investigated in detail to determine the controls on porosity and reservoir development.

The Home Oil core was retrieved from west central Alberta (4-31-67-10 W5) at a depth 2611 m to 2534 m. Preliminary analysis of the core shows that it is a reef system characterised by stromatoporoids including *Amphipora* and to a lesser extent brachiopods, gastropods, echinoderms, and bryozoans. Six distinct facies were observed. Facies 1 (2611 m – 2603 m) is characterised by *Amphipora* in a light brown vuggy matrix. This facies was developed in a low energy, back-reef environment. Facies 2 (2603 m - 2567 m) is characterised by bulbous stromatoporoids and *Amphipora* in a dark-brown matrix, and is interpreted as having been deposited in a platform environment. Facies 3 (2567 m – 2564 m) is characterised by the presence of dendroid stromatoporoids in light to medium-brown coloured matrix indicating a reef environment. Facies 4 (2564 m – 2557 m) is characterised by a light crystalline homogenous matrix with no recognisable macrofossils; this facies probably represents a reworked *Amphipora* bed. Facies 5 (2557 m – 2543 m) is marked by a diverse fossil assemblage but is characterised by the introduction of brachiopods. Its matrix ranges in colour from dark brown to light brown. This colour change is most likely due to fluid interaction. This facies was most likely deposited in a fore-reef environment. Facies 6 (2543 m – 2534 m) is characterised by its vuggy texture and the presence of subspherical stromatoporoids in a light brown silty matrix and was probably deposited in a reef environment.

Porosity was studied through thin section and computer image analysis. Porosity is primarily secondary and was best developed in facies that contained *Amphipora* and other stromatoporoid material. Porosity development was due primarily to the presence of open galleries and intergranular pore spaces and ranged as high as 12%. Interconnectivity was best developed in reef and fore-reef zones where porous *Amphipora* were in close contact to each other. This study shows that a detailed understanding of fossil assemblages and facies architecture may be essential to identifying where porosity is best developed.

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