Characterization of outburst channel sandstones in the Phalen Colliery, Cape Breton Island, Nova Scotia

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The Phalen Colliery of New Waterford, Cape Breton Island, Nova Scotia is currently mining coal from the Phalen Seam of the Sydney Mines Formation, part of the offshore Carboniferous Sydney Basin. Since opening in 1984, the colliery has experienced several rock outbursts within the massive channel sandstone that overlies the Phalen coal seam. An outburst is a violent explosion of rock and gas, the occurrence and intensity of which depends on the presence of high lithostatic pressures, high gas pressure, high modulus of rigidity (brittleness), and very low permeability. Samples of the channel sandstone have been obtained from two cores drilled into the roof of drivage tunnels, distal (PH-102) and proximal (PH-250) to the site of a recent outburst, and from the outburst site.

Sandstones from PH-102 are very fine grained, and have evenly distributed intergranular porosity (range 6.9 to 12.1%, mean 8.5) and horizontal permeability ranging from 0.030 to 3.020 millidarcies (mean 0.88). Sandstones from core PH-250 are very fine grained to very coarse grained, and show generally high amounts of compacted lithic fragments. Isolated porosity occurs within corroded feldspars and pore-filling kaolinite and ranges from 4.5 to 7.7% (mean 6.5). Horizontal permeability is lower than PH-102, ranging from less than 0.01 to 0.19 millidarcies (mean 0.05).

The sandstone in PH-102 is interpreted to represent a lower outburst risk. The evenly distributed intergranular porosity and higher permeability allow for a more controlled release of gas, decreasing the potential energy of the system. Under similar depth conditions, sandstone from PH-250 is interpreted to have a much higher risk for outbursts. The restricted porosity within rock from PH-250 allows for the storage of methane (energy), but the very low permeability greatly restricts the escape of gas when pressure on the rocks is reduced during mining, spawning an outburst. Preliminary work on outburst sandstones from the Phalen Colliery, No 26 Colliery, and Merlebach Colliery, France, show the same characteristics of corroded feldspar, kaolinite pore filling, low permeability, and predominantly intragranular porosity as rock from PH-250.