NORTH GOONYELLA – STRUCTURAL CONTROLS ON PERMEABILITY

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North Goonyella lease, mineplan and extent of inseam gas drainage
Close up of inseam drainage holes MG3N, MG4N and MG5N. Note fan pattern for MG3N and candelabra pattern for MG4N & MG5N
Before an attempt was made to address the structural controls on permeability, it had to be determined what was a typical hole flow.
How were hole flows classified?

All the hole flow charts for inseam drainage holes drilled from MG3N, MG4N & MG5N were studied, and a datum chosen. The life span of a hole had to be taken into account and therefore the flow at Day 20 was taken to be about the peak time.
All Gas Flow data from all holes

Days on Drainage

Flow rate in l/m/m
One of the big problems with looking at all the data was that nothing stood out as being obvious. The data was then sorted into MG3N, 4N & 5N separately. The graphs were then clipped to show only drainage times to Day 120 and max flow of 20 l/m/m. This helped only marginally. A separate datum was chosen for each gate road being Day 20 for MG3N, Day 30 for MG4N and Day 40 for MG5N.
MG 3N Clipped

Flow rates l/m/m

Days

MG 3N

Linear (MG 3N)
MG 5N Clipped

Flow rates l/m/m

Days

MG 5N
Linear (MG 5N)
The hole flow graph from each inseam gas drainage hole was then viewed and the hole classified as either Poor, Good or Exceptional flowing.

- Poor flowing < 5 l/m/m
- Good flowing 5-15 l/m/m
- Exceptional flowing > 15 l/m/m
Typical MG4N Flow Rate per Hole

Flow Rate (l/min/m)

Days

0 20 40 60 80 100 120
COLOR CODE USED FOR HOLE FLOWS. The length of the hole is plotted in the relative colour

- RED – Poor flowing hole, < 5 l/m/m
- Green – Good flowing hole, 5-15 l/m/m
- Yellow – Exceptional flowing hole, >15 l/m/m
All the coloured hole flows are then plotted 5m North of the inseam holes so as not to overwrite the colour coded geology of the inseam hole.
Stub pattern showing coloured flow plots together with coloured geology of inseam holes
The time had now come to fit the last piece of the puzzle.

The “as mined” geology, interpreted and predicted faulting, seismic deduced faulting and other black magic was overlain on the coloured hole flows.
Bugger!

Where’s the obvious structural control on the hole flows?
A reasonable expectation would have been to have all the holes which cross a main fault to have similar flow characteristics.

But No; some are good, some exceptional and some just plain dogs. The same split occurs in unfaulted stub patterns (if there is such a thing at NG).

Larger scale faulting does not seem to provide the uniform control on hole gas flows and therefore permeability.

What else is there?
From past experience at North Goonyella (and most other mines), shear zones which contain mylonite have created some degree of impermeable barriers to conventional wider spaced gas drainage.

Unfortunately these zones can result in the following; firstly they can release gas so strongly that hole completion and installation of dewatering lines is compromised meaning that the zone is not drained adequately with wider spaced drilling or; the hole is completed and lined, but the zone is so soft and weak that the fines clog the hole resulting in low drainage flow rates unless the hole is rigorously maintained and monitored.
Typical shear zone area showing the need to drill many close spaced short holes to drain the area of gas. The location of these zones is often only obvious when gas conformance cores are drilled to test the effectiveness of gas drainage (and the cores fail!).
It would seem that the only real structural control on the effectiveness of gas drainage at North Goonyella is from the mylonite lined shear zones. Identification of these zones can be enhanced by colour coding the geology in the inseam holes and plotting them to give an estimate of the location and extent of these zones.
The ultimate test of the effectiveness of the gas drainage will still be by the placement of gas conformance cores in the “worst” locations. Good practice is to pick the worst spot, estimate what the gas core result should be based on the hole flows, and then see if the core matches the estimate.

If that doesn’t work, then drill more holes and .....
NEVER GIVE UP !!!
• Complex areas are easier to visualize resulting in better structural interpretation