CBM And Shallow Conventional Gas In The Main Karoo Basin Of South Africa

Kinetiko Energy and its South African partners are exploring for coal bed methane (CBM) and shallow conventional gas in the Main Karoo Basin of South Africa. It has long been known that the extensive Permian coals of the northern part of the Main Karoo Basin contain significant amounts of methane gas generated over geological time by the maturation of the coals. Gas fields are located at Evander and in the Free State but it is now recognized gas very widespread in the coals and sediments of the basin. Kinetiko and JV partners have also shown that there are accumulations of methane gas in parts of the sandstones that host the coal measures. These accumulations are contained in the sandstone pore spaces and are consequently shallow conventional gas accumulations.

Kinetiko and its partners have developed a basin model for gas exploration that has enabled the assembly of a tenure position of a possible 28,000 km^2 covering the most prospective parts of the northern Main Karoo Basin. The commercial potential of this nascent gas industry is greatly enhanced by the concentration of economic and power infrastructure in this part of South Africa.

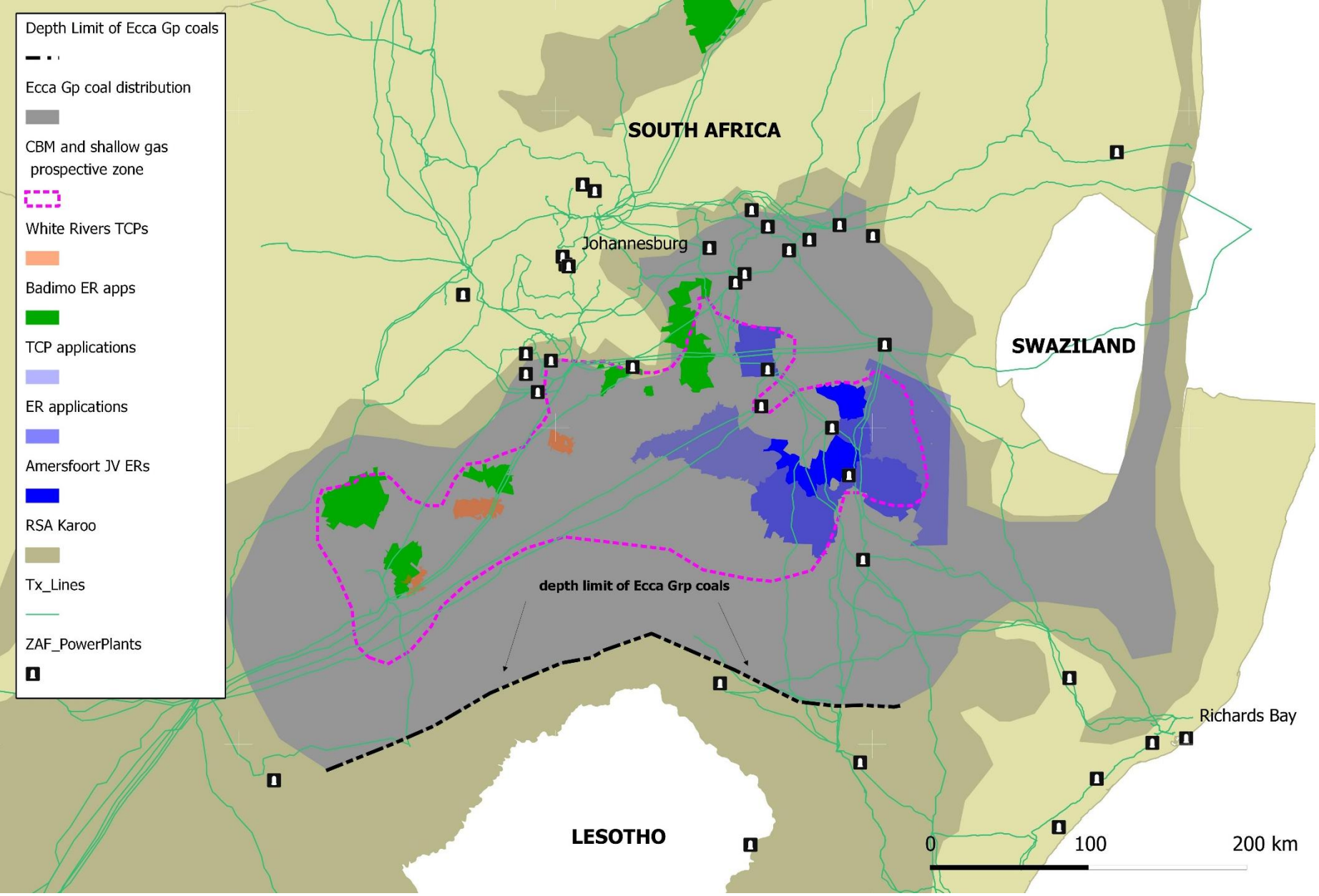
Coal Distribution

The northern Karoo Basin contains extensive coal deposits, the shallower (<200m) portions of which have been providing coal for power generation and export for over 100 years. The designated coal fields shown are based on areas of past mining activity and their immediate depth extensions. However limited deeper drilling has shown that coals are present in the basin at depth of up to 900m.

While coals are extensive in the northern Karoo Basin regional variations in depositional regimes and basin subsidence have resulted in considerable variations in coal geology across the basin. Understanding the coal formation trends across the basin is an important regional factor in gas exploration.

Depth and Gas Content of Coals

Methane gas is generated as the coal matures with burial as the host sedimentary basin subsides. Exploration for gas contained in coals is primarily determined by the relationship between increasing pressure with depth and the resulting increase in the capacity for coal to hold gas adsorbed onto microscopic surfaces. However increases in the capacity of the coal to hold gas is essentially limited at from a point where depth pressure begins collapsing the microscopic architecture of the coal and reducing its capacity to hold adsorbed gas.



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In general terms the relationship between depth and gas content of the coals means that coals between about 200m and 900m are the most prospective for high levels of adsorbed methane gas.

This is not to say that gas contents at any given depth are uniform, as there are many other more subsidiary factors, such as water flow over geological time, sedimentary burial history, coal maturation history and so on, that can affect the generation, retention or loss of adsorbed gas in the coal.

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Tenure and basin prospectivity in South Africa

CBM AND SHALLOW CONVENTIONAL GAS IN THE MAIN KAROO BASIN OF SOUTH AFRICA (cont.)

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Shallow Conventional Gas

Coals are generally though capable of producing many times (in some studies 14x) the amount of gas that can be retained in the coal. Therefore over the maturation history of the coal methane gas migrates through the host sedimentary sequence. Some is trapped in the porosity of the host sandstones. Localised geology plays a role in trapping the gas in the sandstones. In the Karoo Basin sedimentary layers of relatively impermeable mudstones are interspersed with the more porous sandstones, and there are also extensive low permeability dolerite sills (horizontal bodies) and dykes (vertical bodies intruded into the sequence. Dolerites and mudstones compartmentalize the sandstone sequence trapping the gas and slowing or preventing further lateral or vertical movement of the gas.

Understanding the Karoo sedimentary sequences and the geometry of the dolerite intrusions are important in subregional to local gas exploration considerations, particularly with respect to individual well location.

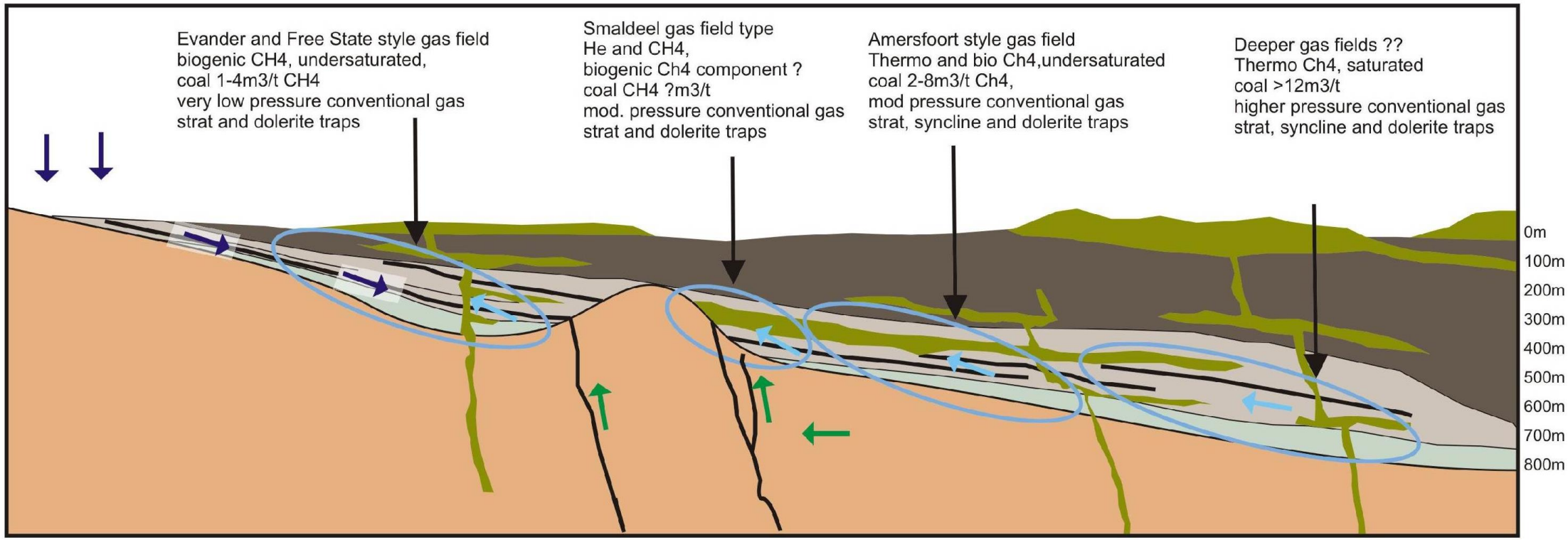
Gas Composition

So far the gas compositions observed at the Amersfoort Project have been over 95% methane. However it is well known that local conditions can result in gas of greatly differing composition. While gas derived principally from maturation of the coals during heating (ie thermogenic) consists essentially if methane with minor traces (<1%) of other more complex hydrocarbons like ethane. At depths of 100 to 300m where ground water is not particularly saline methane can also be produced by biogenic activity consuming remnant organic material. This not only produces methane but variable amounts of economically deleterious carbon dioxide.

Helium is another gas component that occurs in minor quantities in the methane dominated CBM and shallow conventional gasses of the northern Karoo Basin. Helium levels in excess of 10% in otherwise methane dominated gas flows in drill holes in north eastern parts of the basin. Small scale commercial recovery has been undertaken at arious times in the Smaldeel locality. The helium is thought to be the result of radioactive composition of uranium minerals in the Proterozoic basement underlying the Karoo Basin. The gas has migrated over geological up into the Karoo sequences where it has been caught to varying degrees in the methane dominated gas accumulations. As a rare and strategic commodity helium commands a price 10 to 20 times that of methane, and could provide a useful economic boost to methane production.

Regional and depth trends in gas composition are therefore important in exploration.

GAS EXPLORATION MODEL FOR THE NORTHERN MAIN KAROO BASIN SOUTH AFRICA



Dolerite dykes and sills - M-E Jurassic

Beaufort Group , mudstone, shale, sandstone - E. Triassic

Ecca Group, mudstone, shale, sandstone, coal - L. to E. Permian

Dwka Group, glacial sediments - E.Permian to L. Carboniferous

Pre Karoo Basement including Witwatersrand Supergroup

Pre Karoo Fault

Methane migration

Helium migration

Meteoric water infiltration

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