

Keynote Paper 3
**Sedimentology: Application of concepts in exploration for petroleum, coal
and uranium**

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Petroleum, coal and uranium are three very important mineral energy resources; and together, they provide 75% of the total world energy output. Except for uranium which is also found in hydrothermal veins and pegmatites associated with igneous bodies, coals and petroleum are sedimentary in origin. Coal is a sedimentary deposit found *in-situ*, with re-worked coal deposits rarely reported. Petroleum, on the other hand, is a by-product of organic matters, (for example kerogen in shales and sandstones) which is trapped either *in-situ* as in the case of coalbed-methane, or expelled from the source environment and migrated through a porous medium into reservoirs (usually sandstones and carbonates, and less commonly fractured granites and sills).

Uranium deposits in conglomerates, sandstones, shales, or even limestones, have been reported to occur as diagenetic minerals formed or precipitated from uranium-rich solution in generally reducing environments. The uranium deposits have been found in sandstones of intermontane basins where the carbonaceous

materials are present in abundance; in arkosic sandstones and mudstones of continental origin, close to sediment (and uranium) sources, where slight change in the Eh and pH of uranium-bearing solution will trigger the precipitation of uranium; and in shales, lignites and phosphorite where uranium is enriched through sorption or other chemical processes. Uranium deposits in lignites are usually associated with permeable sandstones below a regional unconformity.

Coals in commercial quantity can only be found deposited in coastal/swampy/deltaic environments, where the depositional environments are usually reducing and carbonaceous and/or organic matters are better preserved. Coal deposits are likely to be found in the upper half of the deltas where the environment is favourable for the development of swamp. The extent of coal deposits is a function of size of the prevailing deltas and rate of delta aggradation.

Petroleum is found in a basin where four factors/features must be present: source rocks (coal and coaly materials are good examples), appropriate temperature sufficient to "cook" the source rocks to generate petroleum, reservoir rocks (for the generated petroleum to be stored) and traps (structural, stratigraphic or diagenetic features which impede the migration of petroleum from migrating further). In a sedimentologic complex, it is essential that the depositional environments of sedimentary sequences be determined, as both the source and reservoir rocks, and frequently the stratigraphic and diagenetic traps, are confined to specific sedimentologic settings. In modern day exploration, recognition of the sedimentary sequences is vital, as this will determine the success of an exploration venture. This sequence recognition concept is being applied successfully in the exploration for coal deposits.

Petroleum, coal and uranium deposits play a very significant role in our lives, which provide catalysts for economic growth and development; there is therefore little wonder that mankind fights in wars just to maintain the sovereign right over them. To know their occurrences, it is vital to understand their habitats through application of sedimentologic concepts.
