found to be successful. A matter to be noted with justifiable pride.

The procedures adopted in the computation of additive and multiplicative geochemical anomalies are having strong scientific basis. Especially in tracing the extensions of mineralized zones and in determining the vertical and horizontal depth extensions and their geological relationship in time and space. Thus, it can indicate termination of mineralized zone either vertically or horizontally of an ore body. Hence it has got potential application in geochemical exploration.

In secondary dispersion, sometimes elevated metal values are due to scavenging caused by iron and manganese oxides and hydro-oxides, thus generating false anomalies followed up by drilling and resultant colossal loss of money. Thus, recognition of true and false anomalies is of paramount importance. Statistical methods are not able to provide satisfactory solution in such a context.

Researches carried out in sequential and selective chemical extraction techniques have met with reasonable success, but indepth research is still required. The attempts made in characterizing the anomalies using chemical extractions have also given an insight in understanding and identifying various components that are associated with total extraction in terms of metal ions located in ion exchangeable position. For example, scavenged metals by Fe and Mn, metals associated with organic-metal-complexes, metals located in silicate lattice etc. In addition to this, further characterization was made in terms metals associated with carbonate, sulphide, sulphate phases and computation of differential quantities and identification of their geological responses etc. Work was also carried out in understanding, the behaviour and nature of chemical extraction reactivity properties, which established that some of the sequential extractions were extracting other chemical phases than what they were supposed to extract, thus not only the results were erroneous but also disturbing the structure of other phases, which were not supposed to be disturbed and which were meant for subsequent extraction processes. After recognizing the inapplicability, further research established more precisely the metal phases that were extracted in various techniques and geological reasoning was also adduced.

In summation, in exploration geochemistry endeavour, one has to accomplish the envisaged objectives taking into consideration geological inputs and within the enunciated geochemical doctrine for a meaningful geological success.

PETROLEUM GEOLOGY: KRISHNA-GODAVARI BASIN*

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EXTENDED ABSTRACT

The economic development of any nation can be measured by its energy consumption and hydrocarbons are known primary energy resources in the world. Hence, the hydrocarbon exploration will continue to be of primary importance. The prerequisite for hydrocarbon exploration is the presence of a sedimentary basin and its geological understanding.

The Krishna-Godavari (KG) Basin with an areal extent of 45,000 sq km (up to 200 m isobath) is located at the centre of the East Coast of India. It attained importance since late seventees by the presence of hydrocarbons in commercial quantities in the first well drilled in the basin. Since then, over these 25 years, the continued exploratory efforts by seismic data acquisition and deep drilling have resulted in voluminous subsurface data. The data volume include nearly 40,000 GLK of 2D seismic data, 1000 sq. km of 3D seismic data and more than 325 deep wells. The exploratory efforts till date have resulted in identification of 48 oil and gas bearing prospects out of 170 structures drilled. The deepest well onland went up to

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5200 m and offshore up to 4600 m. The unique distinction of the basin is that it is producing hydrocarbons from the reservoirs ranging in geological age from Permo-Triassic to Pliocene.

Geological history of the basin can be summarized as follows: It was a major intracratonic rift within the Gondwanaland until the Early Jurassic. Since Cretaceous, it became a peri-cratonic basin after the break-up of the Indian plate due to dismemberment of the Gondwanaland. Since then, it moved northwards from 50° south latitude and the eastern continental passive margin rotated 20° in counter-clockwise from the initial E-W position to NNE-SSW direction. The tri-junction of the dismemberment coincides with the Machilipatnam Bay. The NW-SE trending earlier Gondwana graben (Pranitha-Godavari) formed a failed arm of the triple junction and presently underlies the NE-SW trending KG basin up to the Ocean Continent Boundary (OCB).

Since Cretaceous, the deltaic system generally prograded to southeast, although some deltaic lobes have shifted in direction in response to the changing rates of sediment influx and growth faulting.

The stratigraphic column of the basin includes older Talchir Formation of Permo-Carboniferous overlain by Barakars which in turn underlie the Chintalapudi sandstone of Permian. A red coloured sandstone sequence separates these fluvial pre-Cretaceous sequences and the deltaic/marine Cretaceous and younger sections. The Late Cretaceous-Early Palaeocene basalts lithologically distinguish the Tertiaries and Mesozoics in the basin. A thick carbonate section of middle Eocene further differentiates the stratigraphic column. The litho-facies variations of a given geological time, that is, proximal arenaceous and basinal argillaceous sequences can clearly be identifiable in the basin. All these litho-facies variations are studied in space and time and a comprehensive rock stratigraphic nomenclature was suggested and being followed in knowing the source, reservoir and cap facies in a petroleum system concept.

A petroleum system can be summarized as an independent stratigraphic compartment within which the three primary requisites for hydrocarbon accumulation that is, source, reservoir and cap rocks can occur. In Krishna-Godavari Basin four petroleum systems are identified and they are stratigraphically classified as Pre-Cretaceous, Cretaceous, Palaeogene and Neogene systems.

The source rocks are mainly argillaceous sequences deposited in reducing environment and contain marine/plant organic matter which can be converted to hydrocarbons under certain pressure and temperature conditions which is termed as maturation. In the basin, source facies are known in Carboniferous shales-Barakars, Lower Cretaceous Raghavapuram shale, Palaeocene shales and lower Miocene argillaceous sections in different parts of the basin. The reservoir rocks are porus and permeable rocks which not only host the hydrocarbons and allow them to flow within it for a commercial accumulation. On the other hand, the impervious rocks like shales/basalt, carbonates act as cap rocks to arrest the movement of hydrocarbons in the reservoirs both vertically and laterally to form a commercial accumulation. The entrapment styles include low amplitude structural closures, fault closures, wedge-outs, unconformity controlled structures and permeability barriers in different reservoirs. The major petroleum occurrences include Mandapeta gas field from a Permian sandstone, Kaikaluru-Lingala oil fields from a lower Cretaceous clastics, Tatipaka-Pasarlapudi gas field and Mori oil field from lower Eocene sandstones, Ravva oil field in Miocene clastics off Anlapuram coast. However, the pre-Cretaceous and Cretaceous hydrocarbon fields are more of stratigraphically controlled and hence bear relatively less potential, whereas fields in Tertiary sequences are of stratigraphically controlled and hence have higher potential.

The hydrocarbon reserves sequence wise are: 330 MMT in pre-Cretaceous, 230 MMT in Cretaceous, 300 MMT in Palaeogene and 200 MMT in Neogene reservoirs. So far nearly 200 MMT of inplace reserves were established out of 1060 MMT of resources estimated and hence the basin bears good prospects for further hydrocarbon exploration.

ERRATUM

Jour. Geol. Soc. India, v.60, 2002, p.312: In Fig.2, the scale of the map should read as 500 m instead of 50 m.