

## **Carbonatite Emplacement and Localization of Gas Hydrates in the Ocean Floors of Eastern Hemisphere**

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### ABSTRACT

Review on the close spatial and temporal association of carbonatites and hydrocarbon deposits in the Eastern Hemisphere, reveals that the occurrence of carbonatite could be considered an indicator for exploration of hydrocarbon / gas hydrate deposits. The carbonatite magmas / lavas generated in the mantle horizons of the Eastern Hemisphere released huge quantities of volatiles from depth and produced hydrocarbons at near surface conditions within 200 km radius around their volcanic conduits tapping from depth through deep faults. The lightweight hydrocarbon tends to migrate through porous rocks such as sandstone, carbonate rocks and fractured basement crystalline rocks and gets trapped in reservoir rocks such as shale and impervious rocks occurring in Alpine-Himalayan regions extending towards Indonesian arc during northward movement of Indian sub-continent after the break of Gondwana Land. It has also migrated through mid oceanic ridges, plate boundaries and rift and horst structures and deposited in sediments of ocean floors.

**KEY WORDS:** Carbonatite volcanism; Fluid inclusion; Gas hydrate; Plate tectonics; Indian Ocean floor; Eastern Hemisphere;

### INTRODUCTION

Gas hydrates, petroleum and natural gas are used as important fuel. They respectively exist in the Earth's crust in the form of solid, liquid or gas. They are essentially composed of methane (CH<sub>4</sub>) and other lightweight hydrocarbons. Their origin is till now a long debate. Most hydrocarbon deposits are restricted to sedimentary basins and hence petroleum is considered to be as a fossil fuel. However, abiogenic origin for petroleum is proposed as early in the 19<sup>th</sup> Century by many Russian Scientists, but it was not accepted by contemporary petroleum geologists since there is no such deposit of commercial production at that time. But recent discoveries by deep drilling and seismic probing of sedimentary basins, it is known that most petroleum deposits are associated with deep faults (Paropkari, 2008) and some reservoirs are formed in crystalline basement rocks (Petford and Mc Caffrey, 2001). However source for hydrocarbons remains as puzzle. In the late 20<sup>th</sup> Century several carbonatite-alkaline complexes were discovered in the Eastern hemisphere within the radius of 200 km from the hydrocarbon

deposits. Carbonatites and alkaline rocks generally originate from the low velocity zone lying below 400 km from the surface. Carbonatites are magmatic carbonate rocks. They are essentially composed of calcite, dolomite or ankerite. Many intrusive carbonatites are associated with highly differentiated co-magmatic alkaline rocks. However, the magmatic origin of carbonatite was widely accepted only after the eruption of natro-carbonatite in the year 1960 from Oldonyolengai, Tanzania, East Africa. During eruption of natro-carbonatite, huge quantities of CO<sub>2</sub> and water vapours were released (Dawson, 1964). The origin and localization of hydrocarbon deposits are to be revised, since carbonatite magma which evolved from deep mantle source is enriched in these volatiles. Geological settings and close spatial and temporal distributions of carbonatites with hydrocarbon deposits reveal a common genetic link between them (Fig. 1, Table 1). The paper mainly deals abiogenic potentiality of formation hydrocarbon and its localizations.

### HYDROCARBON DEPOSITS

The Eastern Hemisphere is relatively well explored than the Western Hemisphere. Numerous hydrocarbon deposits are located in the Eastern Hemisphere and have exploited since several decades. The important natural gas and petroleum producing countries lie all along the Mediterranean coast and in the ancient plate boundaries of Gondwana Land of Alpine Himalayan-Indonesian arc in the Eastern Hemisphere. Hydrocarbon deposits occur in Britain (North sea), Norway, Finland, Russia, France, Poland, Romania, Germany, Netherlands, Hungary, Spain, Italy, Yugoslavia, Czechoslovakia, Austria, Turkey, Saudi Arabia, Bahrain, Kuwait, Qatar, Iraq, Iran, Russia, Afghanistan, Pakistan, India, Burma, Malaysia, Indonesia, Australia, New Zealand, Philippines and Japan, (Levorsen, 1958). Recent accidental discoveries of hydrocarbon deposits with reservoir rock of crystalline basement rocks (Fig. 1, Table. 1) bear evidences for abiogenic origin for hydrocarbon deposits.

Table 1 Distribution of carbonatite complexes associated with hydrocarbon deposits in the Eastern Hemisphere

Country	Geological setting	Carbonatite	Hydrocarbon Deposits	Reservoir
Greenland	A, F	Gronnedal Ika	Artic sea	GH
Norway	Fenite, F K	Fen. Seiland Fjone	O Norway, Artic	O, G