Biogenic and abiogenic hydrocarbons in Italy

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POSSIBLE NEW HARMONIC SCENARIO FOR HYDROCARBONS FORMATION

Oil and associated phenomena can be found preferentially along old fold belts and margins which building models can be very different in different global tectonics theories. The fold belt building model proposed in preceding papers by SCALERA (2005, 2007, 2008) can be used to judge if the difficulties encountered by the different biogenic/abiogenic conceptions can be solved. In Fig.1 the main characteristics of the model are shown in connection to the abiogenic/biogenic oil production problem.

The tectonic overpressures (MANCKTELOW, 2008), together with the higher temperatures available in the model of SCALERA (2005, 2007, 2008) at shallower depth, can bear a relation with the synthesis of biogenic and abiogenic hydrocarbons. Indeed GLASBY *et alii* (1984) argued that most HCs fields occur in areas of higher than normal thermal gradient, and the above proposed model leads just to higher gradients that are produced by the isostatic uplift of very deep materials (from and above the transition zone). These higher gradients together with uplifted contents of mantle metals (catalysts) and hydrogen, can favour the occurrence of the conditions leading to the development of the Fischer-Tropsch reaction. The underthrust carbonate slabs can interact at proper high temperature with hydrogen and catalityc metals. Pressure range can be very wide both because the nonlithostatic overpressures (MANCKTELOW, 2008) at the boundary between uplifting material and adjacent stable or underthrust lithosphere and occasionally because the inevitable occurrence of strong earthquakes in some periods of the thrust-fold belts building. Laboratory experiments have ascertained that calcareous-marly rocks to which friction is applied produce a strong emission of carbon dioxide and methane of inorganic origin.

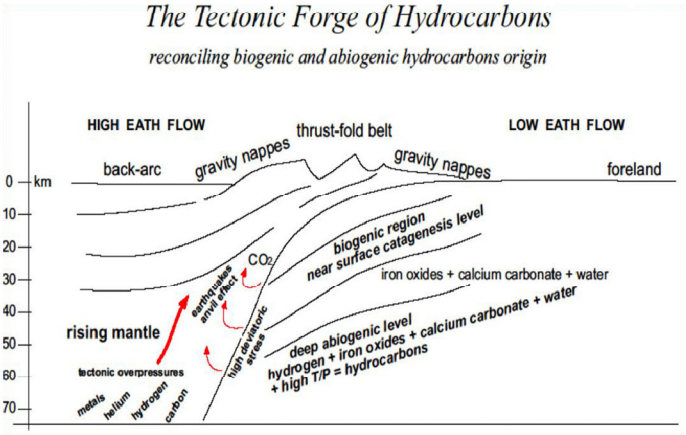

Fig. 1 – The connection between the proposed model (SCALERA 2007, 2008) and various kind of hydrocarbons generation. The convergence of cold and hot materials, oxiding and reducing environments, the presence of high nonlithostatic overpressures, and ascending fluids and catalysts, constitute a favourable dynamical environment in which different types of metamorphism can be realized at shallower depth, ore deposits can form near the surface and the synthesis of biogenic and abiogenic hydrocarbons can occur at depths not exceeding few tens of kilometres.

The compressional state of the gravity-driven nappes, together with the general rifting environment of the proposed model and the aperiodic activation of deep change of phase with extrusion of material below the fold belt, can be facilitating factors in oil migration towards the surface and its accumulation under impermeable layers, following the slopes of the underthrust strata.

The lack of reducing conditions in the upper part of the upper mantle to be possible the Fischer-Tropsch reaction (GLASBY, 2006), is overcome in this model by the upward isostatic transport of the reducing transition zone environment. The criticism of Kenney that suitable TP conditions to produce HCs can be found only at depth greater than 100 km is overcome by the transport of such conditions toward the surface. In my framework a high-temperature reducing environment of undepleted mantle rises up and come in contact with the relatively cold oxidizing lithospheric environment. In the interposed region of thermal gradient, and of hydraulic gradient due to nonlithostatic overpressures – all at depths not overcoming few tens of km – a *continuum* of very different physicochemical conditions come in existence. A number of chemical reaction are then favoured in this sort of tectonic oxidizing-reducing pile,

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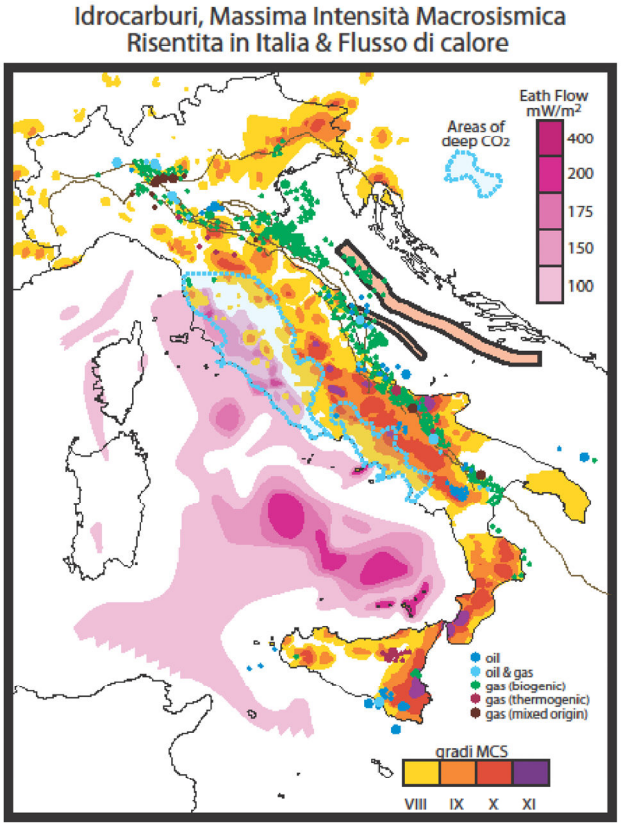

Fig. 2 – The data of locations and productivity of hydrocarbon fields in Italy are from PIERI (2001). The maps of the MCS degrees from VIII to XI is extracted from the Maximum Felt Intensity in Italy that was elaborated by INGV. The front of the orogen is also shown (from BIGI *et alii*, 1991). The hydrocarbons are located beside the eastern side of the highest seismic energy releases. The further adding to this map of the zones of heat flow greater than 100 mW/m2 shows that a similar warm/cold zonation exists like the one proposed in the model (fig.1). Highest CO_2 emissions can be of mantle origin or can be produced by the margin of the underthrust carbonatic platform with the help of the earthquakes. Adjacent to the eastern side of the higher degree seismicity, and following the Adriatic plate margin (revealed by the long magnetic anomaly in fig. 2, right), the hydrocarbons has been found in commercial quantities. They can mostly or partially came from the chemical reactions envisaged in this paper, and then pushed toward east by hydraulic gradients and favorable disposition of microfractures and impermeable sedimentary layers. The two flesh ribbons in the Adriatic sea represent main seismogenic faults along which new HC fields may be found.

leading to a multiple origin of hydrocarbons.

In addition, near to the surface – in the first few tens of kilometres – a considerable amount of fluids and of organic biogenic material of various provenance is present in the underthrust sedimentary layers, which can participate in a passive way (contaminant) or active way (transmuting materials, kerogens) to the HCs forming. However, no evaluation of the abiogenic/biogenic hydrocarbons rate is yet possible.

The cold side of these regions (e.g. the continental side of the Apennines, the Andes, etc.) should be more suitable for petroleum exploration, because the squeezing of fluids caused occasionally by the aperiodic overpressures towards the decreasing horizontal hydraulic gradient. The horizontal flow toward the warm side should with great probability disintegrate the heavy HCs molecules, while they should conserve integrity going toward the cold region.

In Italy, a simple comparison of the petroleum and gas fields (data from PIERI, 2001) with the maximum felt intensity (VIII, XI, X and XI MCS degrees; fig. 2) shows a initial good agreement of the model and the highest seismic energy release. The earthquakes seems to enclose an elongated area of tectonic working in which hydrocarbons can be produced in the depts. and then expelled laterally toward the cold side of the region. The 'warm side' can be considered the region where the volcanic rocks and the seismicity are located. On this side oil cannot migrate without be disintegrated. The carbon coming from the Adriatic carbonatic platform – enriched in ^{12}C formed by remains of marine organisms – and the carbon coming from the eventual maturation and 'distillation' of fossil organic remains contained in buried sediments are today not distinguishable. More deep geochemical investigations and analyses need in determining the real nature (biogenic or abiogenic or mixing of them) of the Italian hydrocarbons.

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