Is the Visean Dolostone from Bartin area, Turkey, a destroyed hydrocarbon reservoir?

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The study area is located close to the southern Black Sea coast, near Bartin, north-western Turkey. While studying a Paleozoic dolostone unit near Bartin, we were surprised by the heavy gas smell on knocking or cutting these rocks and decided to investigate a bit deeper their diagenetic history and to assess their potential reservoir quality.

Bartin region is part of the Western Pontides, Istanbul–Zonguldak Zone (Okay et al., 1994; Yılmaz et al., 1997). In this area, over the Precambrian metamorphic basement lays a highly deformed but nonmetamorphic Paleozoic sedimentary succession - ranging in age from Ordovician to Carboniferous, which is unconformably overlain by Upper Cretaceous rocks of the Western Black Sea Basin and penetrated by Upper Cretaceous volcanic bodies.

Our focus of interest is the Paleozoic unit (Lower Visean dolostones - Yılanlı Formation), which has a good source and reservoir rock potential. The dolostones and cherty limestones of the Yılanlı Formation (Upper Devonian – Lower Carboniferous) passes into Upper Carboniferous (Namurian - Westphalian) coalbearing deltaic to continental clastic units. All of these units experienced two major burial and subsequent uplift-erosion episodes related to Hercynian and Alpine orogeny which allowed coalification and gas generation as well as development of stratigraphic and normal fault traps (Yalçın et al., 2002 and 2003).

Diagenetic history of Visean dolostone was microscopically studied on thin sections, polished slabs and stained peels. Cathodoluminescence, UV fluorescence as well as petrography and some microthermometry of fluid inclusions have also been applied to distinguish between different phases of dolomitization and rock-fluids interactions during the diagenetic events. Dolostone is very porous and has a mimetic structure formed during syndiagenetic metasomatism of shallow water Lower Visean limestone. During burial diagenesis, initial dolomite crystals grew epitaxial from deep brine fluids (showing bright and dull luminescence). Some crystals show significant dissolution of some growth zones, before a second phase of dolomite epitaxial growth. One of the last dolomite growth zones contains fluid inclusions which are fluorescent under UV due to their hydrocarbon content. Also at the contact between adjacent crystals, thin films of fluorescent hydrocarbon inclusions are present and if we corroborate these with the preserved high porosity all suggests that these dolostone were once a hydrocarbon reservoir.

Though the studied dolostone unit is no more a reservoir, being probably destroyed during the last phase of uplift and erosion, we learnt that this unit contained once hydrocarbons and possibly in other regions around located deeper and in more favorable conditions the same unit still act as a good reservoir.

References:

Okay A.I., Sengör A.M.C. & Görür N., 1994. Kinematic history of the opening the Black Sea and its effect on the surrounding regions. Geology, 22, 267–270.

Yalçın M.N., Inan S., Gürdal G., Mann U. & Schaefer R. G., 2002. Carboniferous coals of the Zonguldak Basin (northwest Turkey): Implications for Coalbed Methane Potential. AAPG Bull. 86, 1305–1328.

Yalçın M.N., İnan S., Hoşgörmez H., Çetin S., 2003. A new Carboniferous coal/shale driven gas play in the Western Black Sea Region (Turkey). Marine and Petroleum Geology, v. 19, 1241-1256

Yılmaz, Y., Tüysüz, O., Yigitbaş, E., Genç S.C. & Sengör A.M.C., 1997. Geology and tectonic evolution of the Pontides. Regional and Petroleum Geology of the Black Sea and Surrounding Region (Robinson, A. G., ed.), AAPG Memoir 68, 183–226.