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ISOTOPIC COMPOSITION $\delta^{13}C$ AND $\delta^{18}O$ OF VEIN CALCITES IN FLYSCH DEPOSITS OF THE UKRAINIAN CARPATHIANS

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The structure of the Carpathian chain has a nappe pattern. Now the main outlook for the oil and gas fields is connected with thrust structures. The crack zones of allochthonous rocks were probably the way of migration of hydrocarbons and that is why the elaborate studying of the vein minerals can give us important information about the oil and gas content of the autochthon. Different hydrocarbons (as inclusions in main vein minerals such as calcite or quartz crystals called Marmarosh diamonds, hard bitumen, organic minerals and oil) are found almost in all rock complexes of the Ukrainian Carpathians.

With the purpose of investigation of the genesis of vein formations, the isotopic composition $\delta^{13}C$ and $\delta^{18}O$ of the main vein mineral (calcite) has been studied. The 52 specimens of the different aged complexes of different tectonic units of the Carpathians have been analysed.

The results of the analyses made it possible to draw the following conclusion. Values of $\delta^{13}C$ of the vein calcite (-5.6 – +1.5 ‰) are close to the $\delta^{13}C$ values of the enclosing rocks (-3.8 – -1.7‰).

In general, the isotopic composition of carbon becomes lighter in the direction from the Marmarosh massif to the Krosno zone. The reduction of weight of $\delta^{13}C$ is connected with the presence of hydrocarbon inclusions. Vein calcite from Upper Cretaceous deposits has homogenous values of $\delta^{13}C$ ranging between -2.6 ‰ and +1.5 ‰. The $\delta^{13}C$ values of Lower Cretaceous and Paleogene deposits are similar one to another and a little lighter (-4.6 – +0.8 ‰ and -5.6 – +1.1 ‰). It can be explained in such a way. The main commercial reserves of gas and oil in the Carpathian region are connected with Paleogene deposits. The Lower Cretaceous deposits also have prospects of oil- and gas-bearing. Migration of hydrocarbon along the crack zones of these complexes caused the presence of the inclusions of gas condensate and "light oil" in vein minerals and the the reduction of weight of the isotopic composition of carbon. The similarity of average value of $\delta^{13}C$ in calcite from Paleogene (-1.9 ‰) and Lower Cretaceous (-1.95 ‰) rocks confirm the idea about the possible oil and gas bearing of the Lower Cretaceous rocks.

Values of $\delta^{18}O$ of vein calcite change from +19.4 ‰ to +27.7 ‰. Values of $\delta^{18}O$ from Lower Cretaceous and Paleogene rocks show a wider range compared to Upper Cretaceous rocks. Average $\delta^{18}O$ value of vein calcite is +21.3 ‰ for the Upper Cretaceous deposits and +22.4 ‰ for both Paleogene and Lower Cretaceous deposits.

Plotting these data in a $\delta^{13}C$–$\delta^{18}O$ coordinate system made it possible to single out the fields of different tectonic units of the Carpathians. One big field is formed by results of analyses of specimens from Rakhiv and Porculec nappes, which are located close to Marmarosh massif. Specimens from Chornogora nappe and Krosno zone forms the other field.

These results show that the studying of isotopic composition of carbon and oxygen of calcite from vein formations makes it possible to get an important information which can be used together with other geological and geochemical data for studying of the ways of migration of hydrocarbons and determination of prospects for oil- and gas-bearing of different sedimentary complexes of the Ukrainian Carpathians.