

Ber. Inst. Erdwiss. K.-F.-Univ. Graz	ISSN 1608-8166	Band 20/1	Graz 2014
PANGEO AUSTRIA 2014		Graz, 14. September 2014 – 19. September 2014	

Generation and alteration of natural gas accumulated in the Austrian Molasse Basin

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The Molasse Basin, extending from Geneva to Vienna, is the northern foreland basin of the Alps. The metamorphic basement with local NW- and NE-trending Permo-Carboniferous graben structures is covered by Mesozoic mixed carbonate-siliciclastic shelf sediments. The foreland basin developed since Late Eocene times in response to loading of the southern margin of the European plate during the Alpine orogeny. Two petroleum systems can be distinguished: A thermal petroleum system comprising Lower Oligocene source and Cenomanian and Eocene reservoir rocks; a biogenic gas system in Oligocene and Miocene strata. However, geochemical data suggest a mixing of thermogenic and biogenic hydrocarbons in these horizons.

The aim of the present study is to understand the origin, migration, accumulation and alteration of natural gas and condensate in the Molasse Basin, focusing especially on Cenozoic reservoir rocks. Molecular and isotopic compositions of 70 natural gas samples were measured. In addition, molecular composition as well as biomarker and stable isotope ratios ($\delta^{13}\text{C}$) of individual *n*-alkanes and acyclic isoprenoids were determined on 20 condensate samples.

Primary biogenic gas from Oligocene and Miocene deposits is almost exclusively consisting of methane (96.2-98.7 vol%). Nevertheless, higher hydrocarbon molecules (ethane, propane, etc.), atypical for biogenic gas, are present in low amounts. Stable isotope ratios of carbon in methane (-48 to -65‰PDB) are partly higher than expected for typical biogenic gas (<-60‰PDB). In addition, liquid hydrocarbons occur locally in these Cenozoic horizons.

The presented results indicate that most of the Oligocene and Miocene gas fields do not comprise pure biogenic gases. A complex migration history, the mixture of different sources and later alteration result in compositional variability of hydrocarbons.