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## GAS-BEARINGNESS MIDDLE JURASSIC OF COAL-BEARING ARRAYS OF MOUNTAIN CRIMEA

During all stages of tectogenesis it is marked a contingence between tectoni-magmatic events and litho- and sedimentogenesis in time and space. The coal deposits and manifestations in the Mountainous Crimea are attributed to the zones of structural conjugation and areas impacted by tectoni-magmatic processes. Continuation of land structures towards the Black sea shelf gives the chance to predict offshore hydrocarbon accumulations.

*Key words:* tectonic and magmatic events, coal and hydrocarbon formations, sedimentary measures, coal formation of Mountain Crimea.

**Introduction.** The structure and composition of the coal-bearing deposits in the Mountainous Crimea are developed synchronously to the Cimmerian tectoni-magmatic events. The most significant coal formation took place within intermountain troughs and foredeep depressions of the Cimmerian orogen during Middle Jurassic times. A superposition between tectoni-magmatic events and litho- and sedimentogenesis in time and space is characteristic for all stages of geological development of the region.

**Research results.** The coal deposits and manifestations in the Mountainous Crimea are attributed to the structural conjugation zones and areas impacted by tectoni-magmatic processes. Coal gas composition indicators from the Middle Jurassic Beshui suite have been studied and the results led to conclusion on a modern upward gas influx into the coal seams and host rocks [Vergelska, 2013; Vergelska, Kitchka, 2013]. The Aalen-Bathonian coal-bearing facies of the Beshui suite can be potential source rocks for hydrocarbons. Continuation of onshore structures towards the Black sea shelf gives the chance to substantiate additional gas potential offshore the Crimea Peninsula (Fig.1, 2).

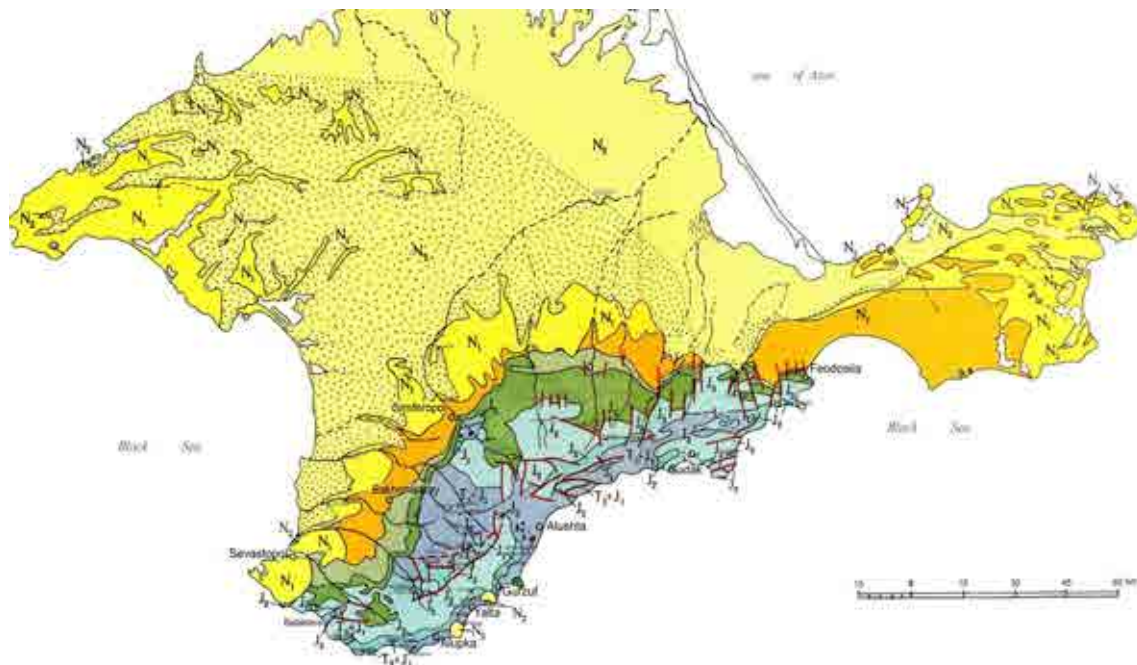


Fig. 1 Geological map of the Crimea (comp. M.V. Muratov)

The coal manifestations are known from 57 sites in the Mountainous Crimea, from the Triassic-Liassic, Upper Jurassic and Lower Cretaceous formations in the eastern part, and from the lower part of Middle Jurassic (Aalenian-Bajocian-Bathonian) paralic-to-molasse sequence in the west-central part of the region. Last century only the latter had a sub-commercial importance.

Age and total thickness	Litho-stratigraphic column	Thickness	Rock description
Upper Jurassic (thickness ~500 m)		~ 110	Limestone with <i>Dicyclina luxhantica</i> Edder
		~ 280	Limestones massive and thin-bedded
		~ 70	Selvankie limestones with <i>Gasteropoda</i> , exfoliating with sandstone and conglomerate
		~ 40	Conglomerate and sandstone
Middle Jurassic (thickness ~700 m)	Bathonian	~ 200	Tuffs and shales with <i>Pseudamonys Buchi</i>
			Fine-grained sandstone and shale
	Bajocian	200 - 300	Sandstone of <i>Pseudamonys foliata</i> and plants (Cladophobis, Otozamites)
			Gray clay with coal; alternation of strata with sandstone, in clays <i>Gasteropoda humilibranchia</i> and plants
Bajocian ?	100 - 150	Coarse-grained quartz sandstone with plants	
Triassic - Liassic		~ 40	Strongly deformed Tauris shales
			Crinoid limestone with <i>Brachiopoda</i> Tauris dark shale with <i>Cephalites</i>

Fig. 2 Litho-stratigraphic column Beshui formation

In the result of erosion followed by the Cimmerian orogenesis and further dislocations the Mid-Jurassic coal-bearing sequence become spatially separated and preserved only in the form of local spots and bands on the northern and southern flanks of the Main Range of Mountainous Crimea. The northern band is stretched NE from Cape Fiolent to Bordash village on Alma river, the second one starts from Mega-Yalo Cove near Balaklava town and includes rather broad area of the Mid-Jurassic rocks development in the upper reaches of Kokkozka, Belbek and Kacha rivers, the third one goes along southern slope of the Yayla Ridge between Laspi harbor and Biyuk-Lambat village, and the last one occurs in the Eastern Crimea, between Sudak town and Kiik-Atlama Cape (Fig. 3).



Fig. 3 Geological section of the coaliferous Beshui formation across the Mountainous Crimea

Two to four coal seams of the Beshui suite (gas / long-flamed coals) striking N-S and dipping west 45-45° occur in the intra-mountain trough in the complex tectonic settings and overlie the folded late Triassic – early Jurassic Tauric Series with angular unconformity (Fig. 4).

The abandoned Beshui coal mines are located in the upper reach of Kacha River and the lower beds of the coal measure crop out also in the valleys of rivers Kambich and Kaspan. Coal seams of the Beshui coalfield (of 0.1 – 2.0 m thick) are hosted by the formation of arcose medium- to coarse-grained sandstones and gravelstones separated by shales and coal shales of total 1500 m thick. A semi-precious stone, gagate, is well known from the coals of the Beshui suite. The coal seams have limited extension up to 1100 m along the strike, and 350— 400 upon the deep [Vergelska, 2011].

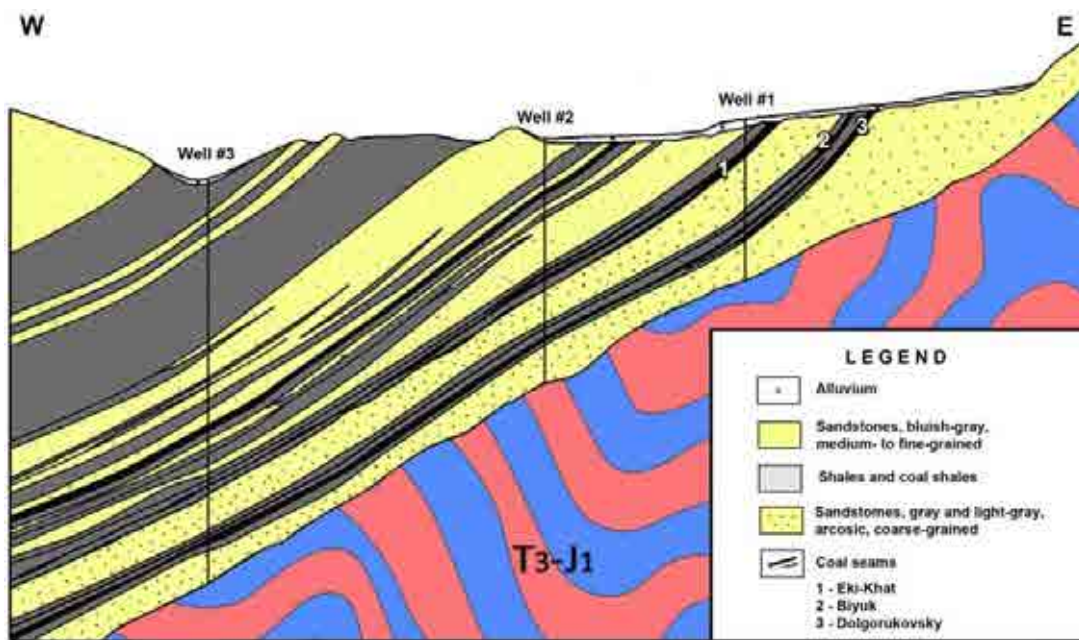


Fig. 4 Geological section of the coaliferous Beshui formation across Chouyou-n-Ilga river valley

The distribution of natural gases within the coal-bearing Crimea is uneven. The accumulations of gases confined to individual structures can be considered as gas deposits. The results of the study of the residual gas component of coal seams are presented (tabl.). It is established particular relationships between the coal seams faults and their absorbed gas content [Radzivil et al., 2012].

The fact of simultaneous development of magmatism and peat accumulations in the Crimea can stimulate re-evaluation of petroleum systems development constrains offshore the peninsula [Valiaev, 2012].

#### Gas-prone coal seal of the coaliferous Beshui formation across the Mountainous Crimea

Gaz	vol. %
He	$2,8 \cdot 10^{-3} - 4,2 \cdot 10^{-3}$
H <sub>2</sub>	$6,5 \cdot 10^{-3} - 1,7 \cdot 10^{-2}$
CH <sub>4</sub>	$7,8 \cdot 10^{-4} - 5,5 \cdot 10^{-2}$
C <sub>2</sub> H <sub>6</sub>	$1,6 \cdot 10^{-5} - 2,9 \cdot 10^{-3}$
C <sub>2</sub> H <sub>4</sub>	$4,6 \cdot 10^{-6} - 2,5 \cdot 10^{-6}$
C <sub>3</sub> H <sub>8</sub>	$1,7 \cdot 10^{-5} - 2,7 \cdot 10^{-3}$
C <sub>3</sub> H <sub>6</sub>	$6,3 \cdot 10^{-6} - 4,3 \cdot 10^{-5}$
iC <sub>4</sub> H <sub>10</sub>	$1,7 \cdot 10^{-6} - 4,4 \cdot 10^{-5}$
nC <sub>4</sub> H <sub>10</sub>	$6,2 \cdot 10^{-6} - 3,4 \cdot 10^{-4}$
neoC <sub>5</sub> H <sub>12</sub>	$1,1 \cdot 10^{-6}$
iC <sub>5</sub> H <sub>12</sub>	$1,3 \cdot 10^{-6} - 4,0 \cdot 10^{-5}$
nC <sub>5</sub> H <sub>12</sub>	$8,3 \cdot 10^{-6} - 1,4 \cdot 10^{-4}$
C <sub>6</sub> H <sub>14</sub>	$1,2 \cdot 10^{-5} - 1,04 \cdot 10^{-4}$
CO <sub>2</sub>	$5,9 \cdot 10^{-1} - 1,3$

Thus, from hydrocarbon exploration viewpoint, it is worth to take into consideration that coal-bearing formations of the Cimmerian structures are stretched to the WSW towards the West Black sea sub-basin and to the ESE into the East Black Sea sub-basin, where gas-prone and magmatic complexes are buried at some depth and covered with seal formations [Valiaev, 2012].

**Conclusions.** Though the Beshui coals has no commercial potential due to their low quality (high ash and sulfur content) and limited areal extent, these one, nevertheless, have a particular importance to speculate about an additional pre-Cenozoic mature potential source rock offshore the Crimea Peninsula.

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#### ГАЗОНОСНІСТЬ СЕРЕДНЬОЮРСЬКИХ ВУГЛЕНОСНИХ МАСИВІВ ГІРСЬКОГО КРИМУ

Для всіх етапів тектогенезу характерна зближеність тектоно-магматичних подій і органогенного седименто- та літогенезу в часі і просторі. Вугленосні відклади Гірського Криму пов'язані із зонами зчленування структур та зонами проявів тектоно-магматичних процесів. Визначені якісні показники газу дають можливість стверджувати про наявність сучасного підтоку із глибших горизонтів у вугільні пласти, а також у вміщуючі їх породи.

*Ключові слова:* тектоно-магматичні події, вугільно-вуглеводневі формації, осадова товща, вуглеутворення в Гірському Криму.

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**ГАЗОНОСНОСТЬ СРЕДНЕЮРСКИХ УГЛЕНОСНЫХ МАССИВОВ ГОРНОГО КРЫМА**

Для всех этапов тектогенеза характерна сближенность тектоно-магматических событий и органогенного седименто- и литогенеза во времени и пространстве. Угленосные отложения Горного Крыма связаны с зонами сочленения структур и зонами проявлений тектоно-магматических процессов. Качественные показатели газа дают возможность утверждать о наличии современного подтока из более глубоких горизонтов в угольные пласты и вмещающие породы.

Ключевые слова: тектоно-магматические события, угольно-углеводородные формации, осадочная толща, углеобразования в Горном Крыму.

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