ANOMALOUS CARBON ISOTOPE COMPOSITION OF LOWER JURASSIC SOURCE ROCK EXTRACTS IN TOMSK REGION

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We have carried out a set of studies (pyrolysis, combined gas chromatography mass-spectrometry, isotope ratio mass-spectrometry) of organic matter (OM) and rock extracts of the well columns in Smolyanaya-3, Archin-51, Kulgin-142, -145 areas (table).

Carbon isotope composition of the Togur Formation rock extracts from Archin-51, Kulgin-142, -145 well columns is characterized by anomalous light isotope composition - $\delta^{13}C$: -35.2…-36.5 ‰ (Table, Figure 1-a). Low values of Pr/Ph ratio (<2.0) in these extracts indicate reducing conditions of initial organic matter accumulation. Increased HI values (over 340-500) of these extracts are also caused by reducing conditions of initial organic matter accumulation.

It is to be noted that the Togur Formation rock extracts not always have anomalous light carbon isotope composition. Among analyzed rock extracts we found some samples with heavier isotope composition (-26.2 ... -33.5 ‰). These extracts are characterized by high values of Pr/Ph ratio (2.5 – 6.6), a bit lower values of MDBT/MPh and H35/H34. Such values of molecular parameters, along with decreased HI values are characterized by oxidizing conditions for predominantly non-marine initial organic matter formation. Significant differences in carbon isotope composition of Togur source rock extracts (2 - 10 ‰) are caused by dominant impact of the facies genetic factors (bioproducer type, sedimentation rate and conditions) on the isotope composition.

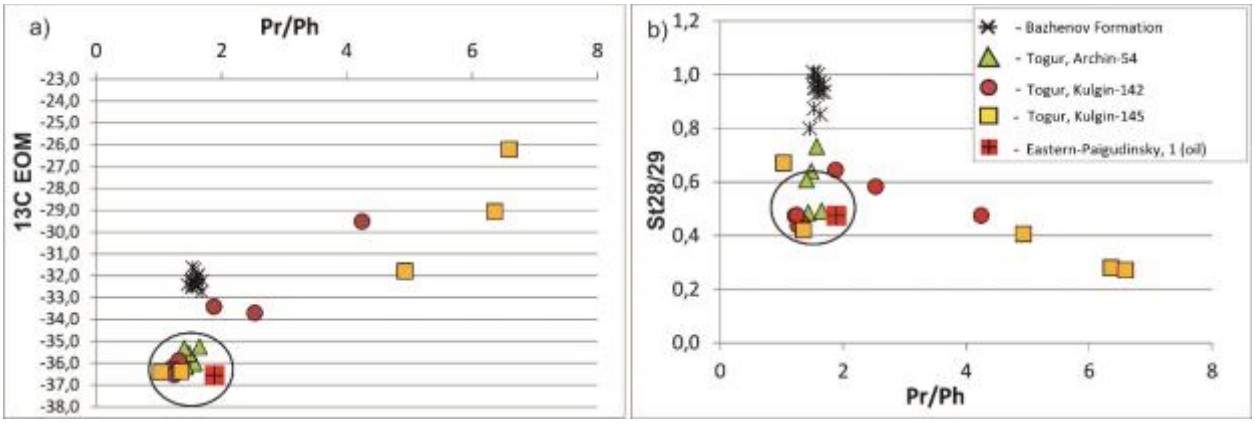

Figure 1 *Correlation of molecular and isotope parameters in rock extracts of Bazhenov and Togur Formations*

Earlier the lowest $\delta^{13}C$ values (-29.1 ... -33.8 ‰) of the Lower Jurassic organic matters in the Tomsk region were recorded in the rocks of Ponomarevsky area, well 2 (Kontorovich A.E. et al., 1995). It is also specific that there is no oil with light isotope composition in the investigated areas. In addition, among more than 50 oil samples of our collection with similar molecular

parameters as in analyzed Togur extracts only one has the same light isotope composition (-36.66 ‰). This oil sample is from Eastern-Paiduginsky well (Table, Figure 1), contained in Paleozoic rocks.

Table - Some pyrolytic, molecular and isotope parameters of Bazhenov and Togur Formations rock extracts (Smolyanaya, Archin, Kulgin areas)

Area, well	Depth, m	Tmax, °C	TOC, %	HI, mg HC/g TOC	$\delta^{13}C$ EOM, ‰	Pr/Ph	MDBT/ MPh	H35/ H34
BAZHENOV FORMATION								
Smolyanaya, 3	2616,80	425	13,64	752	-31,7	1,58	0,75	1,57
Smolyanaya, 3	2618,70	425	6,64	728	-31,6	1,53	0,65	0,97
Archin, 51	2613,30	423	13,46	771	-32,5	1,53	0,83	1,28
Archin, 51	2614,90	424	10,29	696	-32,5	1,59	0,81	1,04
Kulgin, 145	2623,75	426	7,05	746	-32,5	1,53	0,70	1,12
Kulgin, 145	2625,70	422	7,96	713	-32,4	1,65	0,72	1,22
TOGUR FORMATION								
Archin, 54	**3119,30**	**443**	**1,67**	**341**	**-36,0**	**1,57**	**0,19**	**0,39**
Archin,, 54	**3120,40**	**444**	**2,08**	**354**	**-35,6**	**1,48**	**0,18**	**0,48**
Archin,, 54	**3121,60**	**445**	**2,08**	**417**	**-35,3**	**1,41**	**0,13**	**0,48**
Archin,, 54	**3128,50**	**442**	**2,33**	**389**	**-36,2**	**1,43**	**0,14**	**0,43**
Archin,, 54	**3130,40**	**441**	**2,40**	**420**	**-35,2**	**1,65**	**0,18**	**0,43**
Kulgin, 142	**3105,55**	**437**	**2,50**	**443**	**-36,2**	**1,22**	**0,16**	**0,52**
Kulgin, 142	3107,78	441	14,80	498	-29,5	4,25	0,09	0,43
Kulgin, 142	**3108,70**	**430**	**4,76**	**370**	**-35,9**	**1,32**	**0,14**	**0,61**
Kulgin, 142	**3110,55**	**442**	**2,28**	**426**	**-36,3**	**1,27**	**0,16**	**0,54**
Kulgin, 142	**3111,45**	**442**	**4,31**	**448**	**-36,5**	**1,25**	**0,14**	**0,56**
Kulgin, 142	3114,20	443	2,37	392	-33,7	2,53	0,12	0,48
Kulgin, 142	3115,24	439	5,53	274	-33,4	1,88	0,14	0,45
Kulgin 145	**3068,40**	**446**	**3,70**	**508**	**-36,4**	**1,03**	**0,11**	**0,47**
Kulgin, 145	**3071,18**	**439**	**2,89**	**499**	**-36,4**	**1,36**	**0,11**	**0,56**
Kulgin, 145	3079,50	444	3,28	486	-31,8	4,93	0,08	0,44
Kulgin, 145	3080,30	439	4,27	368	-29,1	6,36	0,07	0,41
Kulgin, 145	3083,66	437	10,29	257	-26,2	6,59	0,05	0,40
Eastern-Paiduginsky, 1 (oil)	3537,0 - 3571,5	-	-	-	**-36,55**	**1,89**	**0,15**	**0,45**

Note: Tmax - temperature at which the maximum amount of S2 hydrocarbons is generated (top of S2 peak in Rock-Eval terms); TOC – total organic carbon, wt.%; HI - hydrogen index, mg HC/g TOC; δ13S - carbon isotope composition, ‰; Pr/Ph – the pristane / phytane ratio; MDBT / MPh - methyldibenzothiophenes/methylphenanthrene ratio (m/z 192); H35 / H34 - C35 hopane / C34 hopane S-isomer ratio.

Literature: 1. Kontorovich A.E. et al. (1995) // Geology and Geophysics, V 36, N 6, pp. 110-126