Microfauna of the Miocene Deposits in South Caspian Basin

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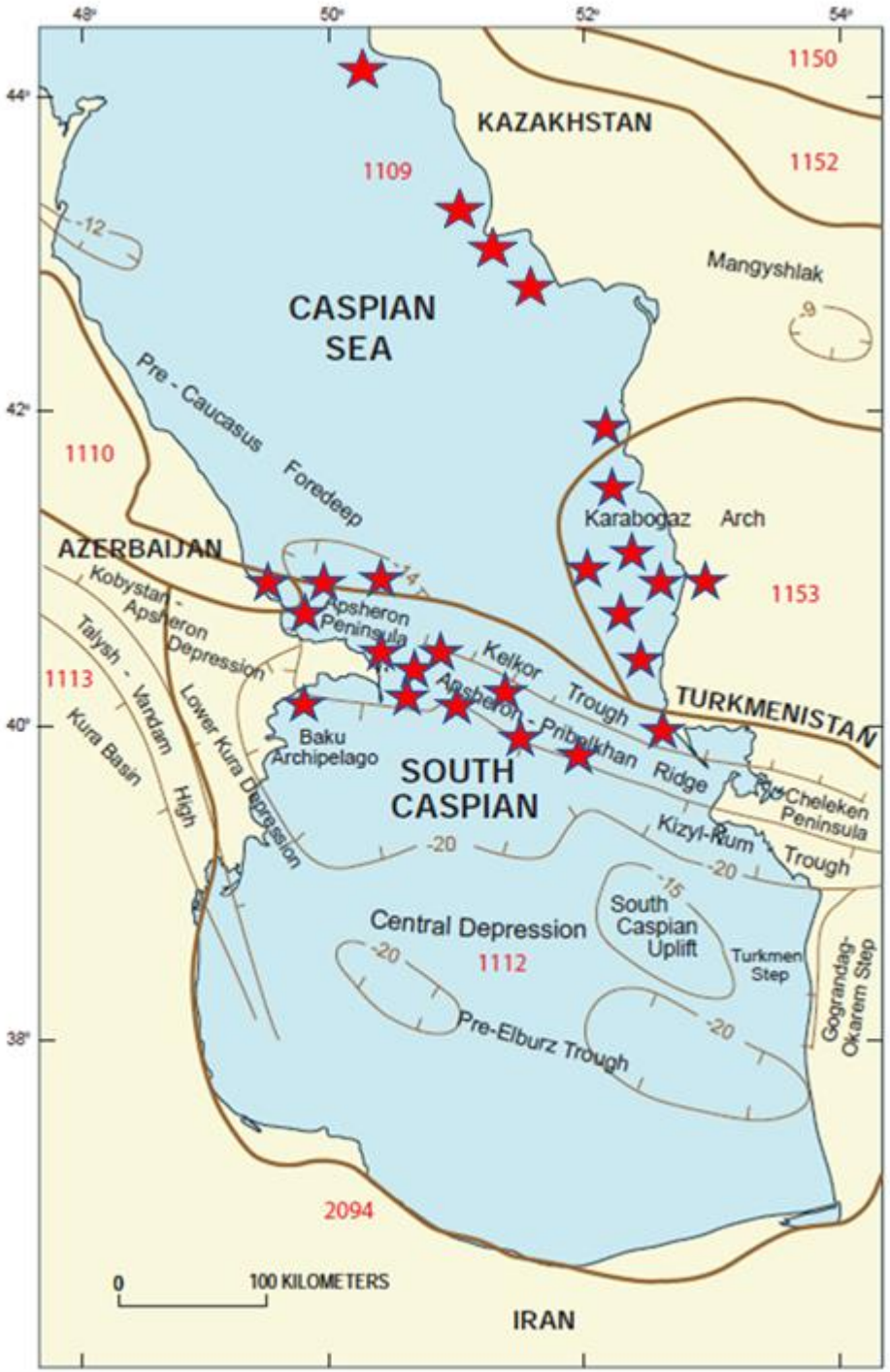
Dedicated to the good memory of my mentors in paleontology, Dr. A. Voroshilova and Dr. S. Kulieva



This works aims on the Miocene deposits of 134 exploration wells drilled in 35 structures from South+ partly Middle Caspian *basin (very close to South Caspian side).*

List of materials:

Kazakhstan sector of Caspian sea
Total number of structure- 4
Total number of wells-55
Total number of samples-324

Turkmenistan sector of Caspian sea
Total number of structure- 2
Total number of wells-31
Total number of samples-119

Azerbaijan sector of Caspian sea
Total number of structure- 29
Total number of wells-48
Total number of samples-375

Total 35 offshore structures
818 samples

Azerbaijan sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
island Chilov	6	112.5-340	227.5	Pontian	112.5-113; 330-340	2
	8	802-846	44		802-805; 840-846	2
	65	1601-1604	3		1601-1604	1
	4	682-805	123		682-685; 800-805	2
Apsheron bank	45	918-923	5		918-923	1
	16	780-900	120		780-790; 890-900	2
	37	611-620	9		611-620	1
Guneshli	5	3722-3730	8		3722-3730	1
	1	3905-4230	325		3905-3910; 4220-4230	2
Chiraq	4	3993-3995	2		3993-3995	1
Kapaz	1	4950-5000	50		4950-4955; 4990-5000	2
Arzu	2	2860-2950	90		2860-2870; 29445-2950	2
Khazri	1	2705-3078	373		2705-2710; 2070-3078	2
Oguz	1	4415-4604	189		4415-4420; 4550-4560; 4600-4604	3
Karabag	3	3703-3840	137		3703-3707; 3830-3840	2
Kurkachidag more	7	569-625	56		569-580; 580-591; 591-595; 595-605; 605-615; 615-625	6
Shurabad more	6	210-461	251		210-220; 300-310; 455-461	3
Neft Dashlari	46	1100-1102	2		1100-1102	1

Azerbaijan sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Shurabad more	6	473-545	72	Meotian	473-480; 480-490; 490-500; 500-510; 510-520; 520-530;530-540; 540-543	8
	14	45-122	77		45-55; 55-65; 65-75; 75-82; 82-92; 92-102;112-122	7
	17	10-28	18		10-14; 24-28	2
Kurkachidag more	5	445-571	126		445-455; 455-465; 465-475; 475-481; 481-491; 491-501; 501-511; 511-520; 521-531; 541-551; 551-561; 561-571	13
	7	625-790	165		625-630; 780-790	2
Yashma more	5	38-203	165		38-48; 48-55; 55-62; 62-72; 72-82; 82-92; 92-102; 102-112; 112-122; 122-132; 132-142; 142-152; 152-163; 163-173; 173-183; 183-203	17

Studied Well list from Azerbaijanian sector of South Caspian basin

Azerbaijan sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Shurabad more	17	23-184	161	Sarmatian	23-32; 59-68;68-77;77-86;86-93;99-102;102-111;134-144;166-175;175-184	10
	14	122-155	33		122-132; 132-142; 142-155	3
	6	545-604	59		545-555; 566-574; 574-584; 584-590; 590-595;595-601; 601-604	7
Kurkachidag more	5	571-636	65		571-576; 576-586; 586-596; 596-606; 606-616; 616-626; 626-636	7
	7	790-866	76		790-800; 850-860; 860-866	3
island Chilov	8	877-962	85		877-880; 955-962	2
Sangachal-Duvanni-Hara Zira	19	3665-3918	253		3665-3670; 3910-3918	2
Neft Dashlary	355	1483-1502	19		1483-1487; 1495-1502	2
Pirallahi Adasi	425	790-864.3	74.3		790-795; 850-855; 860-864.3	3
Pirallahi Adasi	432	1120-1135	15		1120-1125; 1130-1135	2
Pirallahi Adasi	433	626-647	21		626-630; 645-647	2
Pirallahi Adasi	435	1110-1130	20		1110-1115; 1125-1130	2
Yashma more	5	203-363	160		203-213; 213-223;223-233; 233-243; 243-253; 253-263; 263-273; 273-283; 283-293; 343-353; 353-363	11

Azerbaijan sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Shurabad	14	155-204	49	karaganian	155-164; 164-174; 174-184;184-194;194-204	5
Kurkachidag	5	636-666	30		636-646; 646-656; 656-666	3
	7	866-921	55		866-877; 877-886; 886-897; 897-906; 907-910; 915-921	6
Yashma more	5	370-385	15		370-378; 378-385	2
Apsheron Bank	6	1508-1517	9	Conkian+Karaganian	1508-1515; 1515-1517	2
	34	698-939	241		698-705; 800-810; 930-939	3
	37	588-766	178		588-598; 600;610; 760-766	3
	41	994-1155	161		994-1000; 1150-1155	2
island Chilov	6	880-896	16		880-890; 890-896	2
	4	805-810.5	5.5		805-810.5	1
	17	58.2-204.5	146.3		58.2-63; 200-204.5	2
Yuzhnaya	155	0.5-70	69.5		0.5-10; 60-70	2
Guneshli	1	4255-4260	5		4255-4260	1
	37	658-766	108		658-663; 760-766	2
Zhliloy island	4	805-810.5 m	5.5		805-810.5	1
Apsheron Bank	37	787-810 m	23		787-797; 797-810	2
	80	986-1030	44		986-1000; 1020-1030	2

Azerbaijan sector of Caspian sea
Total number of structure- 29
Total number of wells-48
Total number of samples-375

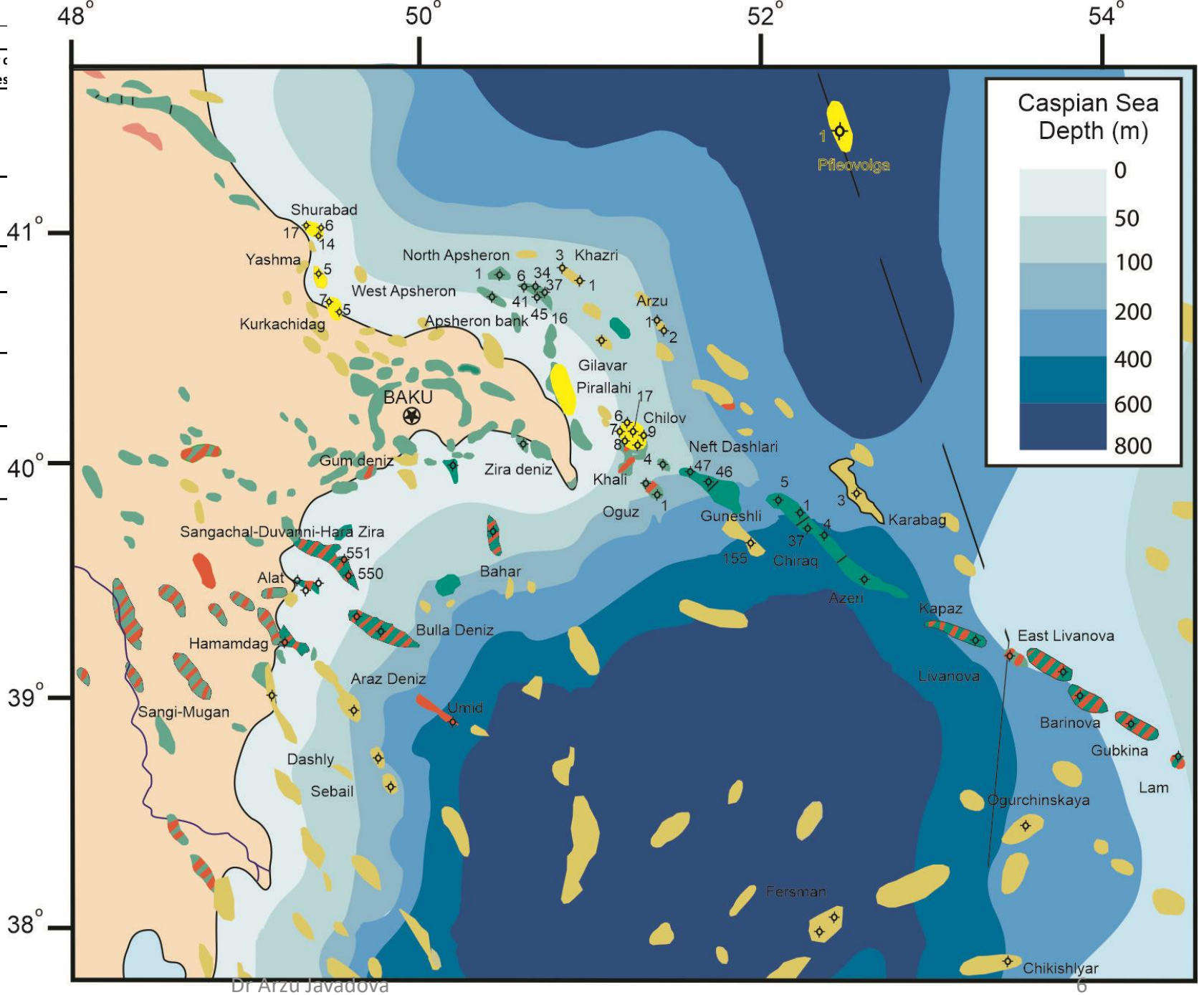
Pontian deposits in 12 structure
Average thickness 112 m
Studied in 18 wells with 36 samples
Meotian deposits in 3 structure
Average thickness 104 m
Studied in 6 wells with 49 samples
Sarmatian deposits in 7 structure
Average thickness 80 m
Studied in 13 wells with 56 samples

Azerbaijan sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Yasma more	5	385-414	29	Chokrakian	385-395; 395 404; 404-414	3
Kurkachidag	5	684-728	44		684-688; 688 694; 698-705; 719-728	4
	7	921-962	41		921-932; 932 940; 940-951; 951-962	4
Shurabad	14	213-241	28		213-223; 229 231; 231-241	3
	17	214-223	9		214-223	1
	6	604-659	55	Tarkhanian-Chokrakian	604-606; 606 613; 647-659	3
North-Apsheron	1	2125-2164	39		2120-2125; 2158-2164	2
	4	2250-2650	400		2250-2255; 2645-2650	2
	3	1995-2116	121		2250-2255; 2645-2650	2
Khazri	1	3078-3375	297		3078-3088; 3200-3210; 3365-3375	3
Island Chilov	7	204.5-262	57.5		205-211; 255 262	2
Kirmaku coastal	1134	360-550	190		360-365; 545 550	2
Kirmaku coastal	1502	420-486	66		420-430; 480 486	2
Sangachal-Duvanni-Hara Zira	550	4800-4898	98		4800-4810; 4890-4898	2
	534	4426-4900	474		4426-4431; 4890-4900	2

Azerbaijan sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Apsheron Bank	41	1150-1155	5	Maykopian	1150-1155	1
Guneshli	37	810-899	89		810-820; 890-899	2
island Chilov	7	280.5-504	223.5		280.5-290; 500-504	2
Paleo-Volga	1	1381-1777	396		1381-1390; 1590-1690; 1770-1777	3
Arzu	2	3201-3206	5		3201-3206	1
Apsheron bank	41	1190-1233	43		1190-1200; 1223-1233	2
Neft Dashlari	478	616-628	12		616-625; 625-628	2
Sangachal more	550	5010-5775	765		5010-5020; 5500-5510; 5770-5775	3
	551	3850-4000	150		3850-3860; 3990-4000	2
PaleoVolga	1	2121-2249	128		2121-2131; 2240-2249	2
Shurabad more	14	250-441	191		250-260; 358-368;378-388;395-403; 403-412; 412-423; 431-441	8
	6	659-791	132		659-671; 680-689; 689-697; 697-705; 705-713; 713-728; 728-735; 735-749; 749-758; 758-767; 767-771; 771-776; 785-791	13
	17	271-362	121		271-280; 289-299; 299-309; 309-320; 341-351; 351-362	6
Kurkachidag	5	734-906	172		734-744; 754-764; 764-775; 775-785; 795-805; 805-815; 815-825; 840-850; 850-860; 860-864; 864-874; 905-906	12
	7	962-1385	423		962-971; 971-982; 982-992; 992-1001; 1011-1021; 1021-1031; 1031-1039; 1039-1046; 1046-1054; 1054-1064; 1064-1074; 1084-1093; 1093-1100; 1100-1113; 1113-1124; 1124-1134; 1135-1145; 1155-1165; 1165-1175; 1185-1195; 1204-1211; 1213-1226; 1226-1235; 1235-1245; 1257-1269; 1269-1282; 1282-1295; 1308-1317; 1317-1321; 1321-1331; 1331-1341; 1341-1351; 1351-1363; 1363-1373; 1379-1385	35
Neft Dashlary	380	439-1000	561		439-445; 500-510; 700-710; 990-1000	4
Yashma more	5	414-810	396		414-424; 424-434; 434-444; 444-453; 453-461; 464-475; 475-486; 510-520; 530-540; 540-550; 550-560; 560-570; 570-580; 590-596; 630-643; 655-665; 675-686; 686-698; 698-703; 709-721; 721-731; 731-741; 741-755; 755-766; 766-777; 777-787; 787-791; 794-805; 805-810	29

Concian+Karaganian deposits in 6 structure
Average thickness 79 m
Studied in 13 wells with 25 samples
Karaganian deposits in 3 structure
Average thickness 37 m
Studied in 4 wells with 16 samples
Chokrakian deposits in 3 structure
Average thickness 30.2 m
Studied in 5 wells with 15 samples
Tarchanian+Chokrakian deposits in 6 structure
Average thickness 180 m
Studied in 10 wells with 22 samples
Maycopian deposits in 13 structure
Average thickness 224 m, with 127 samples
Paleogene deposits in 3 structure
Average thickness 68 m
Studied in 6 wells with 29 samples

Azerbaijan sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Yashma more	5	810-871	61	Paleogene	810-820; 820-828; 828-838; 838-848; 848-858; 858-869; 869-871	7
Shurabad	14	441-507	66		441-452; 452-466; 466-476; 489-499; 499-507	6
	6	791-819	28		791-799; 799-805; 815-819	3
	17	430-498	68		430-439; 487-490; 494-498	3
Kurkachidag	5	916-1037	121		916-926; 936-946; 946-954; 971-981; 989-999; 1011-1024; 1024-1037	7
	7	1385-1450	65		1385-1395; 1430-1440; 1440-1450	3

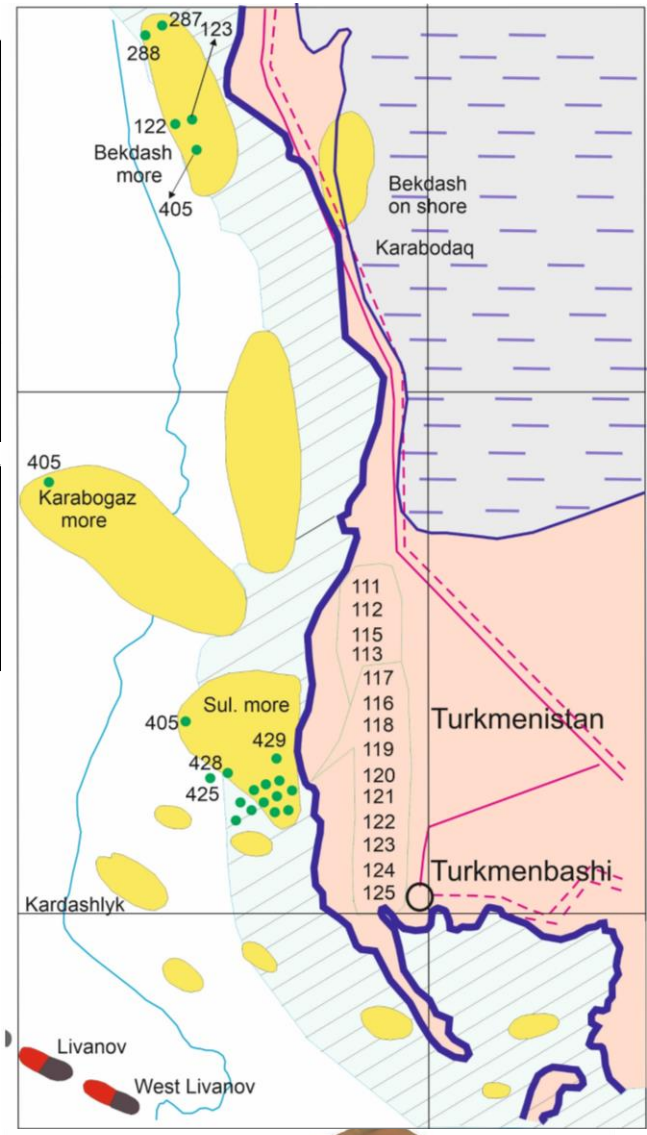


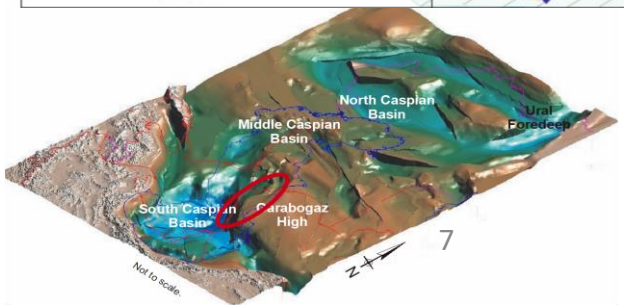
Turkmenian sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Bekdash more	122	10-130	120	Sarmatian	10-20; 100-110; 120-130	3
	123	0-100	100		0-10; 50-60; 90-100	3
	288	0-80	80		0-10; 40-50; 70-80	4
Sue more	101	0-65	65		0-10; 50-60; 60-65	3
	102	0-45	45		0-10; 30-40; 40-45	3
	103-	0-90	90		0-10; 20-30; 80-90	3
	107	0-101	101		0-10; 20-30; 50-60; 90-101	4
	111	0-110	110		0-10; 15-25; 45-55; 100-110	4
	112	0-120	120		0-10; 40-50; 70-80; 110-120	4
	113	0-110	110		0-10; 60-70; 100-110	3
	115	0-125	125		0-10; 50-60; 90-100; 115-125	4
	116	0-125	125		0-10; 30-40; 70-80; 120-125	4
	117	0-115	115		0-10; 40-50;70-80; 110-115	4
	118	0-125	125		0-10; 50-60; 90-100; 115-125	4
	119	0-125	125		0-10; 40-50; 70-80; 115-125	4
	120	0-101	101		0-10; 20-30; 50-60; 90-101	4
	121	0-130	130		0-10; 30-40; 70-80; 120-125; 125-130	5
	122	0-120	120		0-10; 30-40; 70-80; 110-120	4
	123	0-120	120		0-10; 30-40; 70-80; 110-120	4
	124	0-118	118		0-10; 40-50; 70-80; 110-118	4
	125	0-80	80		0-10; 30-40; 70-80;	3
	127	0-100	100		0-10; 40-50;70-80; 90-100	4
	303	0-110	110		0-10; 30-40; 70-80; 100-110	4
	304	0-135	135		0-10; 30-40; 70-80; 110-120; 130-135	5
	305	12-75	63		12-20; 30-40; 70-75	3
	426	10-130	120		10-20; 30-40; 70-80; 110-120; 120-130	5
	427	16-81	65		16-20; 40-50; 71-81	3
	428	5-50	45		5-10; 40-50	2
	429	6-61	55		6010; 50-55; 55-61	3

Turkmenian sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Sue more	427	106-116	10	Chokrakian	106-110; 110-116	2
	428	95-125	30		95-100; 120-125	2
	429	86-106	20		86-96; 96-106	2
Bekdash more	287	0-110	110		0-10; 30-40; 70-80; 100-110	4

Turkmenian sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Bekdash more	405	90-110	10	upper Maycopian suite	90-1100; 100-110	2

Turkmenistan sector of Caspian sea
Total number of structure- 2
Total number of wells-31
Total number of samples-119
Miocene upper Maycopian suite in single structure aver. thick.-10 m
Chokrakian deposits in 2 structure ,
Average thickness -43 m with 10 samples
Sarmatian deposits in 2 structure
Average thickness – 101 m with 107 samples





Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Skalistaya	561	2-75	73+D3:D32D 3:D45	Meotian	2-15; 15-30; 30-45; 45-60; 60-75	5
Skalistaya	578	3-40	37	Sarmatian	3-10; 30-40	2
	564	0-80	80		0-10; 50; 60; 70-80	3
	551	0-100	100		0-5; 5-10; 20-30; 50-60; 60-70; 70-80; 80-90; 90-100	8
	541	10-40	30		10-12; 20-30; 30-40	3
	542	20-90	70		20-30; 50-60; 60-70; 70-80; 80-90	5
	552	0-100	100		0-5; 5-10; 10-20; 20-30; 30-40; 40-50; 50-60; 60-70; 70-80; 80-90; 90-100	11
	558	0-105	105		0-10;10-20; 20-30; 30-40; 40-50; 50-60; 60-70; 70-80; 80-90; 95-105	10
	553	0-120	120		0-10; 10-15; 15-25; 25-35; 35-45; 45-55; 65-75; 85-95; 95-110; 110-120	10
	559	0-100	100		0-10; 10-20; 20-30; 30-40; 40-50; 50-60; 60-70; 70-80; 80-90; 90-100	10
	591	20-90			20-30; 30-40; 40-50; 60-70; 70-80; 80-90	6
	590	20-90	70		20-30; 30-40; 40-50; 60-70; 70-80; 80-90	6
	578	85-115	30		85-95; 100-105; 105-115	3
	273	30-87	57		30-40; 50-60; 80-87	3
	275	0-50	50		0-10; 40-50	2
	276	40-110	70		40-50; 70-80; 100-110	3
	277	0-75	75		0-10; 50-60; 65-75	3
	284	0-70	70		0-10; 50-60; 60-70	3
	285	0-95	95		0-10; 60-70; 85-95	3
	286	5-25	20		5-10; 20-25	2
	287	10-50	40		10-20; 40-50	2
	294	0-90	90		0-10; 70-80; 80-90	3
	295	0-105	105		0-10; 70-80; 100-105	3
	296	0-101	101		0-10; 70-80; 91-101	3
	539	12-40			12-15; 15-17; 17-20; 20-25; 25-32; 35-40	6
	560	5-100	95		5-10; 10-20; 20-30; 30-40; 40-50; 50-60; 70-80; 80-90; 90-100	9
	566	5-120	115		5-15; 15-25; 25-35; 35-45; 45-55; 55-65; 65-75; 75-85; 90-105; 105-120	10
	565	0-110	110		0-10;10-20;20-30;30-40;40-50; 60-75;75-85;90-100; 100-110	9
	563	10-70	60		10-20; 20-30; 30-40; 40-50; 50-60; 60-70	6
	567	3-110	107		3-15; 15-25; 25-35; 35-45; 45-60; 60-70; 70-80; 80-95; 95-110	3
	568	20-100	80		20-30; 30-40; 40-50; 50-60; 60-70; 70-80; 80-90; 90-100	8
	548	20-110	90		20-30; 30-40; 40-50; 50-60; 60-70; 70-80; 80-90; 90-100	8
	545	0-110	110		0-2.5; 2.5-5; 5-15; 15-25; 25-35; 35-45; 55-65; 65-75; 75-85; 85-95; 95-110	11
	550	9-40	31		9-12; 12-14; 14-16; 18-20; 20-25; 25-30; 30-40	7
	547	0-70	70		0-3;20-30; 30-40; 40-50; 50-60; 60-70	6
	556	0-110	110		0-10; 10-20; 20-30; 30-40; 40-50; 50-60; 60-70; 70-80; 80-90; 90-100; 100-110	11
	555	0-120	120		0-15; 15-30; 30-45; 45-60; 60-75; 75-90; 90-105; 105-120	8
Rakushechnoe more	265	100-110	10		100-110	1
	281	0-110	110		0-10; 40-50; 100-110	3
	282	0-100	100		0-10; 20-30; 70-80; 90-100	4
	297	0-60	60		0-10; 40-50; 50-60	3
	298	5-105	100		5-10; 60-70; 100-105	3
	278	0-100	100		0-10; 50-60; 90-100	3
Sagindig	271	65-90	25		65-75; 80-90	2
	273	0-75	75		0-10; 60-70; 70-75	3
	274	20-70	50		20-30; 60-70	2
	288	0-12	12		0-5; 5-12	2
	290	0-28	28		0-5; 20-28	2
	293	0-5	5		0-5	1
	291	34-54	20		34-44; 44-54	2
Melovoy More	260	40-80	40		40-50; 70-80	2
	259	70-85	15		70-75; 80-85	2

Kazakhian sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Skalistaya more	539	40-100	60	Conkian	40-50; 50-60; 60-70; 70-80; 80-90; 90-100	6
	547	80-100	20		80-90; 90-100	2
	1	1300-1444	144		1300-1310; 1390-1400; 1434-1444	3
Avarage thickness			224	75 m	Total quantity of sample	11
Skalistaya	547	100-110	10	Karaganian	100-110	1
	591	50-90	40		50-60; 80-90	2
Avarage thickness			60	30 m	Total quantity of sample	3
Skalistaya more	7	220-635	410	Chokrakian	220-230; 300-310; 500-510; 600-610; 630-635	5
	5	180-605	10		180-190; 250-260; 500-510; 600-605	4
Avarage thickness			420	210 m	Total quantity of sample	9
			Grand total quantity of sample			22

Meotian deposit found in 1 structure
Studed in 1 well with 1 sample
Thinkness is 73 m

Sarmatian deposits found in 4 structure,
Studied in 52 wells with 244 samples
Average thickness is 66.5 m

Conkian deposits found in 1 structure,
Studied in 3 wells with
11 samples.
Average thickness is 75 m

Karaganian deposits found in 1 structure
Studied in 2 wells with 3 samples
Average thickness is 30 m

Chokrakian deposits found in 1 structure,
Studied in 2 wells with 9 samples
Average thickness is 210 m

Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Skalistaya more	7	220-635		Maycop	220-230; 280 290; 337-347; 372-	10
	1	1300-1444			1300-1310; 1310-1320-	7
	559	70-100	30		70-80; 80-90; 90-100	3
	5	180-605	425		180-190; 221 231; 288-298; 403-413; 449-	9
	3	143-605			143-153; 250 260; 350-360; 400-440; 424-	10
Skalistaya more	7	635-672		Paleogen	635-645; 645 655; 666-672	3
	3	635-1055			635-645; 744 757; 757-767; 878-880; 905-945; 938	9
Skalistaya more	7	744-755		Cretaceous	744-755	1

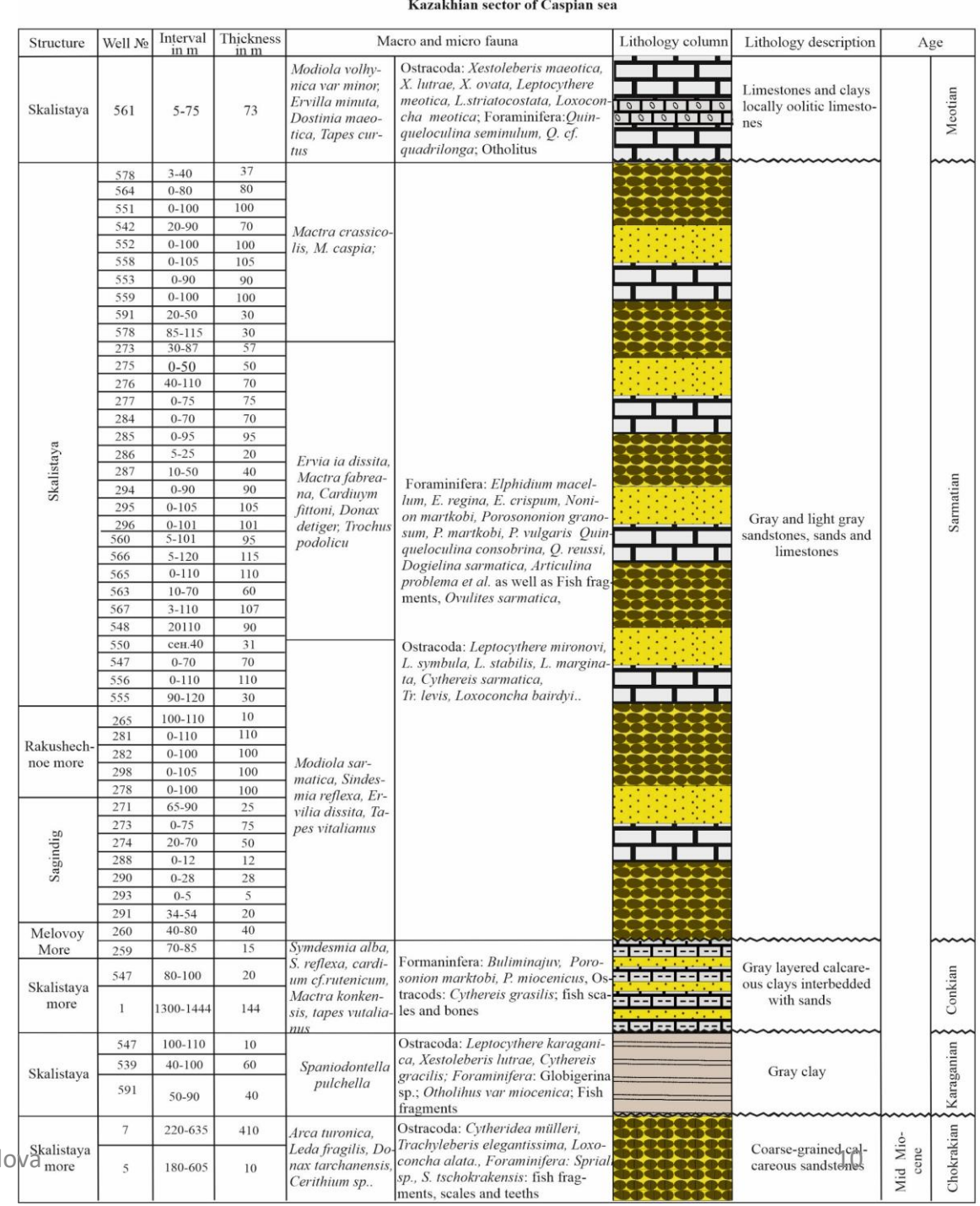
Kazakhstan sector of Caspian sea
Total number of structure- 4
Total number of wells-62
Total number of samples-267

Kazakhian sector of Caspian sea						
Structure	Well №	Interval in m.	Thickness in m	age	interval of sampling	number of samples
Skalistaya more	7	220-635	415	maycop	220-230; 280-290; 337-347; 372-382; 414-424; 453-463; 492-502; 528-538; 570-580; 623-635	10
	1	1300-1444	144		1300-1310; 1310-1320; 1320-1330; 1330-1340; 1340-1350; 1392-1400; 1432-1444	7
	559	70-100	30		70-80; 80-90; 90-100	3
	5	180-605	425		180-190; 221-231; 288-298; 403-413; 449-460; 478-488; 515-525; 530-540; 595-605	9
	3	143-605	462		143-153; 250-260; 350-360; 400-440; 424-434; 434-444; 453-463; 528-538; 562-572; 595-605;	10
Skalistaya more	7	635-672	37	Paleogen	635-645; 645-655; 666-672	3
	3	635-1055	420		635-645; 744-757; 757-767; 878-880; 905-945; 938-948; 971-980; 1011-1021;1045-1055;	9
Skalistaya more	7	744-755	11	Cretaceous	744-755	1

Maycopian deposit found in 1 structure
Average thickness: 295 m
Studied in 5 wells with 39 samples

Paleogene deposit found in 1 structure
Average thickness 229 m
Studied in 2 wells with 12 samples

Cretaceous deposit found in structure
Well penetrated 11 me only.



The stratigraphy Neogene-Quaternary deposits of South Caspian

- Commercial reservoirs have been established in the Miocene deposits. The large scale of oil and gas exploration and prospecting requires a more detailed breakdown of stratigraphic splitting of the Miocene deposits
- The primary source rocks are the marine Oligocene to lower Miocene Maykop Suite and the upper Miocene Diatom Suite.
- The stratigraphic sequence is not continuous across the basin, and in some areas, there are major unconformities:
  - at the base of lower Miocene strata,
  - at the base of lower Pliocene strata, and
  - at the base of middle Pliocene strata (between Nadkirmaku and “Pereryva” rocks,

system	subsystem	stage	part	unit	Alps	Stage/Horizon/subhorizon / Caspian sea basin	Caspian sea basin Thickness in m.	Ma Age	source rock	Reservoir rocks	Seal	HC
Quarternary	Holocene					Recent	5-1200	0.006-0.01				
						Novo Caspian						
	Pleistocene Upper	Tarantiy	Neopleistocene	upper	Wurm	Khvalinian		0.10				
	Pleistocene Mid	Tarantiy / Ioniy		upper / middle	Riss-Wurm / Mindel-Riss	Khazarian		0.25-0.3				
	Pleistocene lower	Ioniy		lower	Gunz-Mindel	Bakunian		0.80-1.1				
		Calabrian	Eopleistocene		Gunz	Apsheronian	10-1000	1.8-2.2				
Neogene	Pliocene Upper	Gelasiy- Plasencian				Akchagilian	0-500	2.5-3				
	Pliocene Lower	Zandean				Productive/ Red series	up to 6000	3.8-5.5				
	Miocene Upper	Messinian			Miocene upper	Pontian	10-160	5.8				
	Miocene Upper	Sarmatian			Miocene upper	Diatomian layers: Meotian	35-130	8.8				
	Miocene Upper	Sarmatian			Miocene upper	Diatomian layers: Sarmatian	10-80	13.6				
	Miocene Mid	Tortonian +Serravaliy			Miocene Middle	Diatomian layers: Konkian	20-25	14.3				
	Miocene Mid	Tortonian +Serravaliy			Miocene Middle	Diatomian layers: Karaganian	10-75	15.8				
	Miocene Mid	Helvetian + Langian			Miocene Middle	Sprialis layers: Chokragian	10-50	17				
	Miocene Mid	Helvetian + Langian			Miocene Middle	Sprialis layers: Tarkhanian	30	17.2				
	Miocene Lower	Burdigalian			Miocene lower	upper Maycop	70-250	24.6				
Paleogene	Oligocene				Oligicene	lower Maycop						
	Eocene				Eocene	Foarminifer layer: Koun	140-250					

Azerbaijan sector of Caspian sea

Structure	Well №	Interval in m	Thickness in m	Microfauna	Lithology column	Lithology description	Age
Chilov island	6	112.5-340	227,5	Ostracods: *Pontoniella loczyi, Euxinocythere praebacuana, Amnicythere multituberculata, Amnicythere subcaspia, Caspiocypris filona, Cytherissa napthatscholana, Loxoconcha djaffarovi* along with sporadic foraminifera.		Grey, dark – and light-grey, unctuous, heavy, laminated broken clays. Macroscopically the rocks are represented by siltstone and limestone. Carbonate content of sandy rocks varies from 0.4 to 33.9% (average 9.7%), siltstones – 5.6% and limestone – 9.3%.	Pontian
	8	802-846	44				
	65	1601-1604	3				
Apsheron bank	4	682-805	123				
	45	918-923	5				
	16	780-900	123				
Guneshli	37	611-620	9				
	5	3722-3730	8				
Chiraq	1	3905-4230	325				
Kapaz	4	3993-3995	2				
Arzu	1	4950-5000	50				
Khazri	2	2860-2950	90				
Oguz	1	2705-3078	373				
Karabag	1	4415-4604	189				
Kurkachidag more	3	3703-3840	137				
Shurabad more	7	569-625	56				
Neft Dashlari	6	210-461	251				
Shurabad more	46	1100-1102	2	*Miliolina; Otolithus; Otholites (clupea) didjakensis sp., O. meoticus sp., Rotalia beccarii,* Diatomea, Pelecypoda, fish fragments Ostracoda: *Leptocythere meotica, Xestoleberis meotica, X. ovata, Loxoconcha eichwaldi*		gray clays with interlayers of laminated shales. Brecciated dolomites, oolitic limestones and conglomerates	Meotian
	6	473-545	72				
Kurkachidag more	17	10-23	13				
	5	445-571	126				
	7	625-790	165				
Yashma more	5	38-203	165				
Shurabad more	17	23-184	161	*Ovulites sarmaticus, Miliolina;* Pelecypoda; fish fragments Ostracoda: *Leptocythere mironovi, L.symbula, Xestoleberis lutrae*		gray dense laminated and sandy clays	Sarmatian
	6	545-604	59				
Kurkachidag more	5	571-636	65				
	7	790-866	76				
Yashma more	5	213-363	150				
Apsheron Bank	6	1508-1517	9	Foraminifer: *Otolithus miocenicus, Ot. tarchanicus, Elphidium kudakoense, Bulimina elongated, Nonion miocenicus, N. soldani, Sprialis tschokrackensis, sp. andrussovi , Miliolina alsaica,* from ostracods only by *Cythreis grasilis, Xestoleberis lutrae,* Fish fragments, embryon Pelecypoda		The Conkian deposits: interbedded clays, sands, and rarer conglomerates; The Karaganian deposits clays intercalated with sandstones and sands. Scarce occurred conglomerate and gravelstone interbeds	Conkian-Karaganian
	34	698-939	241				
	37	588-766	178				
	41	994-1155	161				
Chilov island	17	58.2-204.5	146,3				
Yuzhnaya	155	0.5-70	69.5				
Guneshli	1	4255-4260	5				
	37	658-766	108				
Yashma more	5	370-414	44				
Kurkachidag more	5	636-705	68				
	7	860-921	61				
Zhliloy island	4	805-810.5 m	5,5				
Apsheron Bank	37	787-810 m	23				
	80	986-1030	44				
Shurabad more	6	604-659	95	Ostracods are: *Leptocythere stabilis, Cythereis dromas; Loxoconcha carinata, Leptocythere stabilis Xestoleberis lutrae,* foraminifera *Sigmolina tchokrakensis, Miliolina caucasica, Articulina tchokrakensis, Chara*		Gray and dark gray clays with interlayers of sands and sandstones	Chokrakian
North-Apsheron	1	2125-2164	39				
Shurabad	6	604-659	55			Clays with scarce sandstone and marlstone bands	
Kurkachidag more	7	962-1395	433				
Chilov Island	7	204.5-262	57,5				
Shurabad more	17	214-223	9	Abundant Sprialis; Miliolina; Nonion; Elphidium; Globigerina; fish fragments		Dark gray clay with a brown tint interbedded with dolomites with abundant fish remains	Tarkhanian
	14	S213-241t	28				
Apsheron Bank	41	1150-1155	5	Abundant Radiolaria, *Globigerina triloculinoides, Gimbelina globulosa, Bolivina incrassata, Globigerina pseudobulloides, Gl. ex gr. bulloides, Globigerinoides conglobata, Globorotalia crassa,* and sporadic fish teeth		Dark-grey non-carbonate clays with scarce marlstone and sandstone beds. Sometimes clays have a low carbonate content	Lower Maikopian
Guneshli	37	810-899	89				
Chilov Island	7	280.5-504	223,5				
Paleo-Volga	1	1381-1777	396				
Arzu	2	3201-3206	5				
Apsheron bank	41	1190-1233	43				
Neft Dashlari	478	616-628	12				
Sangachal more	550	5010-5775	765				
	551	3850-4000	150				
PaleVoolga	1	2121-2249	128				
Shurabad more	14	241-250	9			Gray and dark gray clays with occasional interlayers of argillaceous sandstones with an abundance of fish remains	
	17	271-362	121				

Azerbaijan offshore
Lithostratigraphy of Miocene deposits

In places where the Tarkhanian horizon is absent, the Chokrakian horizon lies transgressively on the Upper Maikop Formation.

Ostracods in the Maykop Formation, are absent. The comparison was made according to lithology based on the presence of foraminifera fauna and another microfauna

Onshore Azerbaijan. Kobustan area
Eastern slope of the Islamdag mountain.
Outcrop of Oligocene-Miocene
Total thickness 500 m
26 Oligocene-Miocene outcrops in the onshore Azerbaijan (Shamakha-Kobustan HC province)

Turkmenistan offshore
Lithostratigraphy of Miocene deposits

Turkmenian sector of Caspian sea

Structure	Well №	Interval in m	Thickness in m	Microfauna	Lithology column	Lithology description	Age
Bekdash more	122	10-130	120	Formainifera: *Quinquueloculina consobrina, Articulina problema,* ostracoda: *Trachyleberis kolesnikovi, Leptocythere symbula, Loxoconcha impressa, Otholithus (gobius) sarmaticus .*		Gray and light gray clays and silts	Sarmatian
	123	0-100	100				
	288	0-80	80				
Sue more	101	0-65	65	Ostracoda: *Leptocythere mironovi, L. saluta , L. marginata, Trachyleberis sarmatica, Loxoconcha bairdyi,* Foraminifera: *Elphidium macellum, E. regina, E. crispum, Nonion martkobi, Porosononion granosum et al.*as well as fish fragments, *Ovulites sarmatica.*		Sandy clay formations in the very bottom of sarmatian oolithian limestone	
	102	0-45	45				
	103	0-90	90				
	107	0-101	101				
	111	0-110	110				
	112	0-120	120				
	113	0-110	110				
	115	0-125	125				
	116	0-125	125				
	117	0-115	115				
	118	0-125	125				
	119	0-125	125				
	120	0-101	101				
	121	0-130	130				
	122	0-120	120				
	123	0-120	120				
	124	0-118	118				
	125	0-80	80				
	127	0-100	100				
	303	0-110	110				
	304	0-135	135				
	305	12-75	63				
	426	10-130	120				
	427	16-81	65				
	428	5-50	45				
	429	6-61	55				
Sue more	427	106-116	10	In the top of Chokrakian a lot of fish fragments along with pelecypoda and gastropoda. From formainifera: *Quinqueloculina akneria, Cibicides ex gr.lobatulus, Florilus boueanus, Elphidium rugosum atschiensis,* Ostracoda: *Cytheridea mülleri, Trachyleberis elegantissima, Loxoconcha carinata.* Limnocythere tschokrakensis		Limestones are whitish gray with a darkish tine with interlayers of dark gray and fine grained sand and gray and dark gray clay and marl with a bluish green tint, highly carbonate. Includes oolites and pyrites	-Chokrakian
	428	95-125	30				
	429	86-106	20				
Bekdash more	287	0-110	110	Forminifera: *Spiroloculina cf plana, Sigmolina tschokrakensis, S. tschokrakensis kobistanensis, Quingueloculina akneriana bulloides, Q. akneriana longa, Q. caucasica, Lenticulina sp., Rotalia becarii, R. turkmeniensis sp.nov., Elphidium rugosum atschiensis, Bulimina tarchanensis.* Ostracoda: *Limnocythere tschokrakensis,Cytheridea mülleri*			
	405	190-110	10	Formainifera: *Quinqueloculina akneriana, Q. akneriana rotunda, Q. cf circularis, Florelus boueanus, Sigmolina tschokrakensis,*		Non-carbonate dark gray, gray clays with a lot of scale bones, fish teeth	upper Maycopian suite

Legend

- Dark clays
- Limestone;
- Siltstone
- Clayey limestone;
- Sand
- Conglomerate
- Sandstones
- Qravelit
- Marlstone
- Dolomit
- Light clays
- Gray clays
- Sandy clay formation
- Oolithian limestone
- Coarse-grained calcareous sandstones
- Oolites
- Pyrites
- Laminated shales
- Argillaceous sandstones
- Scale bones, fish teethlimestones

Azerbaijan offshore. Table of distribution of microfauna in the Miocene-Paleogene deposits over the area of Shurabad well 14

age	meotian					sarmatian			karaganian					chokrakian			maycopian					Koun					
number of samples	4	6	7	8	9	11	12	13	14	15	16	17	18	19	20	21	23	31	34	35	36	39	40	41	42	43	44
depth	45-55	65-75	75-82	82-92	92-102	122-132	132-142	142-155	155-164	164-174	174-184	184-194	194-204	213-223	229-231	231-241	250-260	358-368	395-403	403-412	412-423	441-452	452-466	466-476	480-489	489-499	499-507
name of fauna																											
Globigerina bulloides	xx																								xxx		xx
G.triloculinoides																	x				xxx				xx	xxx	xx
G.compressa																					xxx				xxx		
Globigerinella voluta	x																								xx	xx	
G. aspera																										xx	xx
Globorotalia canariensis																									xx		
G.crassaformis																						xxx			xx	xxx	xxx
Gyroidina exculpta																						x					
Elphidium macellum	x																										
Eponides umbonatus																						xx				xx	x
Cibicides midwayensis																											x
C. lobatulus												x														xx	
Rotalia beccarii	x			x	x							x															
Porosononion granosum	x																										
N. micrus																						xx					
Radiolaria	x																					xx					
Miliolina sp	x					xx	x	xx				xx	x			xx											
Sprialis sp			x											xxxx	xxxx	xx											
Pelecypoda						x	xx					xxxx				xx											
Otholithus						xxx							xx	xx													
Fish bone	xx	xxx	xx	xx	xxx	xxx	xx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xx	xx		xxxx	xx	xxx	xxx	xx	xxx	xx		x	x
fish scales		xx										xxx							xx	xxx			xx			x	
Fish teeth																								x	x	x	
Embyro macrofauna	xx																										
from other microfauna Ovulites sarmaticua						x	xxx	xx																			
Ostracoda *Lepocythere meotica*	x				x																						
L.karaganica									x		x		x														
Euxionocythere suzini			x			x		x																			
Cypris gigas				x				x						x													
C. dromas														x		x											
Xestoleberis lutrae		x		x		x							x														
Cyprideis littorallis					x	x		x								x											
Cythereis sarmatica						x		x								x											
Loxoconcha bairdyi														x		x											
Cytheridea mülleri														x													

Legend	x	rare (1-5)	xxx	usulally (10-20)	xxxx	abundand (<100)
		xx	seldom (5-10)			

Azerbaijan offshore. Table of distribution of microfauna in the Miocene-Paleogene deposits over the area of Kurkachidag more well 7

age	pontian						karaganian						chokrakian			
number of samples	37	38	39	40	41	42	65	66	67	68	69	70	71	72	73	74
depth	569-581	580-591	591-595	595-605	605-615	615-625	866-877	877-886	886-897	897-906	907-910	915-921	921-932	932-940	940-951	951-962
name of fauna																
Cyprideis littorallis			x			x		x			x			x		
Loxoconcha djaffarovi	x	x	x	x												
L. carinata													x			x
Euxinocythere praebacuana	x	x		x	x											
E. bosqueti	x	x		x	x	x										
Leptocythere lata		x	x	x	x											
L. stabilis													x	x	x	
Xestoleberis lutrae					x		xx	x	x	x			x			x
L.sp		x														
Amnicythere multituberculata			x													
A. palimpsesta			xx													
Cythereis chokrakensis													x	x	x	
Pontoniella loczyi (Zalany)	xx	xx	x	x	x	x										
Otholitus (Rhombus) corius Chal							xx	xx	xx	xx	xx	xx				
Spirialis andrussovi Kittl												xxxx	xxxx	xxxx	xxxx	
Globigerina bulloides d Orb																
G. corpulenta Sub																
G. conglobatus (Br)																
Globorotalia pseudoscitula Gl																
fish bone							xx	xx	xx		xx	xx	xx	xx		xx
fish scales							xx	xx	xx				x			xx
Fish teeth								xx								
fish vertebrae							xx									
Embryo pelecypoda												xx	xx			xx
Chara																
Fish fragments							xx	xx		xx	xx	xx				

age	upper maycopian																																				
number of samples	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	95	97	98	99	100	101	102	103	104	106	107	108	109	110	111	112	115	116
depth	962-971	971-982	982-992	992-1001	1001-1011	1011-1021	1021-1031	1031-1039	1039-1046	1046-1054	1054-1064	1064-1074	1084-1093	1093-1100	1100-1113	1113-1124	1124-1134	1135-1145	1155-1165	1165-1175	1185-1195	1204-1211	1213-1226	1226-1235	1235-1245	1257-1269	1269-1282	1282-1295	1308-1317	1317-1321	1321-1331	1331-1341	1341-1351	1351-1363	1363-1373	1430-1440	1440-1450
name of fauna																																					
Cyprideis littorallis																																					
Loxoconcha djaffarovi																																					
L. carinata																																					
Euxinocythere praebacuana																																					
E. bosqueti																																					
Leptocythere lata																																					
L. stabilis																																					
Xestoleberis lutrae																																					
L.sp																																					
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A. palimpsesta																																					
Cythereis chokrakensis																																					
Pontoniella loczyi (Zalany)																																					
Otholitus (Rhombus) corius Chal																																					
Spirialis andrussovi Kittl																																					
Globigerina bulloides d Orb																																	x			x	xx
G. corpulenta Sub																																				xx	xx
G. conglobatus (Br)																																				xx	xx
Globorotalia pseudoscitula Gl																																				xx	
fish bone	xx	xx	xxxx	xx	xx	xxx	xx	xxxx	xxxx	xxxx	xxxx	xx	xx	xx	xx	xxxx	xxxx	xxxx	xx	xxxx	xxxx	xxx	xxx	xx	xx	xx	xxx	xxxx		xx	xx	xx		xx	xx		
fish scales		xx	xxxx	xx	xx	x	xx	xxxx	xxxx	xxxx	xx	xx	xx	xx	xx	xxxx	xxxx	xxxx	xx	xxxx	xxxx	xxx	xxx	xx	xx	xx	xxx	xx			xx	xx	xx	xx	xx		
Fish teeth	x															xx		xx	xx	xx	xx	xx	xx				xxx	xx	x	xx	xx	xx	xx	xx	xx		
fish vertebrae																																					
Embryo pelecypoda																																					
Chara														xx	xx	x	xx		xx							xx	xx	xx		xx	xx						
Fish fragments																																					

Legend: x — rare (1-5); xx — seldom (5-10); xxx — usulally (10-20)

Name of species of foraminifera, ostracods and other microfossils	Miocene		
	upper		lower
	Sarmatian	Chokrakian	Maycopian
ostracods:			
L. kopetdagica	x		
Leptocythere stabilis	x	x	
L. mironovi	x		
L.symbula	x		
Cythereis sarmatica	x		
Trahyleberis kolesnikovi	x		
Tr.dramas		x	
Tr. elegantissima		x	
Tr. tschokrakensis		x	
Tr. spinulosa		x	
Euxinocythere bosqueti		x	
Cyprideis littorallis		x	
Cythereis gigas		x	
C. grasilis		x	
Xestoleberis lutrae	x	x	
Limnocythere tschokrakensis		x	
Loxoconcha carinata		x	
L.carinata alata		x	
L. aff. bairdyi		x	
L. impressa	x		
Cytheridea mülleri Münst		x	
Foraminifera:		xx	
Spiroplectammina carinata		xx	
S.carinata oligocenica		xx	
S. cf. abreviata		xx	
Quinqueloculina aknericana		xx	
Q. boucana		xx	
Bolivina tarchanensis		xx	
Uvigerina pygmea		xx	
Cibicides lobatulus		xx	
Streblus ex gr. becarrii		xx	
Guttalina cf. problema		xx	
L.inornatus		xx	
Caucasica schishkaniskye		xx	
Caudina caudata		xx	
Cassidulina crassa		xx	
Streblus beccarii			
Quinqueloculina consobrina	xx		
Articulina problema	xx		
Parasononion granosum	xx		
P. martkobi	xx		
Ammonia beccarii	xx	xx	
Nonion ex gr. punctatus	xx		
Elphidium macellum	xx		
E. crispum	xx		
Ovulites sarmaticus	xx		
bryozoans		xx	
Pelecypoda, gastropoda	xx	xx	
bones scales fish teeth	xx	xx	xx
Otholits	xx	xx	

Table of distribution of microfauna and other micro remains in the Quaternary and Neogene deposits of the Bekdash and Sue Sea structures in the Turkmenistan sector of Caspian sea

Turkmenistan sector of Caspian sea

Total number of structure- 2

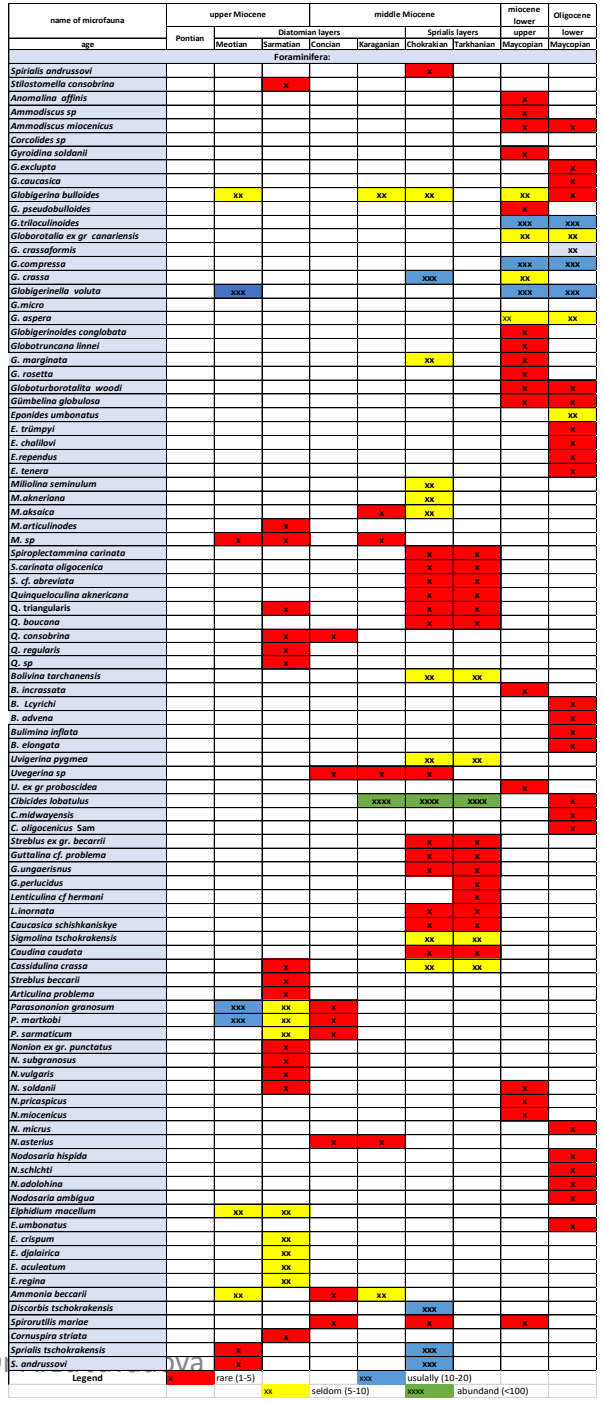
Total number of wells-31

Total number of samples-119

name of structure	Skalistaya										
age	Sarmatian						Conkian				
well number	539										
number of samples	1	2	3	4	5	6	7	8	9	10	11
depth intervals	12-15	15-17	17-20	20-25	25-32	35-40	40-50	50-60	60-70	70-80	90-100
Ostracoda:											
Leptocythere mironovi	x			x		x					
L.marginata		x	x		x						
L. symbula	x			x							
L. suzini		x	x		x	x					
L. karaganinca						x					
L.saluta	x	x									
Cyprideis littorallis		x		x		x					
C. punctullata			x		x	x					
Loxoconcha meotica	x										
L. impressa		x		x		x					
L. aff truncata			x		x	x					
Xestoleberis lutrae							x		x		x
X. lunaris							x			x	
Trachyleberis kolesnikovi			x			x					
Cythereis grasilis							x	x	x		x
C. dromas									x	x	
C. sarmatica		x	x		x						
Formainifera: Elphidium macellum		xx									
Spirorutilis mariae											x
Nonion marktobi		xx	xx	xx	xx		xx				
N.vulgaris			xx								
N.pricaspicus	x		x	x	xx		xx		x		xx
N.miocenicus	x		x		x		xx				xx
N. granosus	x		x		x		xx			x	
N.lucidus				xx	xx						
N. pricaspicus	xx	xx		xx	xx						
Uvegerina sp							x		x		
Ammonia beccarii								xx		x	xx
Spirorutilis mariae			x		x						
S. sp			x		x						
Porosononion sarmaticum		x	x		x						
Elphidium crispum	x	xx	xx	x	x						
E. macellum	x			x	x	x			x		x
Cornuspira striata	x			x	x						
Ovulites sarmatica	x			x			xx	xx			
fish scale and bone						xx	xx			xx	xx
other microfauna: Otholitus	x		x			x			x		x

Kazakhstan sector of Caspian sea. Distribution of microfauna in Skalistaya structure well NN 539

name of microfauna	upper Miocene			middle Miocene				miocene lower	Oligocene
	Pontian	Diatomian layers				Sprialis layers		upper	lower
age		Meotian	Sarmatian	Concian	Karaganian	Chokrakian	Tarkhanian	Maycopian	Maycopian
Ostracoda									
Bacuniella dorsoarcuata	x							no ostracods found	no ostracods found
Caspiocypris ex gr filona	x								
Pontoniella loczyi	x								
Amnicythere subcaspia	x								
A. quinquetuberculata	x								
A. multituberculata	x								
A. palimpsesta	x								
A. saluta									
Euxinocythere (Maetocythere) praebacuana	x								
E.(M) bacuana	x								
E. bosqueti	x		x						
E. suzini	x	x	x						
Tyrrhenocythere azerbaijanica	x								
Gryptocyprideis bogatchovi	x								
Cytherissa naphtatchalona	x								
Cyprideis littoralis			x						
C. punctullata			x						
Cypris gigas		x	x						
Xestoleberis meotica		x							
X. ovata		x							
X. lutrae	x	x	x	x	x	x	x		
Leptocythere meotica		x							
L. striatocostata	x	x							
L. karaganica			x		x				
L.kopetdagica			x						
L. stabilis			x			x			
L. mironovi			x						
L. cymbula	x	x	x						
L. saluta			x						
L.lata	x								
L. microlata	x								
L. marginata			x						
Tracyleberis kolesnikovi			x						
Tr. elegantissima						x	x		
Cythereis gigas sp nov						x			
C. tschokrakensis						x			
C. grasilis		x		x	x				
C. dromas			x			x			
C. sarmatica		x	x						
C. spinulosa Schn			x			x			
Limnocythere tschokrakensis						x	x		
Loxoconcha carinata						x			
L.djaffarovi	x					x			
L. maeotica		x							
L.carinata alata						x			
L. aff. bairdyi						x			
L. eichwaldi	x	x							
L. impressa			x						
l. aff truncata			x						
Cytheridea mülleri						x	x		
Darwinula stevensoni	x				x				



Miocene sediments in Azerbaijan sector of Caspian sea

Foraminifera:
39 genera
95 species

Ostracoda:
12 genera
40 species

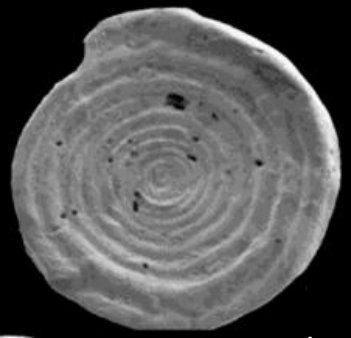
The number of studied individuals is 53 species (together with Pontian) that belong to two families: *Cypridae* and *Cytheridae* with a predominant number of species from the genera *Leptocythere, Loxoconcha, Xestoleberis and Cythereis*

name of microfauna	upper Miocene			middle Miocene				miocene lower	Oligocene
	Pontian	Diatomian layers				Sprialis layers		upper	lower
age		Meotian	Sarmatian	Concian	Karaganian	Chokrakian	Tarkhanian	Maycopian	Maycopian
Other micro fossils									
Rhabdammina									x
Ovulites sarmaticus		xxx	xxx						x
O. renata		xx	xx	xx	xx				
O. gratus sp.			x						
Otholits sp			x			x			
O.var miocenica								xx	
O.(Rhombus) carius					xx				
O.(Clupea) rostrata					xx	xx			
O. (Clupea) tarchanicus					xx	xx			
O.(Gadidarum) minusculus									
O.(gobius) pretiosus			x						
oolits		xx							
Radiolaria		x						xx	
Pelecypoda, gastropoda			xx	xx	xx	xx			
bones scales fish teeth		xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
Chara								x	
Discorbis sp									x
Legend	x	rare (1-5)			xxx	usulally (10-20)			
			xx	seldom (5-10)		xxxx	abundand (<100)		

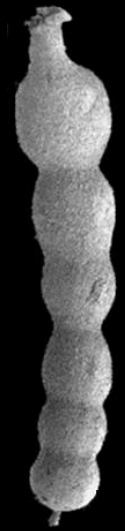
The Miocene deposits in the South and Middle Caspian on the example of the studied wells allow us to conclude that the Miocene deposits are often poorly or completely uncharacterized by macrofauna, contain a rather mid to large accumulation of microfauna: foraminifera, ostracods, fish remains, otoliths and another microfauna

Thus, studied by Dr. Voroshilova, the stratigraphy and microfauna of the Miocene deposits of onshore Azerbaijan and 3 offshore structures of Kazakhstan (in the area of Zhilandy, Zhaga, and Peschanomysskaya) was justified and was confirmed by our data

MIOCENE FORAMINIFERA

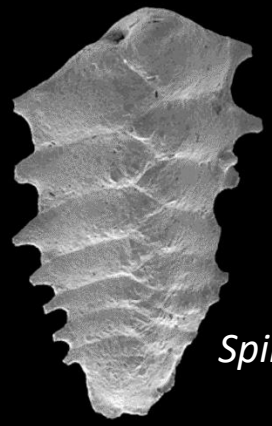


Cornuspira striata (Czjzek)

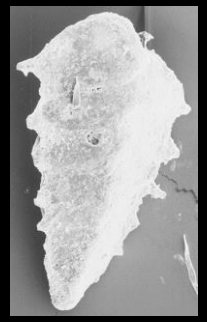


Stilostomella consobrina (d'Orbigny)

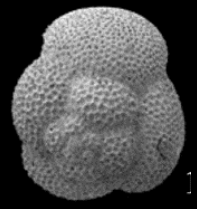
Quinqueloculina triangularis d'Orbigny



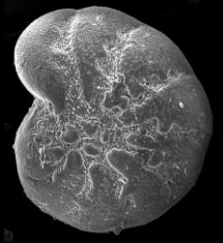
Spirorutilis sp



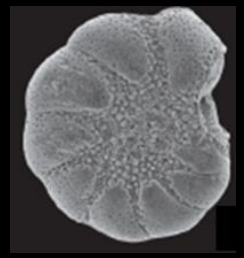
Spirorutilis mariae (d'Orbigny)



Globoturborotalita woodi (Jenkins)

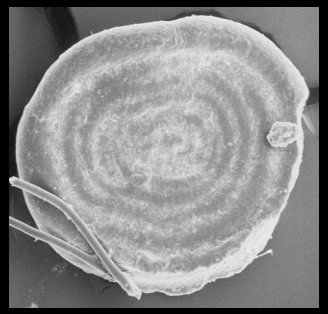


Elphidium sp.



Porosononion martkobi Bogdanowicz

Quinqueloculina regularis Karrer



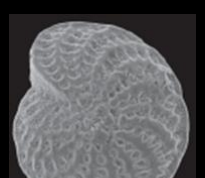
Ammodiscus sp

100 µm

Cibicides sp

Nodosaria sp

Nodosaria ambigua Neugeboren

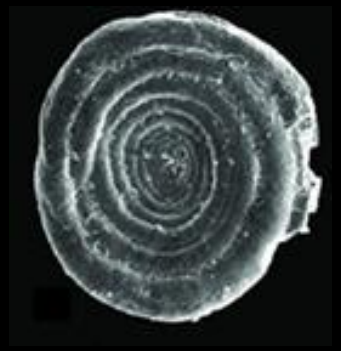


Elphidium macellum (Fichtel & Moll)

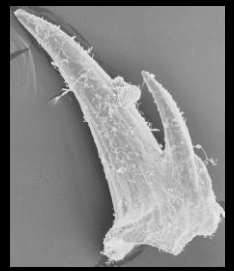
Porosononion granosum (d'Orbigny)

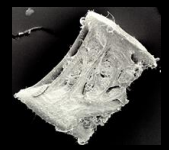
Elphidium crispum (Linné)

Quinqueloculina sp



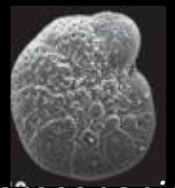
Ammodiscus miocenicus Karrer





Fish fragments

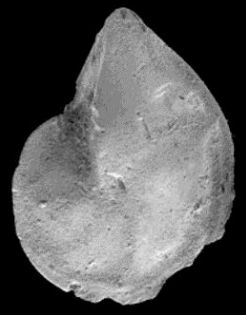
***Globigerina bulloides* d'Orbigny**



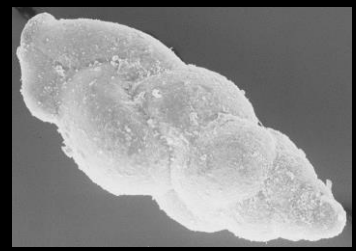
Porosononion sarmaticum Popescu

Dr Arzu Javadova

Cibicides Lobatulus (W &J)

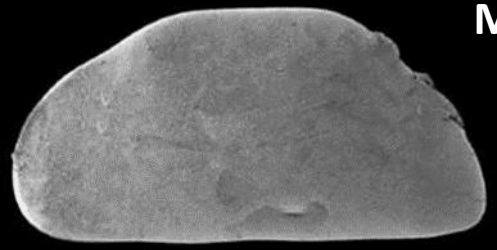


Lenticulina inornata (d'Orbigny)

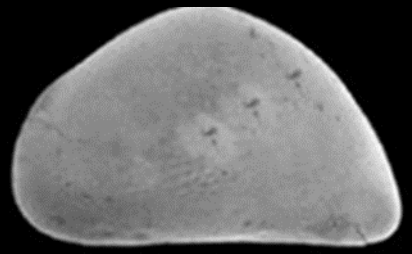


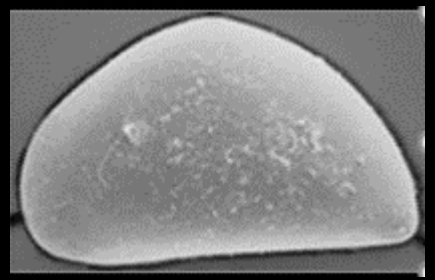
***Bulimina elongata* d'Orbigny**

MIOCENE OSTRACODS & OTOLITHUS



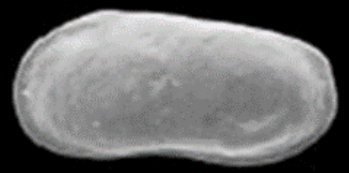
Pontoniella ex. gr. loczyi (Zalányi)



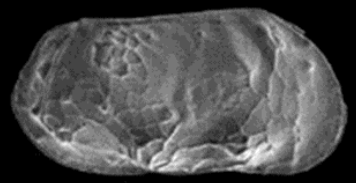


Typhlocypris centropunctata (Suzin)

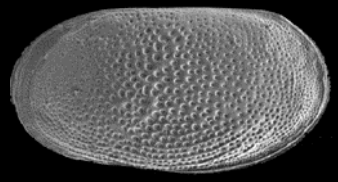
Euxinocythere suzini (Schneider)



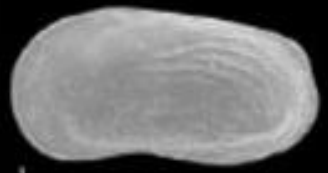
Amnicythere cymbula (Livental)



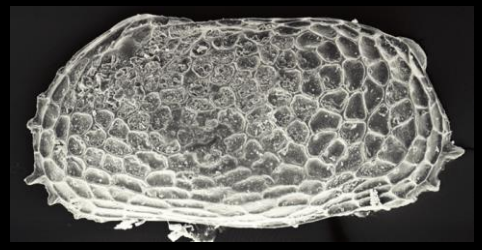
Euxinocythere (Maetocythere) praebacuana (Livental);



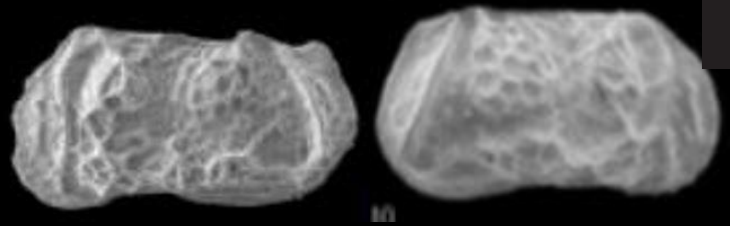
Loxoconcha eichwaldi



Amnicythere striatocostata (Schweyer)

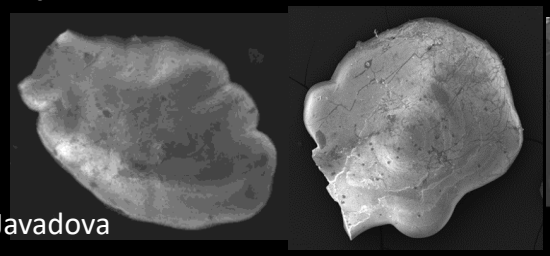


Tyrrhenocythere azerbaijanica (Livental)

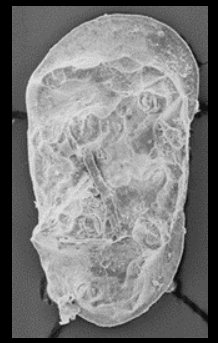


Euxinocythere (Maetocythere) *bacuana* (Livental)

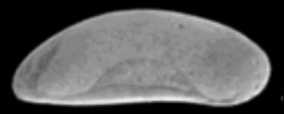
Amnicythere aff. palimpsesta (Livental):



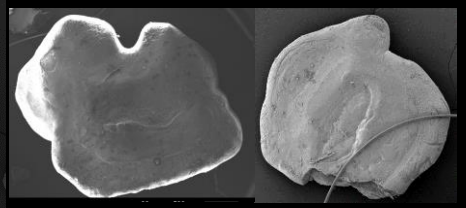
Amnicythere saluta (Livental)



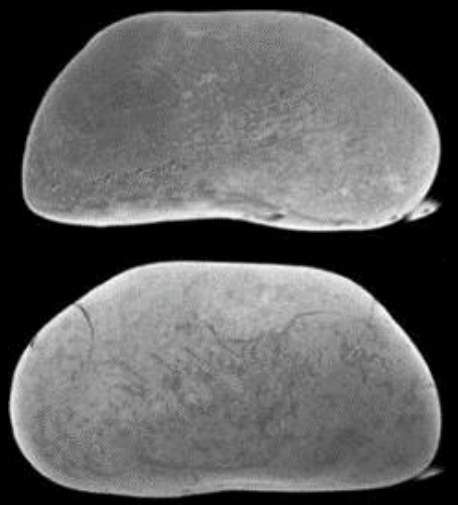
Amnicythere multituberculata (Livental)



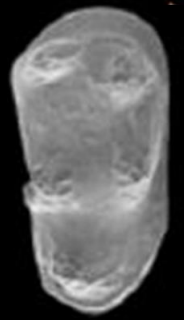
Cythereis sarmatica (Jiřiček)



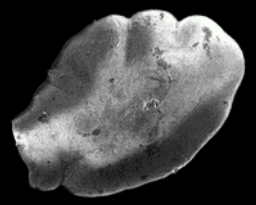
Otolithus



Caspiocypris ex. gr. Filona (Livental)



Amnicythere quinquetuberculata (Schweyer),



Short Information about Oligocene- Miocene sediments

- Oligocene sediment was deposited in a marine waters that stretched from western Turkmenistan westward to the Black Sea. During the formation of Early Miocene basins connection between the east and west Paratethys was rather extensive
- In early Miocene time, the organic-rich sediment formed the Maykop Suite, which constitutes the principal hydrocarbon source rock in the South Caspian Basin region, accumulated in this marine environment.
- Thickness of the Oligocene and Miocene rocks in the center of the basin is as great as 3,000 m (Eyer and others, 1995).
- Uplift of the major tectonic compression zones resulted in formation of the Greater Caucasus and Kopet Dag mountain ranges. As the highlands rose, the connection with open-marine waters became restricted, producing anoxic conditions in the Caspian Sea. During the late Messinian post evaporitic phase, in the eastern region between the Alps and the Aral Sea, the Paratethys was reduced to a number of large independent basins (Pannonian Basin, Pontic Basin and Caspian-Aral Basin) separated by vast continental regions
- The middle Miocene Tarkhanian, Chokrakian, Karaganian, and Conkian horizons overlie the Maykopian horizon . These strata, have been penetrated by a number of wells, consist of shale and marl with interbeds of sandstone and siltstone.
- A last marine connection from the Mediterranean Sea to the Caspian Sea deposited the Diatom Suite, which consists of shales, marls, sandstones, and limestones with interbeds of volcanic ash and coquina.
- The middle Miocene overlie the Upper Maykop Suite . These strata, which have been penetrated by a number of wells, consist of shale and marl with interbeds of sandstone and siltstone.

Palaeoecological aspects of Miocene basin in South Caspian

- During the formation of Early Miocene basins connection between the east and west Paratethys was rather extensive. As a result of the above geological processes the basins were isolated from the open sea periodically, thus promoting the formation of desalinated and freshwater conditions. As a result, the inhabitants composition changed from stenohaline to extremely euryhaline. Due to special conditions endemic forms and different fauna evolved. Paleoecology conditions directly affected the distribution of microfauna and promoted separate genus and species flourishing, as well as their weakening and extinction
- **At the beginning of the Middle Miocene (Tarkhanian age)** orogenic movements were not simultaneous and of the same intensity everywhere. Such situation affected the relief of the basin floor and formed submarine uplifts and isolated depressions. Water movement in horizontal direction did not extend to the deepened areas that complicated vertical circulation of the basin. *(Popkhadze , 2016).* These processes affected the development and distribution of microfauna as well. In Tarkhanian sediments of Caspian Sea the ostracodes of the following genera are found: *Loxoconcha, Trachyleberis, Cythereis, Cytheridea.* The ostracodes are represented by species living both in marine and desalinated basins. By the origin of ostracodes the following main groups are distinguished: species of Mediterranean type – of West European Vienna basin and species of Northern Germany (*Trachyleberis elegantissima (Lnkls.), Loxoconcha carinata (Lnkls.),* also *Cytheridea mulleri (Munst.*), spread in the Oligocene and Miocene of West Europe.
- Often the absence of ostracods in the Tarkhan time in the Caspian basin can be explained by some isolation from the Mediterranean basin, which is confirmed by data from the study of foraminifers.
- In the Upper Tarkhanian sediments besides the endemic species, microfauna that also extends **to the Chokrakian sediments** is widespread. From ostracods *Loxoconcha carinata Lnkls, L. carinata alata Schn., Cytheridea mulleri (Munst.).* Thus, microfauna recorded in the Tarkhanian-Chokrakian sediments points to the normal salinity of the basin and its connection to the open sea. Species of the Mediterranean type that almost do not differ from the West European Miocene forms occur in the Tarkhan-Chokrakian microfauna association.

Palaeoecological aspects of Miocene basin in South Caspian

- **The Tarkhanian and Chokrakian fauna** were genetically related to each other. Ostracodes of Chokrakian sediments comprise species characteristic of properly Chokrakian and also the Mediterranean type species that passed from the Tarkhanian. It should be noted that some of the Mediterranean type ostracodes, which are found in the Chokrakian sediments of Caspian sea and slightly variate from typical forms are not known in the Tarkhanian (*Loxoconcha aff. bairdi Müll., Cythereis spinulosa (Reuss).* According to composition and origin of foraminifers in the Chokrakian sediments the Mediterranean species migrating from the Tarkhanian and the endemic ones are observed
- Mediterranean type species of Chokrakian microfauna migrated without changes from the Tarkhanian at the beginning of the Chokrakian, when the connection with the open sea was restricted. At the same time some species that migrated from the Mediterranean and got adapted to the post Tarkhanian reduced salinity, underwent insignificant changes and continued evolution
- Along with the Chokrakian microfauna the otoliths, spirialis, gastropods, fish bones traced all over the clay facies. In Chokrakian sediments of Azerbaijan sector of South Caspian Sea different types of facies are distinguished. More thick deep-water facies that contains numerous Spirialis lithologically are represented by dark-colored clays , sand & sandstone in upper part, clays with marlstone in lower part of section.
- Facies characteristic of shallow water, finegrained sandstons with clay partings and loose sandstones was deposited near the coast. Most of Chokrakian ostracodes of Caspian Sea occur in deep and transitional facies of the basin. From ostracodes in deep basin facies the following species are frequent: *Leptocythere stabilis Schn., Loxoconcha carinata Lnkls., L. carinata alata Lnkls., Trachyleberis elegantissima (Lnkls.), Cythereis spinulosa (Reuss), C. dromas Schn., Cytheridia mulleri (Munst.).* In the transitional facies often occur the species of genus *Loxoconcha* and *Xestoleberis.* Other species are rarely found, but *Cytherideis littoralis (Brady)* is often met. Types of *Cythereis tschokrakensis* Sch., and *C. dromas* known from the deposits of the Chokrakian horizon of the Crimea and the Caucasus characterize the deep-water facies

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- According to microfauna genera and species of Chokrakian sediments marine conditions were normal. Salinity is lower compared to the Tarkhanian. The salinity decreases in Early to the Middle Chokrakian. Basin depth and temperature along with salinity were of great importance for microfauna evolution and distribution, its qualitative and quantitative composition. Temperature is high in the Chorakian, as evidenced by numerous miliolids.
- The Chokrakian fauna of ostracods formed under conditions of increased salinity of the basin. Salinity according to Khatskevich and before (1954) was significantly higher than in Tarkhanian and Maikopian. The analysis of ostracods showed that among the listed forms indicating the establishment of communications between the Caspian and Western. European seas are *Cythereis tschokrakensis* Sch. *Loxoconcha carinata Lnkls. Leptocythere stabilis Schn*
- The transition from the Chokrakian horizon **to the Karaganian horizon** did not occur in the same way everywhere. Within the distribution of the sandy-clayey facies, conglomerates and gravel appear at the base of the Karaganian. This traces of a significant regression appeared at the beginning of the Karaganian age, where the Karaganian layers contain a redeposited foraminifera fauna from the Chokrakian, Maykopian Paleogene and Cretaceous. A few, new species *Leptocythere karaganica and Cythereis grasilis appears here.*
- The Karaganian time was desalinated in some places, which is indicated by the widespread in *Darwinula stevensoni (Brady et Robert).* Due to the desalination of the basin, the ostracods of the Karaganian become more depressed, less developed, smaller and thin-walled. The species composition of ostracods is characterized by the poverty of small-sized forms, which, apparently, indicates rather an influx of cold waters in the Karaganian time.
- The transition from the Karaganian horizon **to the Konkian horizon** is difficult to distinguish lithologically and according to the composition of ostracods. However, the regime of the pool during Konkian time varies greatly. Ostracods are extremely small, thinly valved, with an indistinguishable hinge without sculpture, and only approximately defined to the genus level

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- **The Sarmatian age** was marked by the appearance of some characteristic species *Cythereis sarmatica Zal, C.kolesnikovi Sch., Loxoconcha impressa (Bairdy) L. aff truncata (Bassiouni). Trachyleberis kolesnikovi Schn, Leptocythere mironovi Schn., etc.* In Turkmenian sector of Caspian sea appeared local species *Leptocythere kopetdagiga (Rozieva),* in Kazakhstanian sector *Leptocythere suzini (Schn).*
- Sarmatian ostracods have the appearance of well-developed forms, larger in size, sculptured. The uniform composition of ostracods throughout the Sarmatian section indicates that the basin has changed little over time.
- Meotian sediemts found in drilled wells of Azerbaijan and Kazakshtan sector of Caspian sea. Unfortunately, we did not find Meotian sediments in studied wells from Turkmenian sector of Caspian sea. A few new species appeared in Meotian sediements like: *Xestoleberis meotica Suzin, X. ovata Voroshilova, Leptocythere meotica Liv., Loxoconcha meotica sp. nov, l. eichwaldi Liv.*
- The presence in the section of the Meotian lithology with an abundant fauna of Pliocene thin-valved ostracods speaks for the relative deepness of this part of the Meotian basin and its transitional character from the Miocene to the Pliocene.

Conclusions

- The study of Miocene stratigraphy and ostracods from the Caspian Sea is important in terms of oil and gas potential.
- Miocene stratigraphic scheme needs clarification
- Ostracods have a wide distribution and significance for the stratigraphy.
- Our study made it possible to trace the succession of ostracod assemblages and identify associations of ostracods with a certain stratigraphic horizon. At the same time, we considered the characteristic fossil fauna of foraminifers, gastropods, pelecypods, and fish otoliths as well
- There are no any ostracods found **in Maycopian or Paleogene sediments**.