6.7 Lithostratigraphy of gravity cores ("Akademik Boris Petrov" Kara Sea Expedition SIRRO-2001)

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Introduction

During the "Akademik Boris Petrov" Kara Sea Expedition SIRRO-2001, a total of 61 gravity cores with lengths between 0.10 and 7.43 meters were obtained (Fig. 6.22; cf. Fig. 6.2). Onboard "Akademik Boris Petrov", a selected set of 10 sediment cores were already opened, described and sampled for smear-slide analyses (see Appendix 10.2). In addition, 18 cores were opend, photographed, and described at AWI. Color slides from the core sections are available at AWI (request to R. Stein, AWI) as well on http://www.pangaea.de. Furthermore, from all these cores sediment slabs were taken for X-Ray photographs. In several of the opened cores, abundant bivalves were found which were sampled for future AMS ^{14}C dating (Tab. 6.13). In almost all of the core tops, dark brown sediments were observed, indicating that the (near-) surface sediments were recovered in the cores.

The main purpose of this chaper is to summarize the major lithologies of the sedimentary sequences based on lithological core descriptions and to obtain a lithostratigraphic framework. These data should be the basis for future sampling and more detailed sedimentological, micropaleontological, and geochemical studies of the BP2001 sediment cores.

Lithostratigraphy

For presentation and description of the major lithologies, 15 sediment cores have been selected and grouped into four groups: the Yenisei cores (Fig. 6.23), the Ob cores (Fig. 6.24), the cores from the northeastern part of the study area (Fig. 6.25), and the cores from the northwestern part of the study area (Fig. 6.26). The complete core descriptions of all cores and smear-slide data are presented in the Appendix 10.2.

Core BP01-03/4 taken from the central part of the Yenisei marginal filter, mainly consists of very dark gray and dark olive gray, bioturbated silty clay to clayey silt (Fig. 6.23). The lithology is very similar to that of Core BP99-04/7 from the northern part of the marginal filter, representing young Holocene sediments and reflecting the high-sedimentation-rate environment (Stein 2001). In Core BP01-26/3 obtained from the area north of the Yenisei (Fig. 6.22), the sediment composition is much more variable. Three lithological units can be distinguished (Fig. 6.23). Unit I is composed of dark olive, very dark gray, and black, bioturbated silty clay. At the base of the unit, a large ikaite cristal (about 5 cm in diameter) was found (cf., Chapter 7.9). The underlying Unit II is characterized by olive gray silty clay to clayey silt with intercalated sandy layers. Unit III consists of silty clay to clayey silt with minor amounts of sand. The unit is less bioturbated than Unit I, and distinct color variations between olive gray, dark olive gray, dark gray, very dark gray, and black with sharp

boundaries are obvious. Furthermore, significat amount of diatoms are present in this unit (see smear-slide data, Appendix 10.2). This variability in lithology probably reflects distinct changes in the depositional environment (e.g., changes in riverine sediment supply).

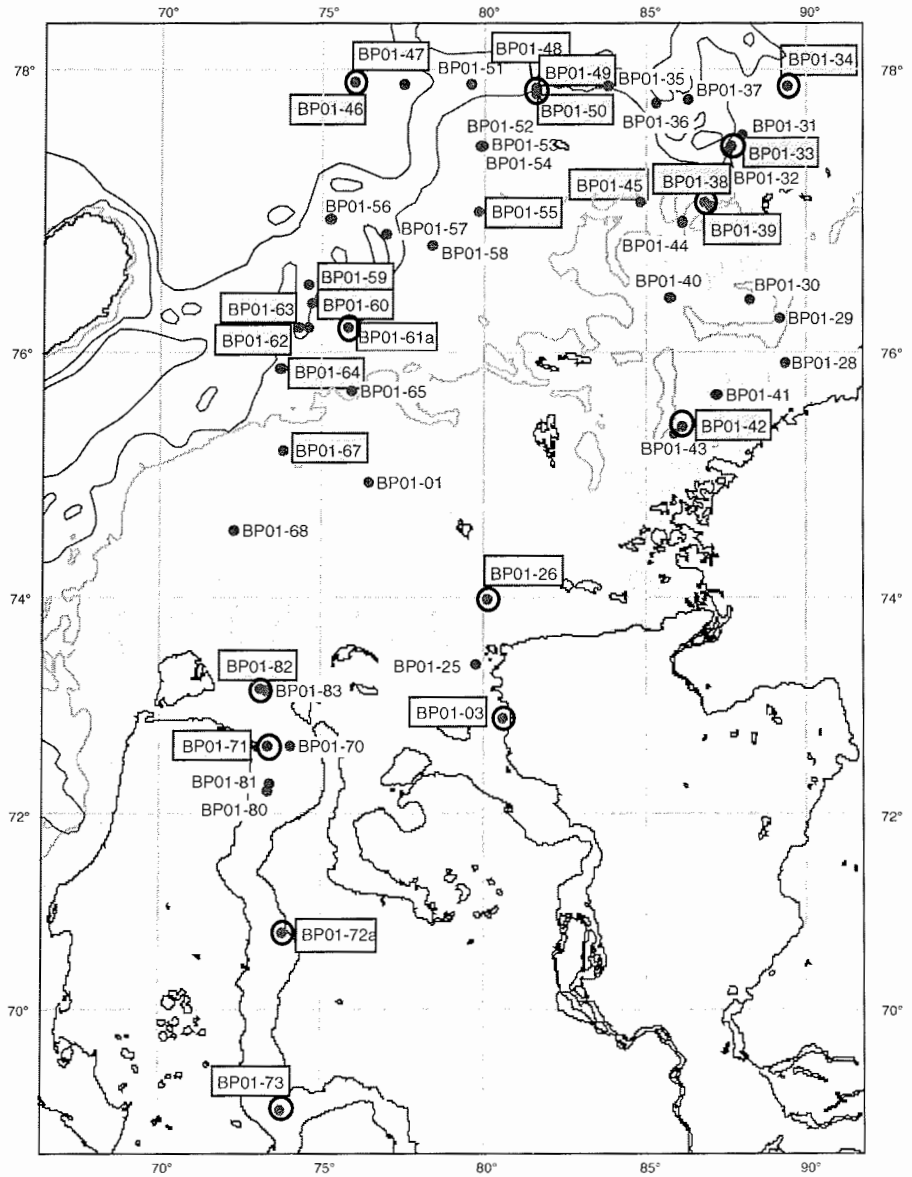

Fig. 6.22: Location of gravity cores obtained during "Akademik Boris Petrov" Expedition 2001. The cores marked by gray boxes were opened and described (see Appendix 10.2). For the circled cores, lithologies are presented in this chapter.

The sediment cores obtained from the Ob area are characterized by very different lithologies (Fig. 6.24). The two northern cores BP01-71/4 and BP01-82/8 are mainly composed of very dark gray and dark olive gray, bioturbated clays (Unit I). In Core BP01-71/4, more sandy layers are occasionally intercalated. The lowermost part of the core (200 - 232 cm) consists of dark olive gray sandy silty clay (Unit II). Core BP01-72a/2 was obtained from a narrow sediment-filled pocket/channel where the ELAC profiler showed a penetration of several meters below the seafloor. Two main lithological units can be distinguished. Below a more sandy, very dark gray and dark olive gray Unit I, most of the core is composed of laminated, dominantly black and very dark gray silty clay (Unit II). These laminated sediments may reflect a short-term variability in the depositional environment controlled by factors such as river supply, oxygenation, organic-carbon preservation, etc. The southernmost Core BP01-73/5 taken in front of the mouth of the River Taz, is mainly composed of alternation between 0.5-2 cm thick, clayey sand silt layers and 0.2-0.5 cm thick clayey silty sand layers. These variations may have been caused by (cyclic) variations in the hydraulic regime.

The northeasternmost Core BP01-34/7 mainly consists of dark gray, very dark gray, and dark olive gray silty clay units, intercalated with two units characterized by mud clasts (Fig. 6.25). Core BP01-33/2 can be divided into three lithological units (Fig. 6.25). Unit I is composed of dark olive gray and very dark gray, bioturbated silty clay. Between 450 and 690 cm core depth, (finely) laminated dark olive gray and very dark gray, relatively stiff silty clay to clayey silt is the typical lithology. The lowermost part of the core (Unit III) consists of dark olive gray and black clayey silty sand. Cores BP01-38/7 and BP42/2 only consists of one lithological unit characterized by dark olive gray, very dark gray, and black (Holocene) silty clay to clayey silt (Fig. 6.25). Further sedimentological studies are necessary to interprete the different lithologies of these cores in relationship to changes in the depositional environment.

The sedimentary sequence of northwesternmost Core BP01-46/7 can be divided into two lithological units (Fig. 6.26). Unit I is composed of dark olive gray, very dark gray, and black (Holocene), bioturbated silty clay to clayey silt. Unit II (211-234 cm core depth) consists of very dark gray to black, firm clayey sandy silt with several pebbles and stones (diamicton). Between both units, a thin horizon of laminated very dark gray silty clay was observed. Cores BP01-48/07, BP01-49/2, and BP01-50/2 taken very closed to each other (cf., Fig. 6.22), can be correlated based on the upper three lithological units preserved in all three cores (Fig. 6.26). Below a very dark brown and dark grayish brown sandy silty clay unit (Unit I), very dark gray and dark olive gray, bioturbated silty clay to clayey silt (Unit II) was observed. The underlying Unit III is composed of very dark gray and dark olive gray silty clay with intercalated sandy layers. Unit IV, not present in Core BP01-48/7, is characterized by very stiff silty sandy clay (and one stone) in Core BP01-49/2 and by silty sandy clay with abundant stones/pebbles (diamicton) in Core BP01-50/2. In the latter core, the diamicton of Unit IV is underlain by four types of lithologies: dark olive gray sandy silty clay (Unit V), sandy silty clay with intercalated sandy laminae (Unit VI), dark olive gray clayey silty sand (Unit VII), and sandy silty clay with intercalated sandy laminae (Unit VIII).

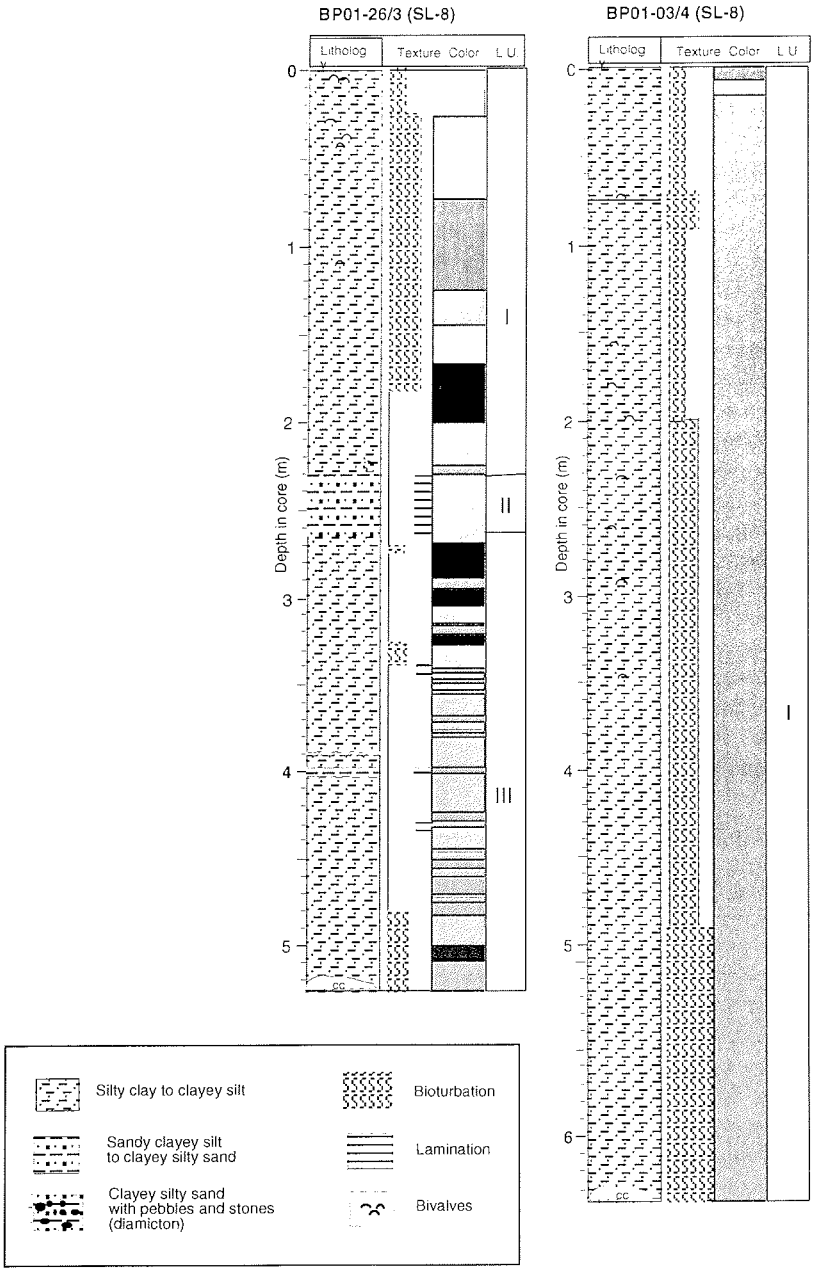

Fig. 6.23: Lithologies of Yenisei sediment cores. Distinct changes in sediment color between mainly gray and olive gray to black are marked by different gray scales (for detailed color codes see Appendix 10.2). For location of cores see Fig. 6.22.

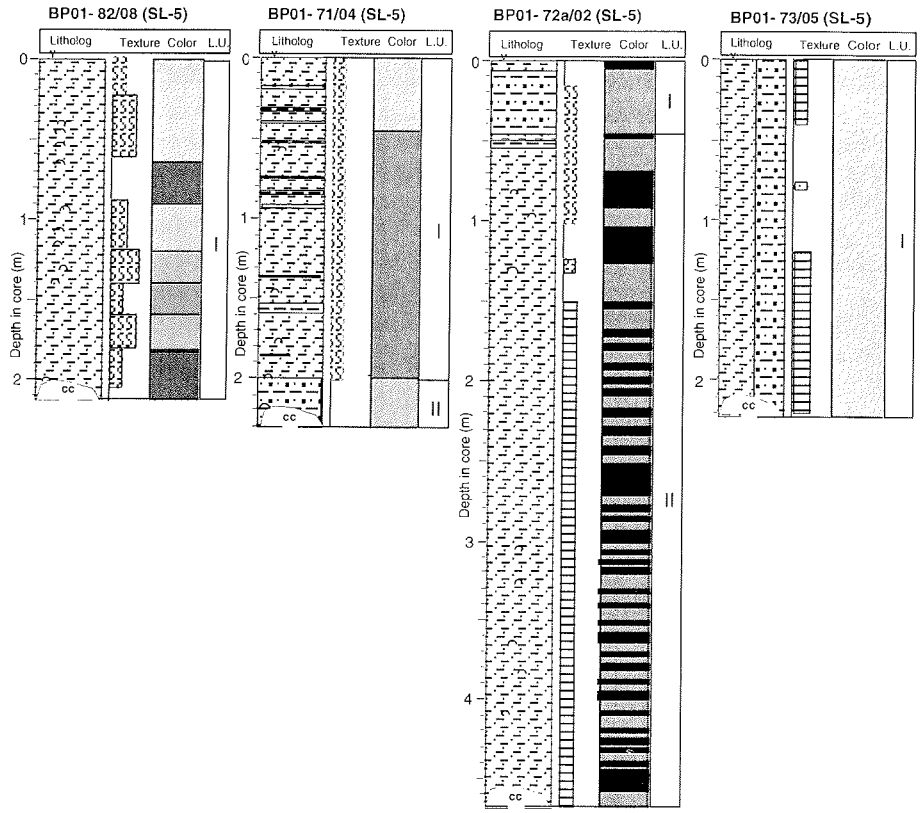

Fig. 6.24: Lithologies of Ob sediment cores. Distinct changes in sediment color between mainly gray and olive gray to black are marked by different gray scales (for detailed color codes see Appendix 10.2). For location of cores see Fig. 6.22, for legend see Fig. 6.23.

Cores BP01-46/7, BP01-48/7, BP01-49/2, and BP01-50/2 were obtained from an area close to the proposed margin of the Last Glacial Maximum (LGM) Kara Sea Ice Sheet (see Chapter 6.2). The different lithologies of these cores (laminated sediments, very stiff silty clayey sand, and diamicton) may be related to glacigenic processes. A detailed study of these cores as well as the other cores taken from this area (see Appendix 10.2) may give information about the extension and the history of LGM glaciation in this area.

Core BP01-61/07 (see Fig. 6.22 for location) is only composed of bioturbated silty clay to clayey silt (Unit I), probably representing young (Holocene) sediments and assuming high sedimentation rates. A study of these sediments will allow a high-resolution recontruction of Holocene depositional environments.

Outlook

Based on (a) the lithological core description, (b) future AMS ^{14}C dating of the sediment cores, (c) sedimentological, mineralogical, micropaleontological, and geochemical data sets, (d) detailed topographic maps, and (e) the evaluation of sediment echograph and Geochirp profiles, a detailed reconstruction of the paleoenvironment (e.g., changes in paleo-river discharge, history of late Quaternary glaciation, etc.) and a calculation of sedimentary and organic carbon budgets will be performed.

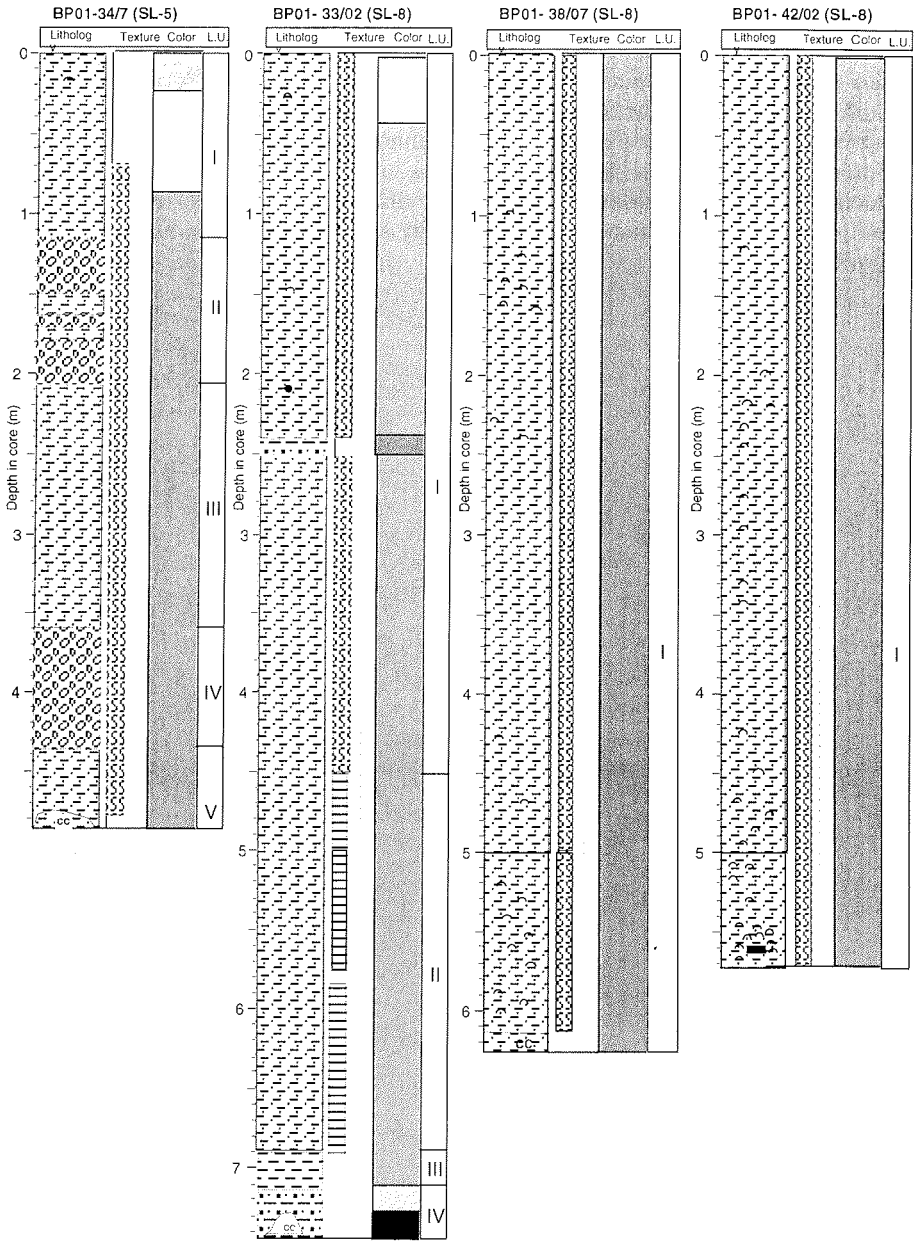

Fig. 6.25: Lithologies of sediment cores from the eastern and northeastern part of the study area. Distinct changes in sediment color between mainly gray and olive gray to black are marked by different gray scales (for detailed color codes see Appendix 10.2). For location of cores see Fig. 6.22, for legend see Fig. 6.23.

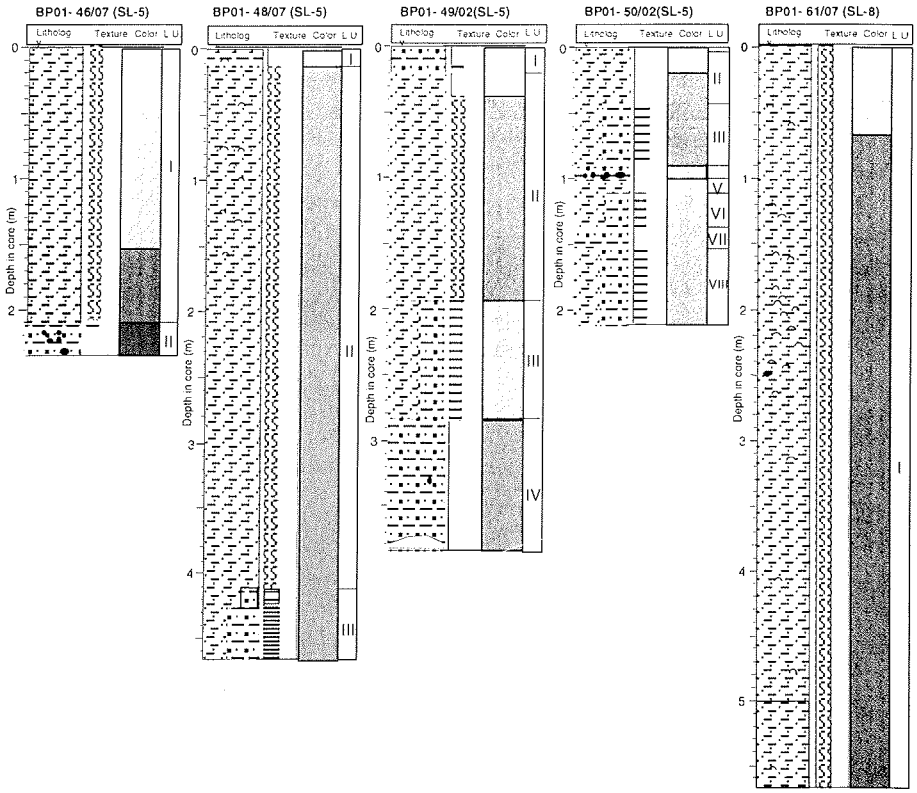

Fig. 6.26: Lithologies of sediment cores from the northwestern part of the study area. Distinct changes in sediment color between mainly gray and olive gray to black are marked by different gray scales (for detailed color codes see Appendix 10.2). For location of cores see Fig. 6.22, for legend see Fig. 6.23.

Table 6.13: Compilation of all bivalve samples taken from cores and available for AMS-14C dating

BP01-33/02 Depth (cm)	**BP01-39/02** Depth (cm)	**BP01-42/02** Depth (cm)	**BP01-45/06** Depth (cm)	**BP01-46** Depth (cm)	**BP01-61/07** Depth (cm)
23-24	51	120	13	40	60
24	60	200	15		120
30	76	214	27		127
47	121	217,5	27,5	**BP01-48/07**	130
85	127	232	47	Depth (cm)	157
144	128	246,5	52		160
	152	275	63	10	183
	169	293,5	70	42	190
BP01-37/06	170	330	85	73	194
Depth (cm)	172	342	169	75	200
	179	427,5	170	87	203
128	187	450	171,5	101	215
160-161	195	468	210	125	225
174	200	477	267	131	239
195	245	487	277	158	242
219	256	494	285		265
240	262,5	504	302,5		313
245	280	508	304	**BP01-49/02**	407
245,5	287,5	516	308	Depth (cm)	478
260	296	530	326		552
284	349	545	350	20	
308	391	547,5	365	52	
	460	550	375		**BP01-62/05**
	470	553	380		Depth (cm)
BP01-38/07	480	554	460	**BP01-59/05**	
Depth (cm)	481	557	488	Depth (cm)	222
	500	560	491		280
5	509	562	499	179	330
99,5	511	567	567	386	346
124	525		599	465	355
140				468	360
144				479	440
156				480	477
160				502	
227					
238					**BP01-72a/02**
429					Depth (cm)
478					
520					80
529					95
540					129
552					304
560					364
561					379
571,5					408
588					
595					
600					