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A compilation of previously published geochemical data on the lower Cambro-Silurian sedimentary sequence, including alum shales in the Oslo region

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REPORT

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Title:
A compilation of previously published geochemical data on the lower Cambro-Silurian sedimentary sequence, including the alum shales in the Oslo region

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Summary:

As part of understanding the lithological variations of the exotic alum shales outcropping in the Oslo Rift (Fig. 1), and how these represent different mineralogical, geochemical, and geomechanical properties, it is helpful to know their geographic distribution within the Oslo Rift in map view (2-D) and especially how they vary stratigraphically in vertical (1-D) sections at certain key localities.

In this report we have reviewed the chemical composition of the Cambrian and lower Ordovician sediments of the Rift based on work published 25-50 years ago, mainly the chemical analyses presented in Nyland & Teigland (1984). The lower Cambrian rocks consist of sandstones and shales desposited in an oxic environment, followed by a gradual transition into an anoxic environment and sediments of Upper Cambrian and Lower Ordovician age, with the composition of black shales (Alum shales). Several elements including U, Mo, V, as well as radioactivity show a positive correlation with the carbon content (TOC) in the rocks.

It is our intention that this compilation of geochemical data, can be used as a database for those who need an overview of the chemical composition of the Cambrian and Lower Ordovician sedimentary rocks of the Oslo Rift.

Keywords:		
Alum shale	Cambrian	Ordovician
Oslo Rift	Stratigraphy	

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1. INTRODUCTION

As part of understanding the lithological variations of the exotic alum shales outcropping in the Oslo Rift (Fig. 1), and how these represent different mineralogical, geochemical, and geomechanical properties, it is helpful to know their geographic distribution within the Oslo Rift in map view (2-D) and especially how they vary stratigraphically in vertical (1-D) sections at certain key localities.

In the current report, which is a contribution to a research project named “Black Shale” funded by the Norwegian Research Council, this type of information is synthesized from available research articles, reports, and theses published in English or Norwegian, with emphasis on basic stratigraphic nomenclature and features, as well as measured content of chemical elements as determined by X-ray fluorescence (XRF) (see particularly Bjørlykke 1974 and Nyland & Teigland 1984). The geochemical data that was available to us have compiled and a presentation and discussion of these is given in this report.

The geochemistry of Cambrian and Lower Ordovician sediments elsewhere in Scandinavia have been well investigated. In Sweden the Alum shales have been under detailed exploration for its kerogen and metal content, particularly with respect to Uranium (Gee 1972, Anderson et al. 1983, Andersson et. al 1985).

2. STRATIGRAPHY

The stratigraphy of the Cambro-Silurian sediments of the Oslo Rift has been described by many authors (Skjeseth 1958, Bjørlykke 1974, Owen et al. 1990 and references therein). In this context it will suffice to give a short synthesis of published work which has described the occurrence and characteristics of the alum shales in areas that have been investigated and which relate the geochemical data to geological setting.

The alum shale is found in the lower parts of the Cambro-Silurian stratigraphic sequence of the Oslo Rift, more specifically in from Cambrian and Lower Ordovician, and their litho-stratigraphy can be summarized as follows:

In the northern part of the Oslo Rift, an almost complete stratigraphic sequence of sedimentary rocks exists from Eocambrian to Ordovician age. Immediately above the Eocambrian Sparagmite Formation, which predominantly consisting of arkosic sandstone, there is a basal conglomerate at the base of the Lower Ordovician sedimentary rock sequence. The Lower Cambrian sediments consist of greenschists, partly with sandy layers. Sediments from the Middle-Cambrian consist of shales/slates with occasional conglomeratic and sandy layers. Farther to the south in the Oslo Rift, the Cambro-Silurian sedimentary sequence, including the Middle Cambrian sediments, is located directly upon Precambrian basement rocks.

In the time interval Late-Middle Cambrian to Early Ordovician, dark, fine-grained sediments rich in organic material, were deposited. These are referred to as *alum shales*. Alum shale is an argillaceous, often carbonaceous, rock impregnated with alum, originally containing iron sulphide (pyrite, marcasite) which, when decomposed, formed sulphuric acid that reacted with the aluminous and potassic materials of the rock to produce aluminium sulphates (AGI 1972). Also known as alum schist; alum slate depending on degree of metamorphism. Alum is specifically a mineral with the chemical formula $KAl(SO_4)_2 \cdot 12H_2O$, but is also referred to as a group of minerals containing hydrous aluminium sulphates, including alum, kalinite ($KAl(SO_4)_2 \cdot 11H_2O$), soda alum ($NaAl(SO_4)_2 \cdot 12H_2O$), mendozite ($NaAl(SO_4)_2 \cdot 11H_2O$), and tschermigite (($(NH_4)Al(SO_4)_2 \cdot 12H_2O$ (AGI 1972).

During deposition the environment was typically reducing, with an excess of H_2S and complete decomposition of any organic material (Skjeseth 1958 and Nyland & Teigland 1984). The alum shales have a high content of carbon, with total carbon values (TOC) up to 16-17% (wt). In certain extreme cases values up to 50% (wt) have been found.

The sedimentation during Upper Cambrian times must have been slow and required quiet waters. The sediments consist of black shales with concretions of limestone. There are no fragments of basement rocks included in the clastic fraction of the shales, which indicates that the relief of the surrounding landmasses during formation of these sediments was low. Bjørlykke (1974) estimated the sedimentation rate to be about 1 mm/ky. The deposition of black shales continued into Lower Ordovician times, with a gradually increasing component of gray shales, which indicates an alternation between reducing and oxidizing environmental conditions during sedimentation. Overlying the black shale we find gray shales and limestones: these indicate the end of the deposition of alum shales and the end of sedimentation under reducing and clastically starved environmental conditions in the Oslo Rift (Bjørlykke 1974).

The geographical distribution of the Cambrian and Lower Ordovician black shales in southeastern Norway is shown in Fig. 1 and a lithostratigraphical column with a biostratigraphic division of the black shales including the alum shales is shown in the two diagrams in Fig. 1 (Skjeseth 1958). The sediments deposited under reducing conditions have a maximum thickness of about 150 m (Nyland & Teigland 1984).

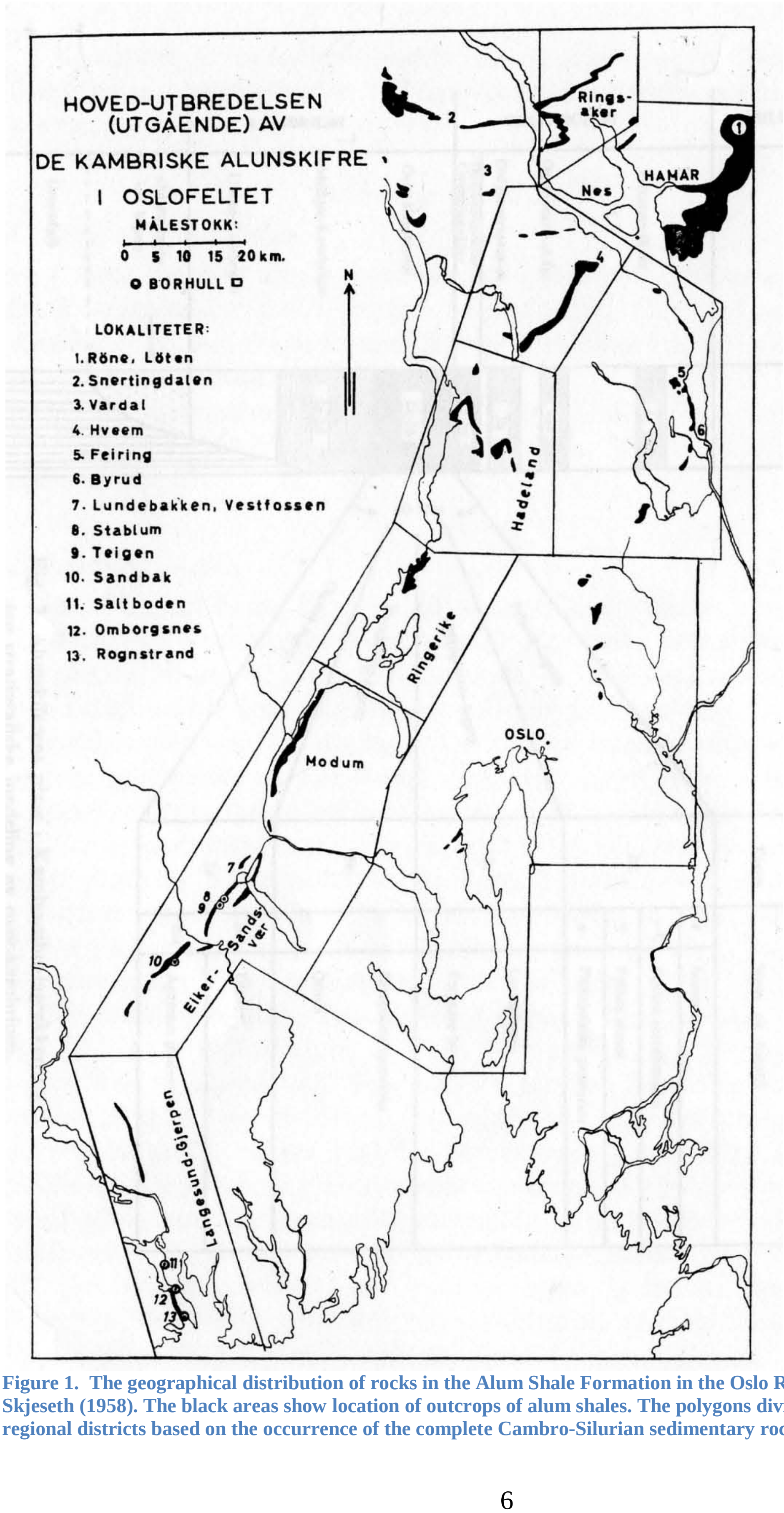

Figure 1. The geographical distribution of rocks in the Alum Shale Formation in the Oslo Rift, modified from Skjeseth (1958). The black areas show location of outcrops of alum shales. The polygons divides the Oslo Rift in regional districts based on the occurrence of the complete Cambro-Silurian sedimentary rocks (Størmer 1953).'

Stratigrafi over Oslofeltets kambro-silur lagrekke og biostratigrafisk inndeling av alunskifer

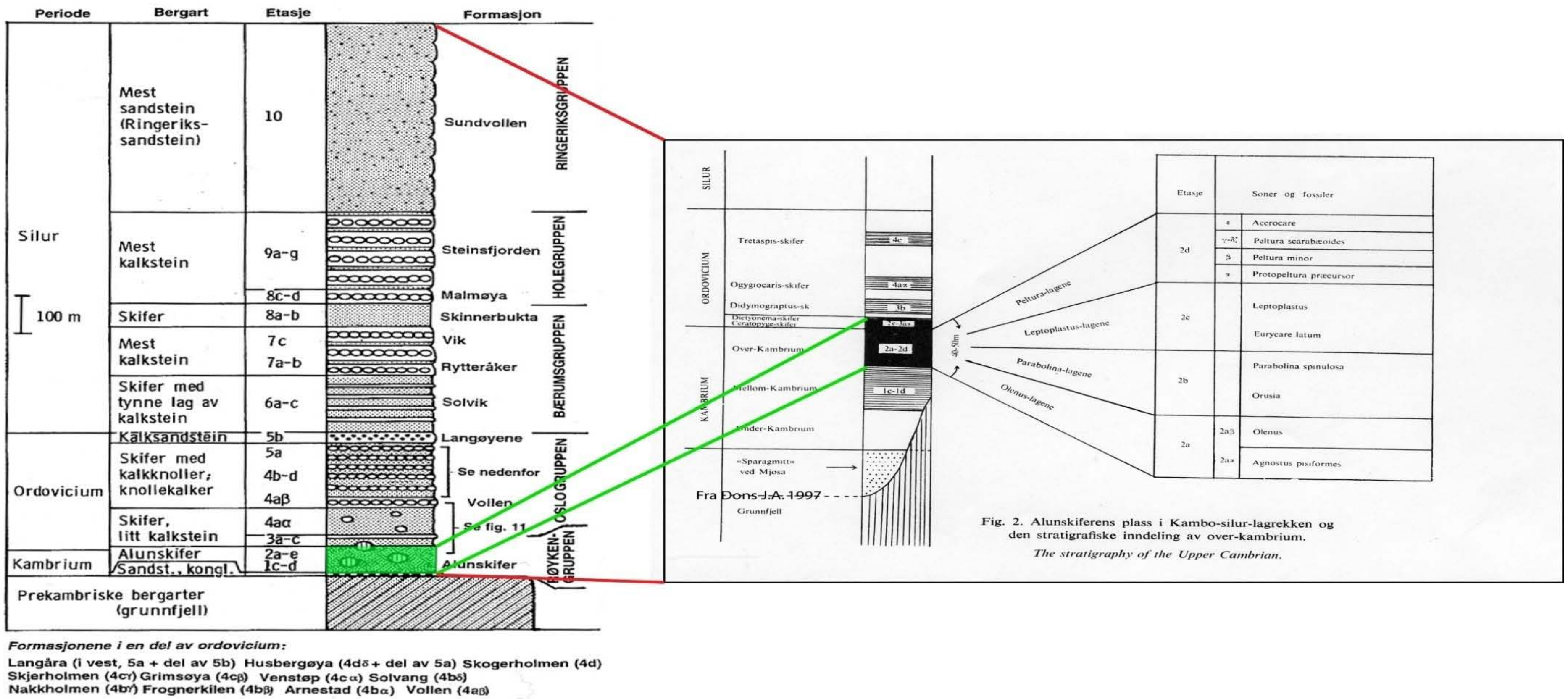

Figure 2. Stratigraphy of the Cambro-Silurian sedimentary sequence of the Oslo region and subdivisions of the Alum Shale Formation (From Skjeseth 1958 and Dons (1994). Left box=Lithostratigraphic column of the Cambrian-Silurian sedimentary rocks of the Oslo Rift. Right box=Column with biostratigraphic division showing sub-units of the Alum Shale Formation

3. OVERVIEW OF REGIONAL GEOCHEMICAL DATA ON THE CAMBRO-SILURIAN ROCKS

Bjørlykke (1974) investigated the whole Cambro-Silurian rock sequence of the Oslo Rift, and attempted to relate the geochemical variations within the shales to sedimentological aspects. Nyland & Teigland (1984) carried out a regional study in which they investigated the relationship between geochemical and sedimentological characteristics in more detail at twenty localities (n= 234 samples) of Cambrian and Lower Ordovician sediments (Fig. 3 and Table 1) by determining the content of major, minor, and trace elements by X-ray fluorescence (XRF). In addition they performed semi-quantative mineralogical analyses using X-ray diffraction (XRD) on samples from most of the localities investigated (see Nyland & Teigland 1984 for details). They also analyzed core samples from three drilled sites, i.e. Stablum gård, Teigen, and Krekling (located between the two former sites in Fig. 3). Thus, their investigation includes the whole Cambrian-Lower Ordovician sedimentary sequence which is considered to constitute the Alum Shale Formation.

In the Oslo area there are a number of boreholes, drilled with the purpose of mapping the temperature gradient and the potential of shallow geothermal energy. One of these drill holes penetrates the alum shales near Slemmestad (Midttømme et al. 2004). Two samples of the alum shales from this drill hole have been split and subjected to chemical analysis, however without any biostratigraphic control. The analyses are presented in Appendix 1.

The work by Nyland & Teigland (1984) is the most comprehensive available regional study of the Cambrian and Lower Silurian sedimentary sequence in the Oslo Rift. In this chapter we have digitized and collated their data and summarized their results with focus on geochemical aspects and less on petrographical and sedimentological results. Twenty localities were investigated by Nyland & Teigland (1984), and the sample material was assigned to three separate *facies*,:

Table 1. Name of sampled localities, their coordinates, stratigraphic position and number of analysis performed on alum shales numbered in accordance with Nyland & Teigland (1984). See Fig. 3 for location.

Name	Loc. #	UTM_X	UTM_Y	Type	Stratigraphy(from- to)	ns
Steinsodden	10	592019	6753575	Profile	L-Cambr.- TopTopDictyonema (2e)	42
Flakstadelva	11	614334	6753422	Profile	L-Cambr.- m-Cambr.	13
Lauselva	12	573778	6733713	Profile	L-Cambr.	27
Ravndalskollen	13	605999	6662412	Profile	M-Cambr.	13
Klekken	14	573031	6670377	Profile	U-Cambr.-TopDictyonema (2e)	10
Slemmestad	15	583859	6628048	Profile	M-Cambr.-TopDictyonema (2e)	11
Nærsnes	16	584671	6625508	Profile	U-Cambr. - TopDictyonema (2e)	12
Nærsnesstrand	21	584261	6625861	Profile	U-Cambr. - TopDictyonema (2e)	5
Krekling	17	543224	6614755	Profile	L-Cambr.	23
Stablum gård	18	542029	6612812	borkjerne	M-Cambr.-TopDictyonema (2e)	16
Teigen	19	541932	6612579	Drill core	M-Cambr.-TopDictyonema (2e)	16
Rognstrand	20	540334	6537969	Drill core	M-Cambr.-TopDictyonema (2e)	17
Bråtad	24	591270	6744264	Profile	M-Cambr.	17
Byrud	25	620869	6700227	Profile	U-Cambr. - TopDictyonema (2e)	2
Ulvåa	22	627323	6764406	Profile	L-Cambr. - TopDictyonema (2e)	2
Røne	23	620342	6730733	Profile	U-Cambr. - TopDictyonema (2e)	
Løven (Vækerø)	26	592421	6642958	Profile	U-Cambr. - TopDictyonema (2e)	2
Sønsteby	28	555036	6643367	Profile	U-Cambr. - TopDictyonema (2e)	2
Sponbekken	29	555593	6645005	Profile	U-Cambr. - TopDictyonema (2e)	1
Rajesetra	30	532268	6600051	Profile	U-Cambr. - TopDictyonema (2e)	3

The **Stratigraphy (from-to)** refers to the stratigraphic interval that is exposed in outcrops at each locality. TopDictyonema (2e) refers to the top surface of Dictyonema schist with the index fossil *Dictyonema flabelliforme*, Lower Ordovician. ns = number of samples

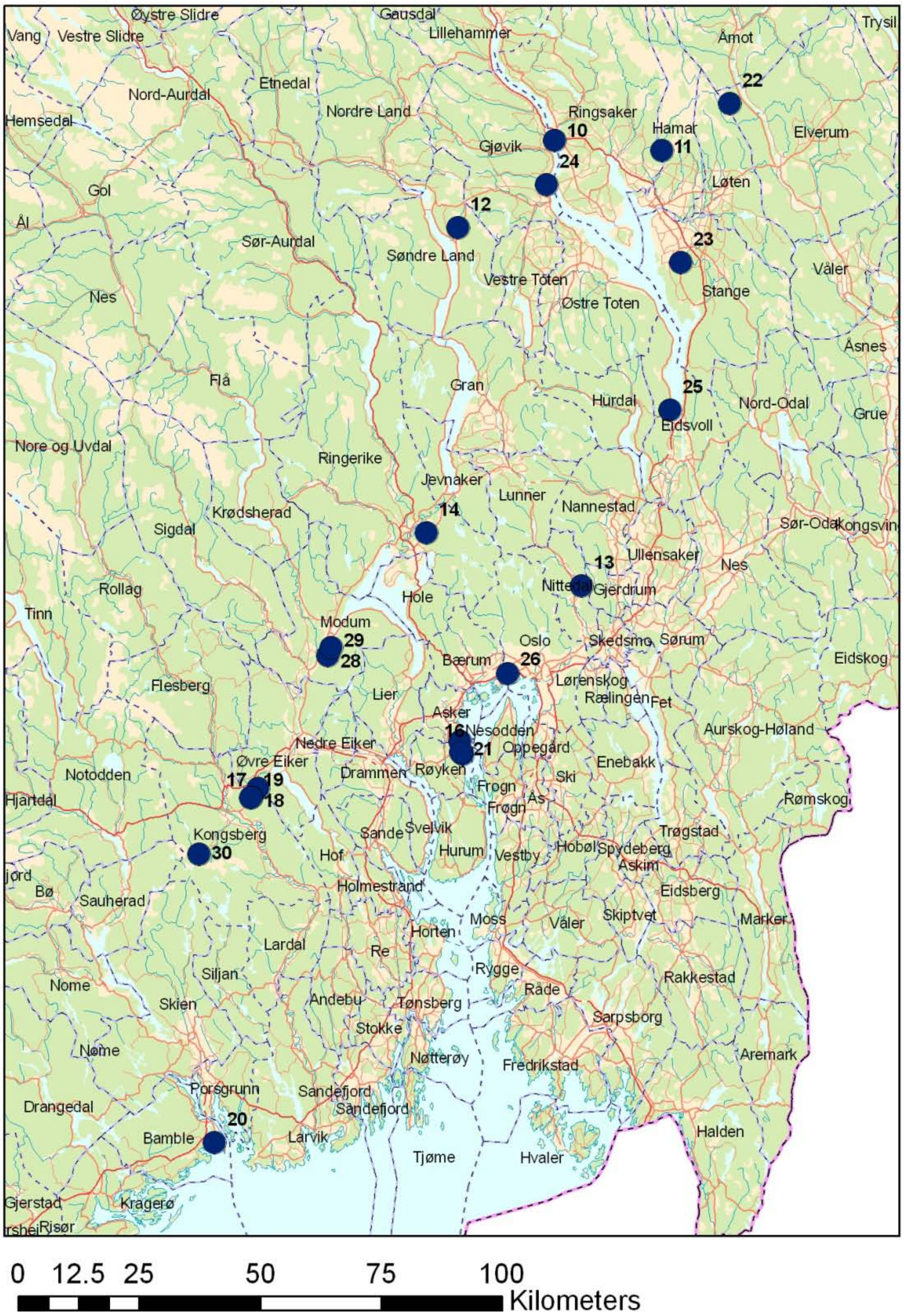

Figure 3. Map showing location of Cambrian and Lower Ordovician rocks, including the Alum Shale Formation, which were used in the study of Nyland & Teigland (1984). See also Table 1.

Facies 1: Includes sedimentary rocks which have been called "Etasje 1a" and "Etasje 1b", i.e. Lower Cambrian sediments, and this facies is only found in the northernmost part of the Oslo Rift. Sediments in this stratigraphic interval are not considered to be black shales or alum shales. The lithology alternates between sandstone and shale.

Facies 2: Sediments of Middle Cambrian to Upper Cambrian age and sediments of "Etasje 2e", i.e. *Dictyonema shale* of Ordovicianage. It is in this stratigraphic sequence that the major part of the alum shales in the Oslo Rift occur.

Facies 3: This facies includes *ceratopyge shale* ("Etasje 3a") and limestone in addition to *Lower Didymograptus shale* ("Etasje 3b"). These are characterized by alternating beds of gray to black shales and limestones. This indicates alternating oxic and anoxic environmental conditions during deposition. Thus, only a part of this facies is classified as alum shales. Nyland & Teigland (1984) carried out, to the extent possible, a detailed log of certain profiles. Through this work, a fairly good control about where to assign the samples in the stratigraphic sequence was gained. We have compiled all the chemical data from Nyland & Teigland (1984) and these are presented in Appendix 2. In Table 2 the results of Nyland & Teigland (1984) are summarized statistically and a short discussion follows with respect to the variation in total organic carbon and each element geographically and in the different depositional environments as this is reflected in the various parts of the stratigraphic column.

The compositional variation with respect to chemistry in the analysed samples can be illustrated in the triangular plot Al_2O_3-SiO_2-CaO (Fig 4). The Lower Cambrian rocks, which vary between sandstone and shale, are scattered along the Al_2O_3-SiO_2-side of the triangle towards the SiO_2 corner, and the rest of the succession plot in the area of black shales (Turgeon and Brumsack 2006), i. e. clustered around 60% towards the Al_2O_3x5-corner along the Al_2O_3-SiO_2-side of the triangle.

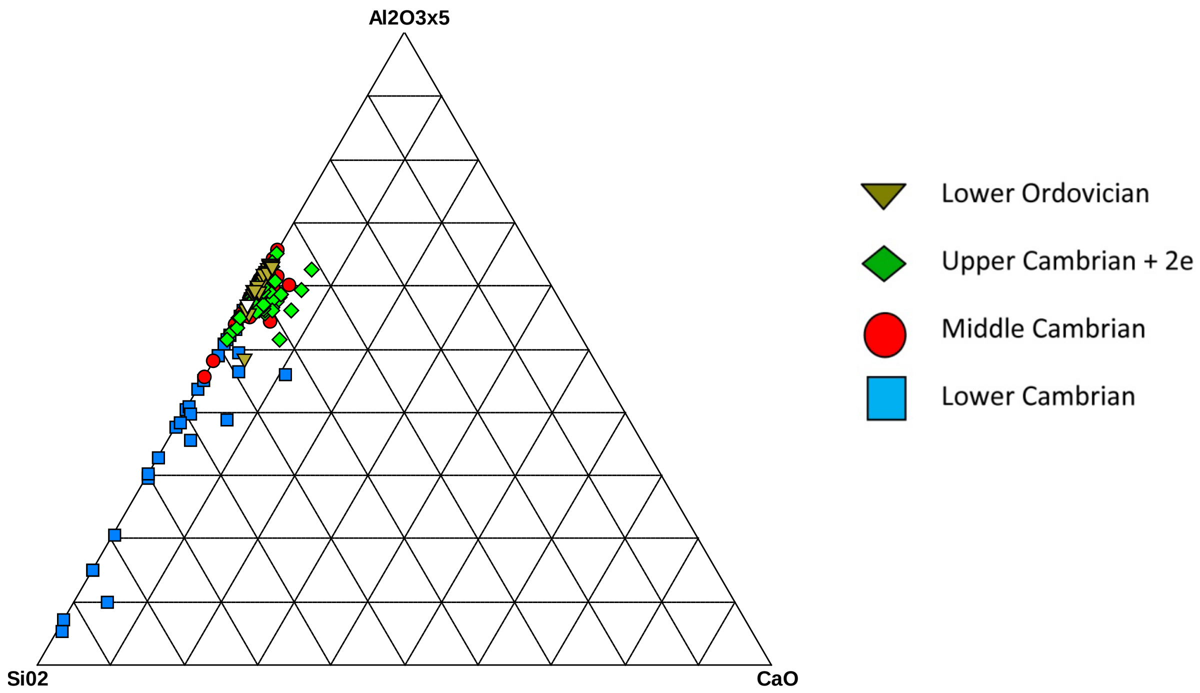

Figure 4. Al_2O_3-SiO_2-CaO triangular plot showing the compositional variation of analyzed samples.

Table 2 Summary of geochemical variation of the lower Cambro-Silurian sequence of the Oslo Rift based on data from Nyland and Teigland (1984)

All samples (n= 235											
Sample	**SiO2**	**Fe2O3**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**P2O5**	**LOI**
Average	58.40	0.91	15.76	4.98	0.03	1.35	1.05	0.52	4.71	0.14	10.52
Max	91.20	1.26	21.08	26.17	0.44	4.42	16.96	2.62	9.76	1.79	28.03
Min	36.32	0.04	0.64	0.33	0.00	0.00	0.00	0.00	0.03	0.00	0.54
Stdv.	7.64	0.19	3.43	3.40	0.06	0.54	2.17	0.41	1.54	0.16	5.63
Median	58.13	0.91	16.13	4.56	0.01	1.29	0.20	0.47	4.92	0.11	9.73
	TOC	**Ba**	**V**	**Ni**	**Cr**	**Zn**	**Cu**	**Mo**	**U**	**Th**	**cps**
Average	5.05	1559	795	119	198	115	84	120	29	11	769
Max	15.52	42750	5088	570	650	999	833	425	126	20	1970
Min	0.00	0	35	25	75	10	10	0	2	4	210
Stdv.	4.15	4605	766	87	85	150	97	114	24	4	489
Median	4.61	617	638	95	180	66	53	75	23	9	708
All Shales (n= 197)											
	SiO2	**Fe2O3**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**P2O5**	**LOI**
Average	56.60	0.94	16.37	4.90	0.01	1.33	1.06	0.58	4.97	0.14	11.73
Max	77.64	1.26	21.08	26.17	0.25	4.04	16.96	2.62	9.76	0.96	28.03
Min	36.32	0.19	1.28	0.33	0.00	0.00	0.00	0.00	0.03	0.00	2.32
Stdv.	5.54	0.15	2.56	3.60	0.03	0.48	2.13	0.41	1.39	0.13	5.17
Median	57.10	0.92	16.40	4.08	0.01	1.28	0.23	0.54	5.06	0.11	10.65

	TOC	Ba	V	Ni	Cr	Zn	Cu	Mo	U	Th	cps
Average	6.05	1823	934	131	203	114	95	141	33	11	867
Max	15.52	42750	5088	570	650	999	833	425	126	20	1970
Min	0.00	0	50	30	95	12	10	3	4	4	210
Stdv.	3.85	5031	775	90	91	150	102	114	24	4	479
Median	5.42	665	765	100	185	62	61	104	33	9	910
Lower Cambrian (n=42)											
	SiO2	**Fe2O3**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**P2O5**	**LOI**
Average	67.96	0.73	12.62	5.67	0.10	1.36	0.92	0.20	3.38	0.15	3.94
Max	91.20	1.21	19.77	20.15	0.44	4.42	11.80	0.93	5.75	1.79	17.02
Min	46.86	0.04	0.64	0.94	0.00	0.13	0.00	0.00	0.04	0.02	0.54
Stdv.	9.55	0.28	5.25	2.94	0.11	0.77	2.28	0.19	1.55	0.26	2.59
Median	65.39	0.79	14.00	5.40	0.06	1.41	0.14	0.19	3.75	0.10	3.63
	TOC	**Ba**	**V**	**Ni**	**Cr**	**Zn**	**Cu**	**Mo**	**U**	**Th**	**cps**
Average	0.15	331	143	58	182	113	36	14	4	10	278
Max	1.19	795	245	105	460	750	182	48	15	14	300
Min	0.00	25	35	25	75	10	10	0	2	6	250
Stdv	0.21	182	49	20	63	141	33	12	4	2	19
Median	0.10	275	145	60	175	73	26	15	3	9	280
Middle Cambrian (n=48)											
	SiO2	**Fe2O3**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**P2O5**	**LOI**
Average	58.40	1.04	17.39	5.22	0.02	1.48	0.95	0.46	4.97	0.13	8.83
Max	71.15	1.26	20.45	13.03	0.25	2.75	16.96	2.05	9.17	0.96	28.03
Min	45.14	0.58	1.28	0.93	0.00	0.28	0.00	0.00	0.26	0.00	2.74
Stdv.	4.43	0.14	2.85	2.91	0.04	0.41	2.55	0.38	1.35	0.13	3.63
Median	59.50	1.07	18.23	4.87	0.01	1.44	0.10	0.34	5.13	0.11	8.65
	TOC	**Ba**	**V**	**Ni**	**Cr**	**Zn**	**Cu**	**Mo**	**U**	**Th**	**cps**
Average	3.66	674	590	95	193	129	75	67	14	16	320
Max	12.40	6750	1475	260	387	999	320	313	19	18	390
Min	0.10	45	50	35	95	12	10	10	9	13	270
Stdv.	2.11	891	274	45	69	158	58	58	4	2	56
Median	3.76	520	545	85	190	70	59	50	15	15	290
Upper Cambrian +2e (n= 107)											
	SiO2	**Fe2O3**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**P2O5**	**LOI**
Average	54.26	0.88	15.58	4.71	0.01	1.25	1.24	0.66	4.95	0.14	14.85
Max	66.17	1.13	20.11	26.17	0.10	4.04	11.05	2.62	9.76	0.83	23.13
Min	36.3	0.65	9.98	0.33	0	0	0	0.02	0	0.02	5.09
Stdv.	4.95	0.09	1.70	3.94	0.02	0.53	2.10	0.45	1.49	0.13	4.16
Median	54.18	0.87	15.61	3.38	0.00	1.12	0.32	0.56	4.90	0.10	15.38
	TOC	**Ba**	**V**	**Ni**	**Cr**	**Zn**	**Cu**	**Mo**	**U**	**Th**	**cps**
Average	8.93	2655	1151	154	212	85	113	209	40	9	1114
Max	15.52	42750	4150	565	650	652	833	425	126	18	1970
Min	3.42	0	258	45	95	21	20	20	4	4	470
Stdv.	2.66	6753	755	94	105	107	128	104	24	3	367
Median	8.85	800	908	115	190	46	70	210	38	8	1040
Lower Ordovician (n= 21)											
	SiO2	**Fe2O3**	**Al2O3**	**Fe2O3**	**MnO**	**MgO**	**CaO**	**Na2O**	**K2O**	**P2O5**	**LOI**
Average	59.92	1.01	18.12	4.34	0.02	1.39	0.66	0.55	5.45	0.20	6.89

Max	65.34	1.15	21.08	10.55	0.11	1.80	5.65	1.08	6.45	0.56	13.99
Min	52.97	0.75	12.98	1.08	0.00	1.02	0.00	0.10	4.12	0.03	3.52
Stdv.	3.17	0.10	2.00	2.57	0.03	0.21	1.18	0.25	0.57	0.13	2.44
Median	60.22	1.03	18.34	4.04	0.01	1.37	0.38	0.59	5.51	0.19	6.62
	TOC	**Ba**	**V**	**Ni**	**Cr**	**Zn**	**Cu**	**Mo**	**U**	**Th**	**cps**
Average	2.07	1226	929	137	173	166	79	88	14	15	389
Max	8.21	2725	5088	570	288	720	207	325	35	20	860
Min	0.00	270	80	60	103	34	16	13	5	12	210
Stdv	2.06	821	1192	130	48	203	63	90	11	2	243
Median	1.56	890	450	90	168	94	52	63	9	15	285

Total organic carbon (TOC)
It is obvious that the samples with the highest levels of TOC, - average of 5.05 % (wt) and median 4.05 % (wt), are found in the Cambrian and Lower Ordovician sediments. The TOC is twice that found in samples from older or younger Cambro-Silurian sediments. However, there is large variation among rocks from the different parts of the stratigraphic section. Figure 4 shows TOC versus cps (counts per second) and can be used as an example of the stratigraphical variation of TOC, with a clear positive correlation with radioactivity (Fig. 5).

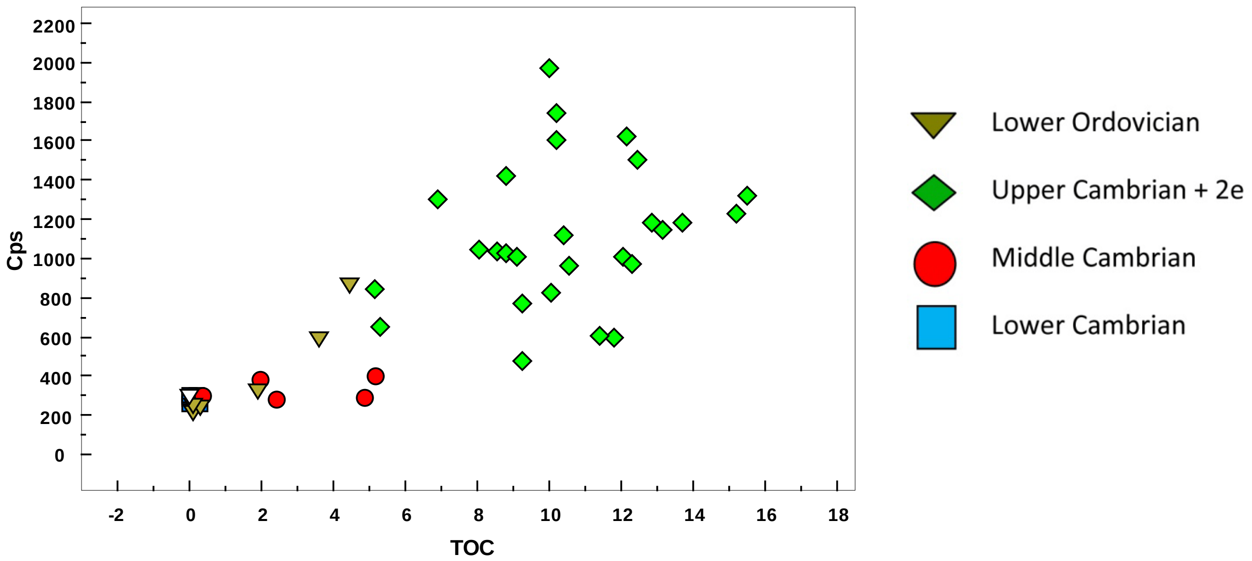

Figure 5. Total organic carbon (TOC) versus radioactivity (in counts per second or becquerel (cps=Bq).

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Barium (Ba)

Barium shows large stratigraphic and regional variations, and seems to increase upwards in the sediment sequence with several samples containing up to 42,750 mg/kg Ba. This could indicate gradually deeper water (Lepland et al. 2000).

Nickel (Ni)
Nickel is expected to occur mainly in sulfide minerals, predominantly pyrite (Fe_2S) with traces of Ni. These seem to be enriched in reducing environments in which they have precipitated from a supersaturated aqueous solution. The average value is 119 mg/kg and the highest values are found in samples from the Upper Cambrian and Lower Ordovician (565 and 570 mg/kg), i.e. the Alum Shale Formation (Facies 2).

Chromium (Cr)
Chromium is expected to be found mainly in clastic grains of heavy minerals (sp. g. > 2.85 g/cm^3). The average concentration level is 198 mg/kg, with the highest values (650 mg/kg) in samples from the Upper Cambrian.

Vanadium (V)
Vanadium is usually incorporated in the crystal structure of clay minerals and/or is sorbed in the iron-/manganese oxide coatings on other minerals. Vanadium in black shales is assumed to be enriched in the organic fraction (Bjørlykke 1974). It is anticipated that a rock with high TOC has a co-varying high concentration of V. The average content of V is 934 mg/kg, and as expected, the highest values (5088 mg/kg) are detected in samples from the Upper Cambrian and Lower Ordovician, i.e. Alum Shale Formation (Facies 2). There is a weak correlation with TOC, with considerable scatter (Fig. 6). V show no correlation with Cr but a positive correlation with Ni (Fig. 7) with a considerable scatter

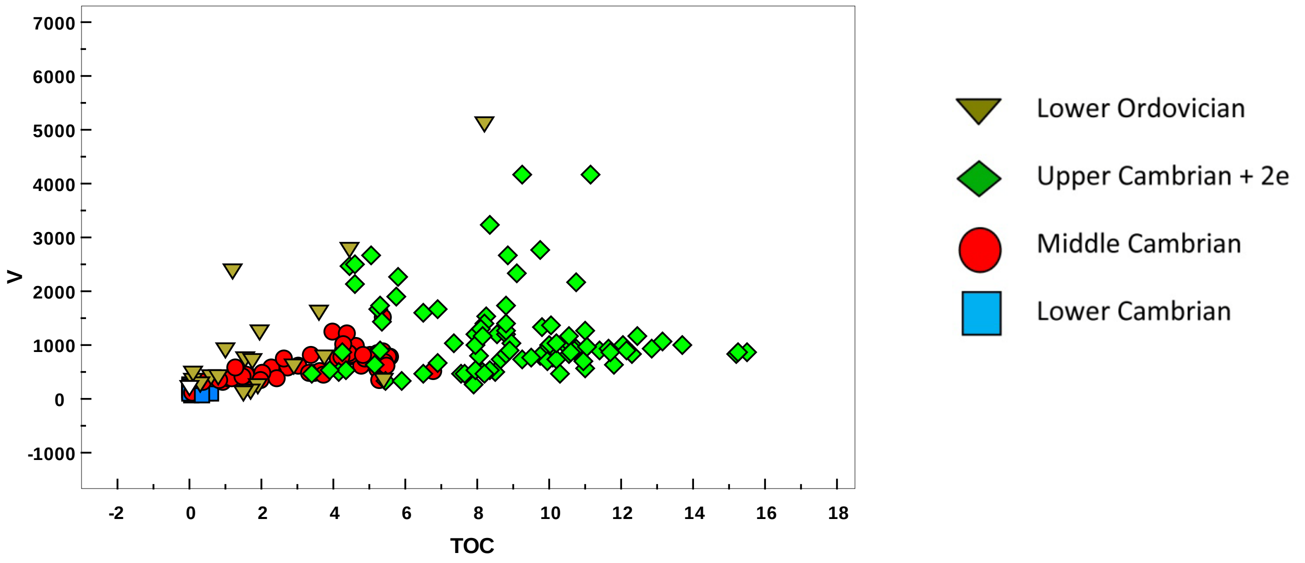

Figure 6. V versus TOC, showing a weak positive correlation with considerable scatter, especially in Upper Cambrian and Lower Ordovician rocks.

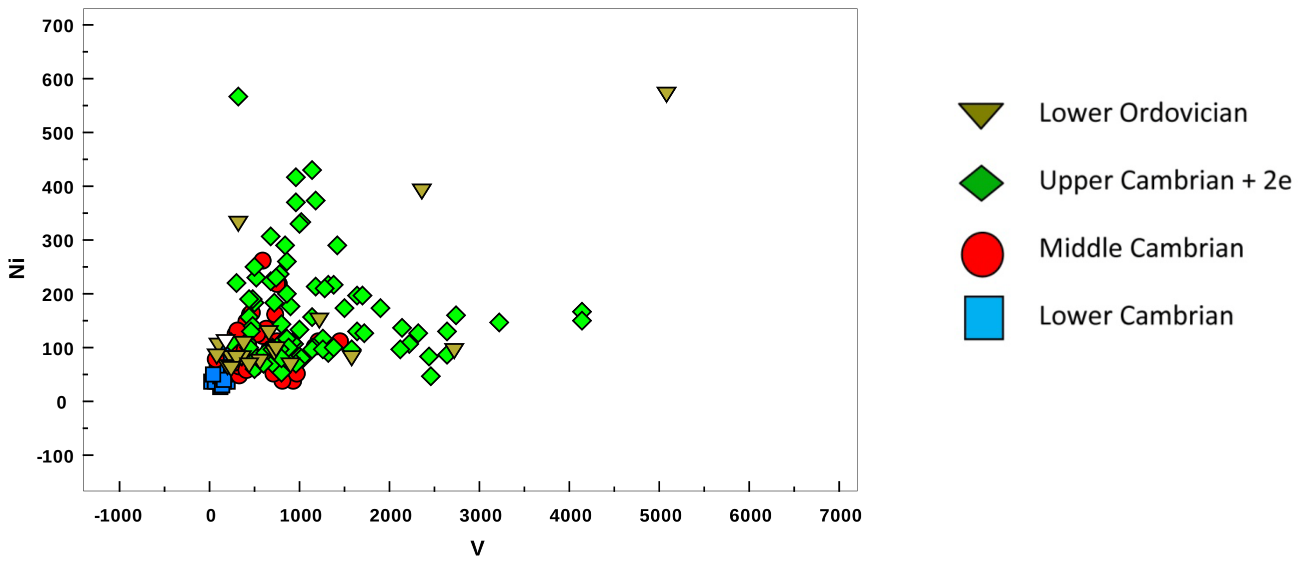

Figure 7 V versus Ni, a positve correlation with a considerable scatter

Copper (Cu)
Copper is found in sulfides, sorbed on clay minerals and in organic material. In general, the concentration of Cu increases upwards in the sedimentary rock sequence. Nyland & Teigland (1984) found an average content of Cu at 84 mg/kg, with the highest concentration (833 mg/kg) in a sample from the Upper Cambrian, i.e. Alum Shale Formation (Facies 2).

Molybdenum (Mo)
Molybdenum will presumably be enriched in sediments deposited in a reducing environment and should consequently be positively correlated with TOC (Fig. 8). The average concentration of Mo is 67 mg/kg and the maximum value at 425 mg/kg is, as anticipated, detected in a sample from the Upper Cambrian, i.e. Alum Shale Formation (Facies 2)..

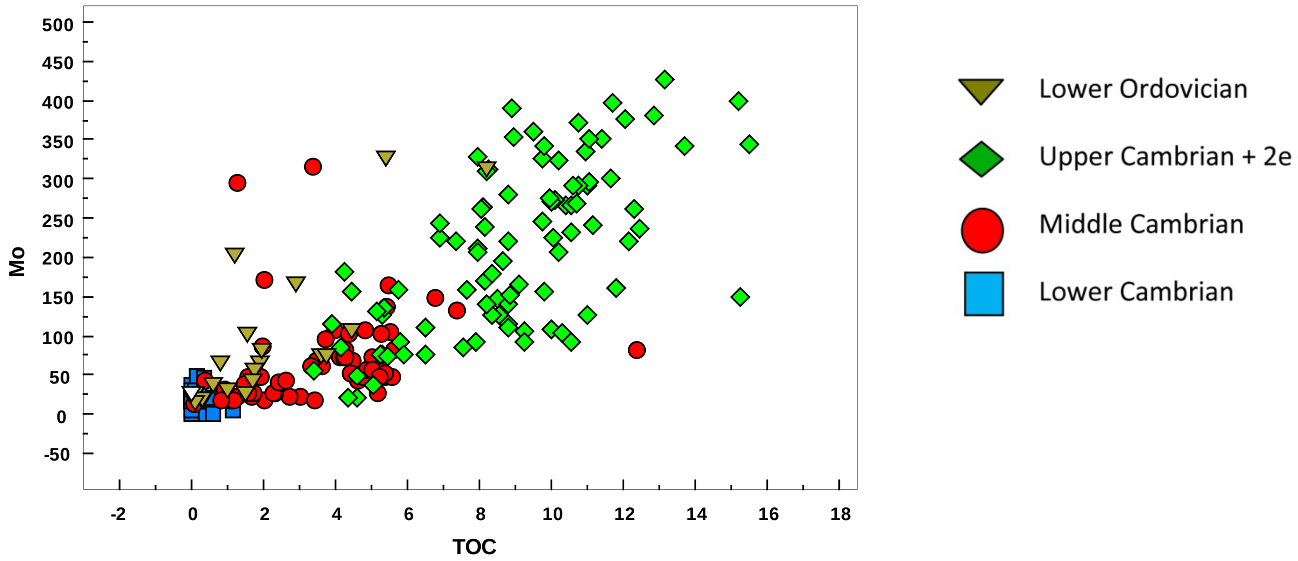

Figure 8. TOC versus Mo showing a positive correlation with much scatter in Middle and Upper Cambrian and Lower Ordovician rocks.

Zink (Zn)
Zink has, according to Bjørlykke (1974), not the same behavior as Cu, since Cu-sulfide is much less soluble and thus precipitates before Zn-sulfides. The results of Nyland & Teigland (1984) show an average of 129 mg/kg and a maximum value of 999 mg/kg in samples from the Middle Cambrian. In the Alum Shale Formation (Facies 2) the average and maximum concentrations of Zn were 85 and 652 mg/kg, respectively.

Uranium (U) and Thorium (Th)
Uranium and thorium were analyzed by Nyland & Teigland (1974) in a subset of samples (see Appendix 2). Uranium is expected to show a large variation which will be related to the variation in Eh and pH. Four-valent uranium (U^{4+}) will be stable in a reducing aqueous environment in which it is expected to be sorbed on organic material (Garrels & Christ 1965). It follows from this that the highest concentration of U is found in the Upper Cambrian, i.e. Alum Shale Formation (Facies 2), with a maximum value of 126 mg/kg. The average U concentration in the remaining samples is 29 mg/kg. See also Andersson et al (1985).

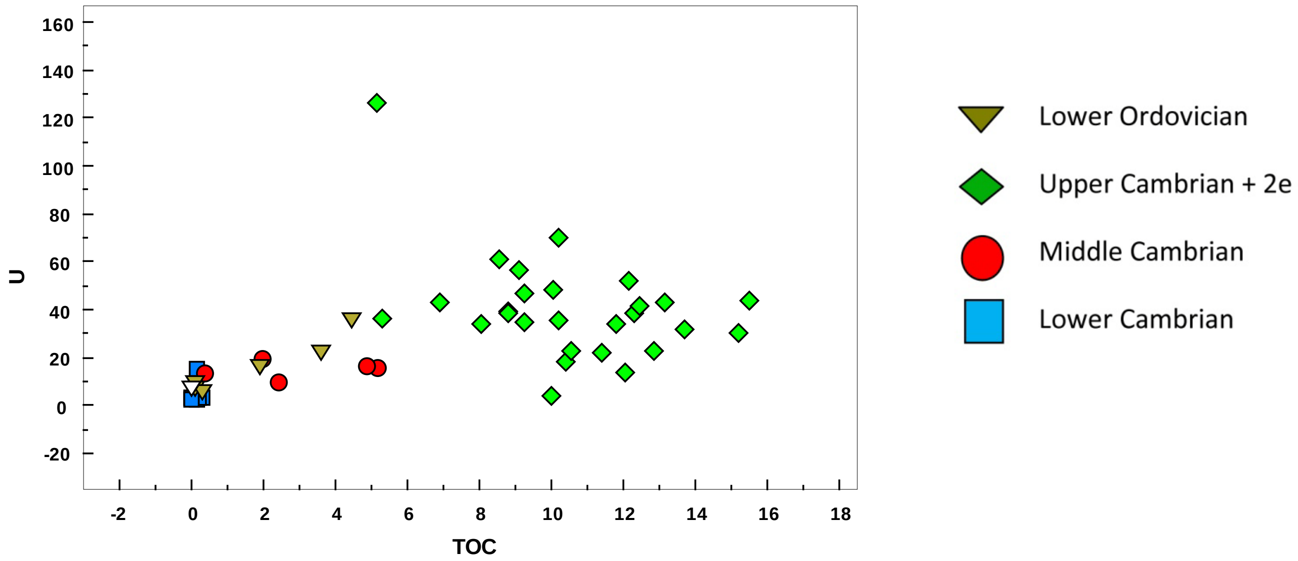

Figure 9. TOC versus U. The carbon rich samples show the highest concentrations.

4. SUMMARY AND CONCLUSIONS

In this report we have reviewed the chemical composition of the Cambrian and Lower Ordovician sediments of the Oslo Rift based on work published 25-50 years ago, mainly the chemical analyses presented in Nyland & Teigland (1984). The lower Cambrian rocks consist of sandstones and shales desposited in an oxic environment, which is followed by a gradual transition into an anoxic environment and sediments of Upper Cambrian and Lower Ordovician have the composition of black shales (alum shales). Several elements including U, Mo, V, as well as radioactivity show a positive correlation with the carbon content (TOC) in the rocks.

It is our intention that this compilation of data, can be used as a database for those who need an overview of the chemical composition of the Cambrian and Lower Ordovician sedimentary rocks of the Oslo Rift.

5. REFERENCES

AGI 1972. Glossary of Geology American Geological Institute, 805 p.

Andersson A,Dahlman B., Gee D.G., Snäll S. 1985: The Scandinavian Alum shales. Svergies Geologiska Undersøking. Ser Ca 56.

Andersson A., Dahlman B., Gee. D.G. 1983: Kerogen and uranium resources in the Cambrian alum shales of the Billingen Falbygden and Näkre areas, Sweden Geolgiska Föreningens Förhandlingar, 104, 197-209.

Bjørlykke, K. 1974. Depositional history and geochemical composition of Lower Paleozoic Epicontinental sediments from the Oslo region. NGU Bulletin 305, 76 p.

Dons J. A. 1997.Oslo-traktens geologi med 25 turbeskrivelser. Vett &Viten, 207 p.
Garrels, R. M. & Christ, C. L. 1965. Solutions, Minerals, and Equilibria. Freeman, Cooper & Co., 450 p.

Gee D.G. 1972: The regional geological context of the Tåsjø Uranium Project, Caledonian Front, Central Sweden. Sveriges Geologiska Undersøking Ser C Nr. 671

Midtømme K., Ramstad R.K., Sollie A., Sørdal T. and Elvebakk H. 2003. Grunnvarme kartlegging i Asker og Bærum. NGU Report 2004.013, 44 p.

Nyland B. & Teigland J. 1984: Sedimentologisk og geokjemisk undersøkelse av de kambriske og underordoviciske marine sedimenter i Oslofeltet. Thesis for cand. real. Geologisk institutt, Universitetet i Oslo, 196 p.

Owen A.W., Bruton D.L., Bockelie J.F., Bockelie T.G. 1990. The Ordovician succession of the Oslo region. NGU Special Publication 4, 54 p.

Skjeseth, S. 1958. Uran i kambrisk alunskifer i Oslofeltet og tilgrensende områder, NGU bulletin. 203, p. 100-111.

Størmer, L. 1953. The Middle Ordovician of the Oslo Region, Norway. No. 1. Introduction to stratigraphy. Norsk Geologisk Tidsskrift 31, p. 37-141.
Turgeon, S. and Brumsack, H.-J. 2006. Anoxic vs dysoxic events reflected in sediment geochemistry during the Cenomanian-Turonian Boundary Event (Cretaceous) in the Umbria-Marche Basin of central Italy. Chemical Geology 234, p. 321-339.

Appendix 1. Chemical analysis of two samples which were split into and A- and B-sample from the Alum Shale Formation in the Arnstad (Slemmestad) drill hole (Midttømme et al. 2004).

Sample	034106A	034106B	034107A	034107B
depth	348	348	408	408
SiO2	52.40	52.53	47.45	44.84
Al2O3	15.13	15.18	14.59	13.92
Fe2O3	6.12	6.68	8.57	7.76
TiO2	0.81	0.81	0.77	0.72
MgO	1.27	1.27	1.34	1.52
CaO	1.04	1.55	4.01	7.14
Na2O	0.80	0.83	0.68	0.64
K2O	5.17	5.10	4.22	3.95
MnO	0.01	0.01	0.03	0.06
P2O5	0.18	0.18	0.16	0.15
Gl.tap	15.19	15.38	17.27	16.94
SUM	98.12	99.52	99.10	97.65
Mo	218	218	203	184
Nb	17	17	17	15
Zr	154	151	148	133
Y	58	57	45	46
Sr	159	158	207	342
Rb	147	142	129	125
U	119	118	118	101
Th	15	14	15	11
Pb	31	30	28	24
Cr	93	93	89	86
V	1138	1101	880	777
As	74	78	88	78
Sc	13	14	17	20
Hf	<10	<10	<10	<10
S	2.55	2.80	4.29	3.55
Cl	<0.1	<0.1	<0.1	<0.1
F	<0.1	<0.1	<0.1	0.14

Appendix 2 The complete data set from (Nyland & Teigland 1984). Available from the authors in excel format up on request

Sample	Locality name	Loc no.	Area	Age	Lithology	UTM_X	UTM_Y	Si02	Ti02	Al203	Fe203	MnO	MgO	CaO	Na20	K20	P2O5	LOI	SUM	Ba	V	Ni	Cr	Zn	Cu	Mo	TOC	U	Th	Th/U	K2O	Cps
121405	Lauselva	12	Snertingdal-Toten	L-Cambr.	Limestone	573778	6733713	46.86	0.58	9.96	6.29	0.31	4.42	11.8	0.07	2.68	0.08	17.02	100.07	700	140	60	175	33	25	0	0.17					
121104	Lauselva	12	Snertingdal-Toten	L-Cambr.	Conglomerate	573778	6733713	65.1	0.46	9.21	4.05	0.14	1.44	7.57	0.21	2.33	1.79	7.73	100.03	150	85	35	140	20	24	0	0.25					
112209	Flagstadelva	11	Hamar-Nes	U-Cambr.	Sand/silt	614334	6753422	59.37	0.79	14.97	7.52	0.15	2.21	2.01	0.39	4.29	0.07	6.39	98.16	380	95	75	150	54	23	10	0.10					
101201	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	91.2	0.5	3.22	2.11	0	0.2	0.04	0	0.65	0.07	1.04	99.03	230	70	40	165	17	13	0	0.34	2.7	9.3	3.44	0.65	250
101203	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	88.49	0.45	3.14	4.34	0.33	0.35	0.02	0	0.61	0.08	1.52	99.33	165	75	35	250	26	13	15	0.26					
101204	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	71.46	0.59	13.76	5.53	0.16	0.95	0.07	0	3.75	0.07	3.46	99.8	425	150	60	175	750	12	35	0.04					
101205	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	77.42	0.65	10.49	4.51	0.1	0.69	0.03	0	2.78	0.06	2.61	99.34	255	115	65	165	55	22	30	0.19	2.3	8.8	3.83	2.78	270
101206	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	67.04	0.94	16.55	4.99	0.01	1.17	0.09	0.12	4.68	0.07	3.67	99.33	375	125	80	185	52	17	25	0.14					
101207	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	83.68	0.54	7.24	3.83	0.06	0.57	0.06	0	1.77	0.06	1.8	99.61	245	80	60	180	24	19	15	0.01					
101208	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	73.65	0.81	11.39	5.19	0.08	1.07	0.11	0.09	3.02	0.08	2.68	98.17	360	110	75	190	116	28	0	0.00	2.8	10	3.57	3.02	280
101209	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	68.89	0.91	14.66	4.96	0.01	1.19	0.05	0.02	4.12	0.07	3.37	98.25	450	145	80	180	159	30	15	0.05					
101210	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	80.17	0.55	7.83	5.01	0.15	0.77	0.08	0.14	1.67	0.09	2.65	99.11	265	95	70	175	223	19	20	0.45					
101211	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	75.12	0.69	10.44	5.38	0.08	1.12	0.12	0.62	2.47	0.1	2.68	98.82	290	115	70	205	130	137	15	0.19	2.2	9.1	4.14	2.47	265
101212	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	61.08	1.13	18.04	6.49	0.04	1.83	0.14	0.23	4.97	0.1	4.32	98.37	590	200	105	220	76	23	30	0.00					
101313	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	67.71	0.79	14	6.32	0.05	1.56	0.03	0.11	3.67	0.1	3.41	97.75	345	145	80	205	72	31	20	0.18					
101214	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	85.19	0.34	4.42	3.17	0.22	0.6	0.28	0.21	0.9	0.13	2.39	97.85	200	85	55	215	256	34	0	0.62					
101215	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	72.28	0.74	11.83	6.92	0.15	1.48	0.16	0.4	2.61	0.12	3.14	99.83	500	130	45	230	94	26	20	0.15					
101216	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	63.23	1.03	17.41	6.72	0.03	1.76	0.04	0.22	4.63	0.11	4.42	99.6	185	215	35	210	93	36	25	0.20	3.2	13.5	4.22	4.63	300
101217	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	61.05	1	17.6	7.17	0.06	2.03	0.11	0.28	4.75	0.09	3.92	98.06	290	235	60	220	117	35	20	0.01					
101218	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	72.21	0.67	9.65	6.32	0.22	1.41	1.21	0.6	2.03	0.11	3.59	98.02	265	145	30	220	104	62	15	0.00	2.1	8.3	3.95	2.03	255
101219	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	61.76	0.95	17.05	8.04	0.32	1.95	0.22	0.28	4.48	0.16	4.19	99.4	310	245	50	240	103	26	20	0.00					
101220	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	61.41	1.01	18.64	6.74	0.03	2.2	1.19	0.21	5.04	0.1	4.02	100.59	270	200	60	225	296	37	25	0.00					
101221	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	67.19	0.86	14.75	6.28	0.07	1.78	0.19	0.24	3.78	0.11	3.37	98.62	200	140	45	205	573	51	25	0.00	2.8	12	4.29	3.78	290
101222	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	60.24	1	18.21	7.06	0.03	2.13	0.07	0.26	4.75	0.11	4.17	98.03	335	185	55	220	236	34	30	0.10					
101223	Steinsodden	10	Ringsaker	L-Cambr.	Sand/silt	592019	6753575	58.16	0.93	17.98	9.26	0.02	2.28	0.15	0.18	4.84	0.07	4.43	98.3	265	205	50	255	142	25	5	0.00	2.1	12.1	5.76	4.84	300
111202	Flagstadelva	11	Hamar-Nes	L-Cambr.	Sand/silt	614334	6753422	56.89	0.08	0.89	0.94	0.02	0.13	0	0	0.16	0.02	0.54	59.67	25	85	35	140	10	25	10	0.05					
111203	Flagstadelva	11	Hamar-Nes	L-Cambr.	Sand/silt	614334	6753422	58.54	1.09	18.91	8.95	0.44	1.6	0.05	0.19	5.16	0.12	4.61	99.66	795	195	85	165	84	17	15	0.09					
111204	Flagstadelva	11	Hamar-Nes	L-Cambr.	Sand/silt	614334	6753422	55.82	0.04	0.64	2.26	0.31	0.18	0.42	0	0.04	0.18	0.81	60.7	55	35	35	125	13	10	15	0.09					
111205	Flagstadelva	11	Hamar-Nes	L-Cambr.	Sand/silt	614334	6753422	64.34	1.21	17.34	5.4	0.05	1.69	0.24	0	5.04	0.2	3.67	99.18	175	210	80	115	66	31	10	0.07					
111206	Flagstadelva	11	Hamar-Nes	L-Cambr.	Sand/silt	614334	6753422	60.2	0.9	18.01	7.21	0.06	1.89	0.1	0.29	5.27	0.07	4.06	98.06	375	170	80	145	90	21	0	0.08					
111207	Flagstadelva	11	Hamar-Nes	L-Cambr.	Sand/silt	614334	6753422	65.4	0.85	16.13	5.93	0.06	1.56	0.22	0.25	4.68	0.15	3.63	98.86	245	155	75	120	73	23	0	0.07					
111208	Flagstadelva	11	Hamar-Nes	L-Cambr.	Sand/silt	614334	6753422	65.39	0.86	14.96	5.37	0.06	1.68	0.8	0.29	4.34	0.13	4.1	97.98	325	110	70	115	57	14	20	0.00					
121202	Lauselva	12	Snertingdal-Toten	L-Cambr.	Sand/silt	573778	6733713	73.16	0.64	14.05	2.06	0.01	1.02	0.25	0.17	3.8	0.12	3.08	98.36	190	170	35	75	22	21	0	0.12					
121203	Lauselva	12	Snertingdal-Toten	L-Cambr.	Sand/silt	573778	6733713	84.08	0.36	7.11	1.62	0.02	0.41	0.36	0.22	1.89	0.2	1.81	98.08	265	130	25	85	14	17	0	0.16					
121206	Lauselva	12	Snertingdal-Toten	L-Cambr.	Sand/silt	573778	6733713	64.19	0.71	13.27	4.32	0.1	1.96	3.69	0.15	3.5	0.15	7.04	99.08	275	145	60	125	35	27	5	0.19					
121207	Lauselva	12	Snertingdal-Toten	L-Cambr.	Sand/silt	573778	6733713	63.37	0.71	11.9	4.73	0.14	2.11	5.26	0.11	3.19	0.08	8.45	100.05	150	135	65	140	51	35	0	0.26					
121208	Lauselva	12	Snertingdal-Toten	L-Cambr.	Sand/silt	573778	6733713	64.86	0.93	16.56	6	0.01	1.02	0	0.09	4.53	0.2	4.09	98.29	695	175	65	150	66	32	0	0.13					
102325	Steinsodden	10	Ringsaker	U-Cambr.	Schist	592019	6753575	61.19	1.06	17.83	2.91	0	1.31	0.27	0.59	5.37	0.12	6.71	97.36					30	43	15	3.47					
102326	Steinsodden	10	Ringsaker	U-Cambr.	Schist	592019	6753575	67.23	0.7	12.43	2.47	0	0.59	0.2	0.79	5.19	0.1	9.78	99.48					16	14	80	5.67					
102327	Steinsodden	10	Ringsaker	U-Cambr.	Schist	592019	6753575	61.55	0.82	14.39	1.85	0	0.72	0.16	0.52	5.82	0.06	12.07	97.96					12	25	130	7.40					
102328	Steinsodden	10	Ringsaker	U-Cambr.	Schist	592019	6753575	55.25	1.05	16.85	1.69	0	1.17	0.06	0.38	5.15	0.04	17	98.64					19	22	80	12.40					
112410	Flagstadelva	11	Hamar-Nes	U-Cambr.	Schist	614334	6753422	55.27	0.58	1.28	7.45	0.25	0.28	16.96	0	0.26	0.96	7.22	90.51	45	50	50	120	64	80	45	0.38					
112311	Flagstadelva	11	Hamar-Nes	U-Cambr.	Schist	614334	6753422	59.85	0.92	17.83	6.18	0.01	1.46	0	0.14	5.03	0.06	7.18	98.66	220	330	85	125	98	45	45	1.99					
112312	Flagstadelva	11	Hamar-Nes	U-Cambr.	Schist	614334	6753422	59.36	1.01	17.12	6.92	0.03	1.78	0.16	0.4	4.59	0.08	8.65	100.1	235	435	145	135	211	111	65	3.51					
112313	Flagstadelva	11	Hamar-Nes	U-Cambr.	Schist	614334	6753422	57.04	1.03	17.15	6.7	0.03	1.85	0.77	0.34	4.83	0.17	11.3	101.21	315	600	120	145	406	177	45	4.83					
122309	Lauselva	12	Snertingdal-Toten	U-Cambr.	Schist	573778	6733713	60.67	1.07	17.41	3.79	0	1.3	0	0.27	4.62	0.11	10.09	99.33	750	850	95	140	70	69	45	5.44					
122310	Lauselva	12	Snertingdal-Toten	U-Cambr.	Schist	573778	6733713	56.96	0.91	15.09	8.42	0.02	1.41	1.63	0.17	3.96	0.14	12.12	100.83	1475	775	100	200	265	190	65	4.53					
122311	Lauselva	12	Snertingdal-Toten	U-Cambr.	Schist	573778	6733713	58.61	1.02	16.87	5.12	0.01	1.25	0.07	0.24	4.57	0.11	10.12	97.99	290	775	110	150	92	117	55	5.05					
122312	Lauselva	12	Snertingdal-	U-Cambr.	Schist	573778	6733713	58.02	1.08	18.23	4.07	0	1.38	0	0.29	4.95	0.09	10.85	98.96	360	750	95	145	57	66	45	5.61					

			Toten																													
122313	Lauselva	12	Snertingdal-Toten	U-Cambr.	Schist	573778	6733713	60.38	1.02	17.54	3.42	0	1.33	0	0.24	4.87	0.06	10.12	98.98	340	1475	110	130	107	48	50	5.44					
122314	Lauselva	12	Snertingdal-Toten	U-Cambr.	Schist	573778	6733713	55.27	1.05	17.49	9.75	0	1.21	0.16	0.1	4.87	0.15	10.09	100.14	295	1225	110	225	105	203	105	4.04					
122315	Lauselva	12	Snertingdal-Toten	U-Cambr.	Schist	573778	6733713	55.32	0.93	15.21	10.17	0	1.08	0	0.09	4.34	0.28	11.16	98.58	250	1180	100	225	58	61	100	4.42					
122316	Lauselva	12	Snertingdal-Toten	U-Cambr.	Schist	573778	6733713	59.78	0.96	16.94	5.93	0	1.12	0	0.09	4.64	0.13	9.17	98.76	350	710	95	150	66	47	70	4.16					
122317	Lauselva	12	Snertingdal-Toten	U-Cambr.	Schist	573778	6733713	61.23	1.04	18.7	3.45	0	1.27	0	0.13	5.06	0.06	8.74	99.68	625	875	100	115	53	46	80	4.34					
122318	Lauselva	12	Snertingdal-Toten	U-Cambr.	Schist	573778	6733713	71.15	0.68	11.89	3.42	0	0.79	0.1	0.06	3.13	0.12	7.09	98.43	330	500	65	105	999	107	60	3.69					
132301	Ravndalskollen	13	Oslo-Asker	U-Cambr.	Schist	605999	6662412	61.78	1.12	19.04	1.64	0.02	1.12	0.28	0.73	8.37	0.13	3.94	98.17	570	425	55	120	45	53	25	1.62					
132302	Ravndalskollen	13	Oslo-Asker	U-Cambr.	Schist	605999	6662412	61.18	1.16	15.4	5.08	0	1.61	0.16	0.66	4	0.1	9.94	99.29	475	830	35	205	27	62	45	5.26					
132303	Ravndalskollen	13	Oslo-Asker	U-Cambr.	Schist	605999	6662412	62.69	1.13	19.16	1.43	0	1.08	0.04	0.53	5.92	0.1	8.19	100.27	800	810	55	120	41	82	50	4.46					
132304	Ravndalskollen	13	Oslo-Asker	U-Cambr.	Schist	605999	6662412	60.32	1.1	15.95	4.15	0.01	2.15	6.85	0.45	0.47	0.13	8.43	100.01	200	760	80	200	102	61	70	4.26					
132305	Ravndalskollen	13	Oslo-Asker	U-Cambr.	Schist	605999	6662412	61.44	1.09	19.28	1.92	0	1.38	0.08	0.34	6.1	0.44	8.24	100.31	665	985	50	130	74	62	70	4.31					
132306	Ravndalskollen	13	Oslo-Asker	U-Cambr.	Schist	605999	6662412	62.2	1.14	18.53	4.56	0	1.18	0.05	0.36	5.53	0	6.68	100.23	675	720	50	175	54	86	40	2.66					
152301	Slemmestad	15	Oslo-Asker	U-Cambr.	Schist	583859	6628048	55.18	1.1	19.93	6.14	0.02	2.04	0.11	0.05	6.31	0.05	7.81	98.74	470	545	123	245	95	83	293	1.32					
152302	Slemmestad	15	Oslo-Asker	U-Cambr.	Schist	583859	6628048	50.91	1.18	19.41	8.49	0.02	1.65	0.1	0.06	5.85	0.1	10.51	98.28	545	403	93	303	160	51	93	3.76					
152303	Slemmestad	15	Oslo-Asker	U-Cambr.	Schist	583859	6628048	51.96	1.05	15.89	12.12	0.14	2.32	0.8	0.14	3.76	0.15	9.99	98.32	665	308	122	363	288	207	83	2.03	18.5	12.8	0.69	3.76	370
172301	Krekling	17	Eiker-Sandsvær	U-Cambr.	Schist	543224	6614755	61.6	1.18	19.23	0.93	0.01	1.4	0.02	0.79	5.18	0.04	8.99	99.37	503	770	68	135	37	61	25	5.22	14.9	15.2	1.02	5.18	390
172302	Krekling	17	Eiker-Sandsvær	U-Cambr.	Schist	543224	6614755	60.37	1.12	18.33	1.72	0.01	1.65	0.06	0.76	5.03	0.08	8.99	98.12	400	505	60	150	72	45	57	5.25					
172303	Krekling	17	Eiker-Sandsvær	U-Cambr.	Schist	543224	6614755	62.34	1.26	18.94	0.98	0.01	1.35	0	0.74	5.08	0.03	8.89	99.62	565	715	65	143	32	80	55	4.94	16	17.9	1.12	5.08	280
172304	Krekling	17	Eiker-Sandsvær	U-Cambr.	Schist	543224	6614755	60.27	1.15	19.6	4.26	0.01	1.48	0.05	0.81	5.21	0.12	6.28	99.24	658	358	77	140	54	32	15	1.23					
172305	Krekling	17	Eiker-Sandsvær	U-Cambr.	Schist	543224	6614755	62.26	1.21	19.39	0.99	0.01	1.33	0	0.65	5.11	0.04	6.36	97.35	520	340	63	95	28	29	38	2.46	8.6	14.1	1.64	5.11	270
172306	Krekling	17	Eiker-Sandsvær	U-Cambr.	Schist	543224	6614755	62.49	1.19	20.45	1.5	0.01	1.59	0.08	0.63	5.55	0.03	4.64	98.16	638	295	68	108	33	59	40	0.43	12.9	17.6	1.36	5.55	290
182301	Stablum gård	18	Eiker-Sandsvær	U-Cambr.	Schist	542029	6612812	57.87	0.99	18.24	5.57	0	1.44	0.63	0.43	5.13	0.11	8.98	99.39	625	780	215	215	360	77	313	3.41					
182302	Stablum gård	18	Eiker-Sandsvær	U-Cambr.	Schist	542029	6612812	45.14	0.83	13.21	6.96	0.03	1.61	1.15	0.4	3.61	0.08	28.03	101.05	450	320	130	280	190	135	100	5.33					
182303	Stablum gård	18	Eiker-Sandsvær	U-Cambr.	Schist	542029	6612812	50.6	0.88	15.95	10.08	0.03	1.91	3.05	0.58	4.19	0.11	12.23	99.61	800	600	260	335	218	199	163	5.50					
192301	Teigen	19	Eiker-Sandsvær	U-Cambr.	Schist	541932	6612579	57.13	1.06	19.33	4.97	0.02	1.93	0.38	0.97	4.94	0.1	8.92	99.75	375	443	103	220	185	48	60	3.37					
192302	Teigen	19	Eiker-Sandsvær	U-Cambr.	Schist	541932	6612579	47.12	0.95	15.2	13.03	0	1.39	0.86	0.44	4.12	0.11	16.38	99.6	725	490	162	293	220	320	145	6.84					
192303	Teigen	19	Eiker-Sandsvær	U-Cambr.	Schist	541932	6612579	55.07	0.99	18.13	6.09	0	1.94	0.92	0.91	4.62	0.11	10.7	99.48	550	778	215	245	120	176	105	4.86					
202301	Rongstrand	20	Langesund	U-Cambr.	Schist	540334	6537969	56.76	0.97	18.79	4.27	0.01	1.46	2.26	0.87	9.17	0.08	4.56	99.2	6750	400	108	237	240	22	35	1.53					
202302	Rongstrand	20	Langesund	U-Cambr.	Schist	540334	6537969	50.51	0.98	16.99	12.28	0.01	1.53	2.73	1.01	5.55	0.21	7.34	99.14	1225	460	158	387	613	51	168	2.09					
202303	Rongstrand	20	Langesund	U-Cambr.	Schist	540334	6537969	58.24	1.15	19.56	3.42	0.02	1.59	6.97	2.05	2.46	0.23	2.74	98.43	800	327	100	215	70	10	15	0.87					
202304	Rongstrand	20	Langesund	U-Cambr.	Schist	540334	6537969	50.24	0.89	16.31	9.08	0.03	2.38	1.38	1.59	7.43	0.12	8.77	98.22	2050	758	160	310	34	57	103	5.58					
202305	Rongstrand	20	Langesund	U-Cambr.	Schist	540334	6537969	52.9	0.9	16.14	9.83	0.05	2.75	3.46	1.34	4.05	0.08	8.49	99.99	925	640	133	368	45	51	135	5.48					
242304	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	59.65	1.13	18.55	5.48	0	1.57	0.28	0.26	5.1	0.22	5.79	98.03	450	365	70	200	162	75	20	1.31					
242305	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	61.65	1.17	19.37	4.75	0	1.6	0.17	0.29	5.26	0.15	5.3	99.71	390	300	60	185	73	46	30	0.97					
242306	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	57.4	1.06	18.06	5.44	0.01	1.37	0.03	0.19	5.3	0.1	9.97	98.93	515	765	95	195	63	49	50	4.45					
242307	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	60.99	1.12	18.43	3.83	0.01	1.43	0.03	0.27	5.34	0.07	7.78	99.3	490	600	70	170	43	27	20	3.08					
242308	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	59.83	1.15	19.12	5.09	0.02	1.42	0.04	0.32	5.42	0.11	6.84	99.36	455	460	75	190	57	60	15	2.05					
242309	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	58.33	1.15	19.15	4.87	0.01	1.57	0.03	0.3	5.39	0.12	7.4	98.32	475	540	80	190	58	71	20	2.75					
242310	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	57.12	1.16	18.72	3.88	0.01	1.31	0.07	0.16	5.49	0.14	9.51	97.57	510	940	35	170	85	29	40	4.69					
242311	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	59.50	1.10	18.00	3.52	0.00	1.21	0.00	0.23	5.19	0.07	9.52	98.34	645	695	95	175	235	32	70	5.06					
242312	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	59.95	1.25	19.50	3.87	0.00	1.35	0.03	0.27	5.51	0.10	6.82	98.65	550	445	60	175	92	34	25	2.37					
242313	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	60.27	1.14	19.33	4.42	0.00	1.47	0.04	0.25	5.37	0.11	6.31	98.71	565	385	60	195	66	47	20	1.71					
242314	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	59.34	1.14	18.66	4.33	0.00	1.56	0.14	0.30	5.23	0.20	6.95	97.85	565	550	75	190	154	60	25	2.32					
242315	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	60.54	1.22	19.47	5.34	0.00	1.51	0.09	0.30	5.39	0.16	5.78	99.8	590	345	45	190	42	49	15	1.14					
242316	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	59.55	1.21	19.57	5.06	0.00	1.55	0.07	0.26	5.47	0.15	6.16	99.05	590	370	70	205	69	55	45	1.60					
242317	Braåstad	24	Toten	U-Cambr.	Schist	591270	6744264	59.19	1.12	18.76	5.20	0.02	1.62	0.26	0.33	5.20	0.17	6.25	98.12	405	300	80	200	167	92	25	1.77					
103329	Steinsodden	10	Ringsaker	U-Cambr. + Dictyonema (2e)	Schist	592019	6753575	54	1	17.04	3.85	0	1.01	0.05	0.25	5.25	0.11	16.46	99.02	550	1335	90	170	39	57	225	10.08	48.2	6.8	0.14	5.25	825
103330	Steinsodden	10	Ringsaker	U-Cambr. + Dictyonema (2e)	Schist	592019	6753575	64.11	0.84	15.66	3.07	0	0.86	0.2	0.31	5.07	0.16	9.42	99.7	465	615	70	135	74	87	130	5.15	126	8.8	0.07	5.07	835
103331	Steinsodden	10	Ringsaker	U-Cambr. + Dictyonema (2e)	Schist	592019	6753575	58.01	0.84	15.17	1.45	0	1.08	0.03	0.3	5.46	0.06	15.93	98.33	655	1155	95	125	36	33	90	10.59					
103332	Steinsodden	10	Ringsaker	U-Cambr. + Dictyonema (2e)	Schist	592019	6753575	58.49	0.89	16.52	2.07	0	1.16	0.02	0.6	5.77	0.1	14.58	100.2	580	1260	95	145	27	29	115	8.83					
103333	Steinsodden	10	Ringsaker	U-Cambr. + Dictyonema (2e)	Schist	592019	6753575	58.57	0.9	16.63	2.27	0	1	0.01	0.46	5.58	0.1	14.18	99.7	740	1380	100	140	24	29	140	8.81	38.5	8.5	0.22	5.58	1025
103334	Steinsodden	10	Ringsaker	U-Cambr. + Dictyonema (2e)	Schist	592019	6753575	58.3	0.92	16.64	1.3	0	1.1	0.02	0.66	5.83	0.05	13.81	98.63	915	815	80	120	26	28	110	8.81					
103335	Steinsodden	10	Ringsaker	U-Cambr. + Dictyonema (2e)	Schist	592019	6753575	57.11	0.86	16.51	1.95	0	1.08	0.04	0.45	5.96	0.09	14.92	98.97	1155	2325	125	145	41	36	165	9.12	55.9	11.8	0.21	5.96	1005
103336	Steinsodden	10	Ringsaker	U-Cambr. + Dictyonema (2e)	Schist	592019	6753575	57.99	0.9	15.7	3.17	0	1.05	0.03	0.6	5.83	0.09	14.44	99.8	800	3225	145	205	32	29	125	8.35					

103337	Steinsodden	10	Ringsaker	U-Cambr. + Dictyonema (2e)	Schist	592019	6753575	56.91	0.85	15.89	2.78	0	1.13	0.07	0.63	5.84	0.12	14.83	99.05	805	2650	130	175	35	28	150	8.85					
103338	Steinsodden	10	Ringsaker	U-Cambr. + Dictyonema (2e)	Schist	592019	6753575	56.07	0.99	17.53	1.73	0	1.32	0.06	0.6	6.35	0.06	14.12	98.83	690	4150	150	200	31	29	90	9.29	46.4	8.8	0.19	6.35	765
123319	Lauselva	12	Snertingdal-Toten	U-Cambr. + Dictyonema (2e)	Schist	573778	6733713	51.77	0.72	13.99	2.67	0	1.01	4.11	0.34	3.51	0.11	20.16	98.39	515	950	105	125	107	67	295	11.06					
123320	Lauselva	12	Snertingdal-Toten	U-Cambr. + Dictyonema (2e)	Schist	573778	6733713	53.38	0.85	16	6.36	0.01	1.18	0.09	0.2	4.18	0.18	17.73	100.16	580	925	110	170	74	77	300	11.69					
123321	Lauselva	12	Snertingdal-Toten	U-Cambr. + Dictyonema (2e)	Schist	573778	6733713	46.07	0.77	14.18	7.13	0.02	1.04	4.64	0.02	3.7	0.26	21.48	99.31	520	1330	215	215	226	252	340	9.82					
123322	Lauselva	12	Snertingdal-Toten	U-Cambr. + Dictyonema (2e)	Schist	573778	6733713	63.34	0.99	17.2	2.7	0	1.22	0	0.12	4.85	0.05	7.79	98.26	305	455	85	110	33	44	55	3.42					
123323	Lauselva	12	Snertingdal-Toten	U-Cambr. + Dictyonema (2e)	Schist	573778	6733713	56.29	0.92	16.67	10.11	0	1.41	0	0.02	4.64	0.1	10.6	100.76	310	480	85	220	50	73	85	4.19					
123324	Lauselva	12	Snertingdal-Toten	U-Cambr. + Dictyonema (2e)	Schist	573778	6733713	60.86	1.06	17.17	3.65	0.01	1.37	0.02	0.09	4.8	0.09	9.98	99.1	300	895	100	135	47	50	75	5.33					
123325	Lauselva	12	Snertingdal-Toten	U-Cambr. + Dictyonema (2e)	Schist	573778	6733713	58.13	1.05	17.26	4.93	0.01	1.35	0.02	0.12	4.83	0.16	10.14	98	405	1645	130	165	74	57	75	5.26					
133307	Ravndalskollen	13	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	605999	6662412	66.17	0.97	16.49	0.43	0.01	1.09	0.4	0.3	6.58	0.03	7.92	100.39	635	2470	45	115	43	31	20	4.64					
133308	Ravndalskollen	13	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	605999	6662412	62.32	1.05	17.44	1.48	0	1.18	0.31	0.18	6.3	0.16	9.09	99.51	990	2640	85	140	86	72	35	5.05					
133309	Ravndalskollen	13	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	605999	6662412	64.33	0.89	14.94	1.26	0.02	1.4	0.82	0.45	9.42	0.09	6.35	99.97	840	850	80	125	41	86	180	4.29					
133410	Ravndalskollen	13	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	605999	6662412	63.44	0.9	15.86	1.02	0.02	2.34	11.05	0.51	0.03	0.11	5.09	100.37	75	510	60	135	31	38	20	4.37					
133311	Ravndalskollen	13	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	605999	6662412	58.47	0.93	16.77	0.71	0	0.96	0.38	0.14	6.13	0.51	14.34	99.34	640	4150	165	130	46	161	240	11.17					
133312	Ravndalskollen	13	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	605999	6662412	59.47	1.01	16.47	0.94	0	1.7	0.37	0.94	6.05	0.57	12.12	99.64													
143301	Klekken	14	Ringerike	U-Cambr. + Dictyonema (2e)	Schist	573031	6670377	60.57	0.98	18.21	1.9	0	1.25	0	0.49	5.62	0.04	9.99	99.05	875	2235	105	110	56	33	90	5.83					
143302	Klekken	14	Ringerike	U-Cambr. + Dictyonema (2e)	Schist	573031	6670377	59.59	0.95	18.29	1.83	0	1.24	0	0.49	5.76	0.02	11.45	99.62	990	1590	95	100	27	39	110	6.53					
143303	Klekken	14	Ringerike	U-Cambr. + Dictyonema (2e)	Schist	573031	6670377	58.38	0.92	16.64	1.72	0	1.21	0	0.54	5.24	0.04	14.43	99.12	1040	2745	160	100	42	27	325	9.79					
143304	Klekken	14	Ringerike	U-Cambr. + Dictyonema (2e)	Schist	573031	6670377	57.44	0.93	17.12	2	0	1.24	0	0.47	5.26	0.07	15.47	100	1230	2155	135	100	32	36	370	10.75					
153304	Slemmestad	15	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	583859	6628048	50.43	0.87	14.92	6.18	0.01	1.13	1.56	0.51	4.39	0.07	19.46	99.53	1355	1705	195	260	115	64	278	8.82	38.6	9.8	0.25	4.39	1420
153305	Slemmestad	15	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	583859	6628048	47.35	0.82	14.43	6.95	0	1.11	2.36	0.59	4.61	0.83	21.12	100.17	1888	635	88	293	74	84	243	6.91	42.4	8	0.19	4.42	1300
153306	Slemmestad	15	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	583859	6628048	48.94	0.75	13.76	8.41	0.01	1.03	1.07	1	4.42	0.05	21.06	100.5	1175	713	95	305	56	113	205	10.24	35.5	7.3	0.21	4.64	1600
153307	Slemmestad	15	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	583859	6628048	51.06	0.77	14.14	4.45	0.01	1.06	0.69	0.65	4.64	0.07	21.41	98.95	1640	880	100	215	59	39	220	12.17	51.3	6.4	0.12	4.21	1620
153308	Slemmestad	15	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	583859	6628048	47.02	0.72	13.01	9.2	0	0.91	1.41	0.44	4.21	0.08	22.52	99.52	1235	1010	133	327	54	40	323	10.21	70	8.3	0.12	8.95	1740
153309	Slemmestad	15	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	583859	6628048	47.43	0.77	13.16	13.32	0	0.99	0.05	0.47	4.31	0.05	19.73	100.28	2005	790	95	383	80	139	260	8.05	33.3	6.9	0.21	6.45	1040
163301	Nærsnes	16	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584671	6625508	47.85	0.71	12.93	8.02	0.01	0.99	2.14	0.42	4.1	0.48	20.89	98.54	1138	735	183	278	64	141	273	10.13					
163302	Nærsnes	16	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584671	6625508	50.9	0.77	14.16	5.69	0.01	1.09	0.03	0.46	4.57	0.05	20.84	98.57	1925	1153	155	230	44	137	235	12.47	41.5	5.7	0.14	4.57	1500
163303	Nærsnes	16	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584671	6625508	48.82	0.74	13.54	7.32	0.01	1.04	1.13	0.52	4.45	0.13	20.49	98.19	1233	803	143	273	55	166	230	10.58					
163304	Nærsnes	16	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584671	6625508	50.5	0.81	14.39	7.65	0.01	1.03	0.31	0.52	4.64	0.04	18.52	98.42	1215	908	175	290	46	137	290	10.79					
163305	Nærsnes	16	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584671	6625508	53.65	0.81	14.65	4.09	0.01	1.1	0.31	0.6	4.84	0.05	18.7	98.81	1695	820	103	190	38	60	270	10.00	3.82	5.2	0.14	4.84	1970
163306	Nærsnes	16	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584671	6625508	54.43	0.85	15.12	4.61	0.01	1.06	0	0.61	5.07	0.05	17.46	99.27	1648	878	115	200	34	122	268	10.74					
163307	Nærsnes	16	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584671	6625508	51.41	0.87	14.3	3.4	0.01	1.12	0	1.38	5.06	0.04	16.89	94.48	1245	1167	98	177	39	108	125	8.56	60.4	8.7	0.14	5.06	1030
163308	Nærsnes	16	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584671	6625508	55.63	1.02	12.45	0.45	0	0.03	0.15	0.89	4.29	0.07	15.29	90.27	37550	970	68	130	28	43	108	10.04					
163309	Nærsnes	16	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584671	6625508	59.91	0.87	13.38	0.77	0	0.39	0	0.67	4.82	0.04	14.65	95.5	10775	808	53	100	21	27	155	9.81					
163310	Nærsnes	16	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584671	6625508	51.34	0.9	10.87	1.06	0	0	0.04	0.23	2.76	0.1	12.18	79.48	42750	1730	125	168	40	60	125	5.33	36	12.3	0.34	2.76	650
213301	Nærsnesstrand	21	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584261	6625861	58.13	0.89	15.9	3.38	0	1.18	0	1.01	5.33	0.07	12.31	98.2	4200	1640	195	190	44	216	225	6.92					
213302	Nærsnesstrand	21	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584261	6625861	53.24	0.87	15.06	3.68	0	0.25	0.04	0.39	4.77	0.11	9.8	88.21	33225	1425	290	210	90	169	135	5.38					
213303	Nærsnesstrand	21	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584261	6625861	58.95	0.91	15.84	2.47	0.02	0.84	0	0.84	5.37	0.07	10.18	95.49	6000	1900	172	172	43	117	158	5.78					
213304	Nærsnesstrand	21	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584261	6625861	62.52	1.05	18.41	1.01	0	1.39	0	0.75	5.85	0.05	8.47	99.5	2350	2450	83	155	25	39	155	4.46					
213305	Nærsnesstrand	21	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	584261	6625861	60.41	1.03	17.46	1.19	0	1.22	0	0.76	5.73	0.05	8.6	96.45	5418	2125	95	168	28	35	48	4.61					
173307	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	55.03	0.94	17.17	2.12	0.01	1.32	0	0.61	4.59	0.05	17.29	99.13	648	605	68	113	29	30	160	11.83	33.3	9.5	0.29	4.59	590
173308	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	57.24	0.95	16.9	1.76	0.01	1.24	0	0.65	4.52	0.04	16.22	99.53	545	555	65	100	34	87	125	11.03					
173309	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	57.09	1	17.87	3.25	0.01	1.27	0	0.59	4.59	0.04	13.77	99.48	463	708	68	130	44	98	105	9.26	34.6	13.8	0.4	4.59	470
173310	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	56.41	0.88	15.68	3.19	0	0.96	0	0.61	4.92	0.04	17.15	99.84	490	882	105	115	78	158	350	11.41	21.4	6.4	0.3	4.92	600
173311	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	56.26	0.95	16.86	1.38	0.01	1.12	0	0.73	5.09	0.04	17.12	99.56	535	995	75	110	46	68	374	12.08	13.1	4.4	0.34	5.09	1000
173312	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	57.7	0.94	14.06	1.36	0	0.9	0	0.56	4.64	0.05	18.4	98.61	883	1053	80	108	92	48	425	13.19	42.9	9	0.21	4.64	1140
173313	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	55.48	0.88	15.67	2.25	0	0.97	0	0.56	5	0.05	18.41	99.27	915	902	97	115	56	57	380	12.87	22.7	7.9	0.35	5	1180
173314	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	56.09	0.89	16.09	1.43	0	1.06	0	0.55	5.06	0.05	18.21	99.43	665	990	85	105	33	55	340	13.71	31.4	8.3	0.26	5.06	1180
173315	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	57.47	0.92	16.41	1.28	0	1.06	0.18	0.55	5.16	0.03	15.18	98.24	700	1025	78	95	35	71	265	10.41	17.9	7	0.39	5.16	1110
173316	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	57.56	0.92	16.56	1.94	0	1.05	0	0.61	5.11	0.04	15.76	99.55	595	1033	80	108	22	45	265	10.55	22.5	7.1	0.32	5.11	960
173317	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	51.99	1.04	19.39	2.87	0.01	1.42	0	0.38	5.66	0.29	16.4	99.45	595	1260	115	142	90	145	290	11.00					
173318	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	56.86	0.86	16.22	0.97	0	1.03	0.24	0.72	5.08	0.03	16.87	98.88	635	817	78	100	28	52	260	12.33	38.1	9.4	0.25	5.08	970
173319	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	54.34	0.85	15.35	1.92	0	1.06	0	0.78	4.82	0.03	20.25	99.4	638	848	87	115	21	70	343	15.52	43.2	8.7	0.2	4.82	1320
173320	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	53.35	0.79	15.08	2.07	0	1.03	0.06	0.91	4.9	0.05	20.9	99.14	765	805	110	130	43	73	398	15.22	29.8	8.2	0.28	4.9	1220
173321	Krekling	17	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	543224	6614755	57.09	0.9	15.43	0.92	0	1.04	0	0.88	4.92	0.06	18.55	99.79	965	835	83	100	33	55	148	15.26					

183304	Stablum gård	18	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	542029	6612812	36.32	0.65	9.98	26.17	0.02	0.93	2.32	0.27	2.77	0.08	19.46	98.97	800	320	565	650	511	745	73	5.45					
183305	Stablum gård	18	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	542029	6612812	45.51	0.9	12.7	14.58	0.02	1.99	2.69	0.47	3.64	0.17	17.06	99.73	625	303	218	455	652	833	75	5.90					
183306	Stablum gård	18	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	542029	6612812	51.58	0.83	14.52	6.91	0	1.31	1.97	0.56	4.27	0.13	16.21	98.29	550	258	107	275	104	102	92	7.92					
183307	Stablum gård	18	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	542029	6612812	53.94	0.86	14.99	7.84	0	1.16	0.59	0.5	4.48	0.13	15.79	100.28	425	490	190	288	201	414	145	8.52					
183308	Stablum gård	18	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	542029	6612812	52.53	0.9	15.75	6.93	0	1.19	0.28	0.56	4.53	0.16	17.55	100.38	675	448	190	275	178	241	103	10.34					
183309	Stablum gård	18	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	542029	6612812	48.68	0.88	14.79	8.4	0.01	1.13	0.52	0.53	4.44	0.16	18.62	98.16	750	863	258	335	95	259	290	10.61					
183310	Stablum gård	18	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	542029	6612812	49.01	0.8	14.73	9.06	0	0.87	0.38	0.57	4.79	0.21	18.99	99.41	800	685	305	325	58	136	333	10.97					
183311	Stablum gård	18	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	542029	6612812	49.27	0.78	14.9	8.16	0	0.84	0.38	0.55	4.75	0.15	19.22	99	425	1008	330	300	72	164	353	8.97					
183312	Stablum gård	18	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	542029	6612812	51.32	0.72	13.57	5.76	0	0.95	2.21	0.92	4.34	0.21	19.55	99.55	775	965	370	250	136	154	350	11.05					
193304	Teigen	19	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	541932	6612579	47.57	0.86	15.46	9.52	0.05	2.44	2.5	1.01	3.42	0.1	15.59	98.52	700	450	155	333	250	237	158	7.66					
193305	Teigen	19	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	541932	6612579	47.19	0.72	13.19	10.36	0.06	4.04	2.57	0.67	2.91	0.28	17.66	99.65	500	498	138	348	410	103	168	8.16					
193306	Teigen	19	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	541932	6612579	48.58	0.81	14.48	11.47	0	1.09	1.35	0.38	3.74	0.33	17.76	99.99	450	520	228	355	230	296	177	8.39					
193307	Teigen	19	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	541932	6612579	48.93	0.85	14.9	11.44	0.03	1.4	1.01	0.35	4.05	0.11	16.05	99.12	550	505	250	395	233	244	210	7.99					
193308	Teigen	19	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	541932	6612579	55.13	0.91	15.17	6.04	0.02	1.29	0.63	0.52	4.33	0.09	14.09	98.22	600	465	128	255	118	87	138	8.24					
193309	Teigen	19	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	541932	6612579	41.04	0.69	12.37	8.53	0.06	1.24	7.23	0.48	3.51	0.18	23.13	98.46	575	840	290	360	529	350	395	11.71					
193310	Teigen	19	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	541932	6612579	52.4	0.83	15.27	6.97	0.01	0.99	0.65	0.64	4.75	0.18	16.18	98.87	750	878	200	288	55	98	388	8.90					
193311	Teigen	19	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	541932	6612579	52.96	0.82	15.52	6.42	0.01	1.12	0.62	0.62	4.93	0.14	16.61	99.77	575	757	227	265	96	126	360	9.50					
193312	Teigen	19	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	541932	6612579	50.39	0.95	17.4	6.22	0.01	1.27	0.59	0.82	5.31	0.12	15.6	98.68	2425	978	415	290	80	184	205	7.98					
193313	Teigen	19	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	541932	6612579	54.16	0.8	14.8	5.92	0.01	1.12	0.69	0.88	5.05	0.16	14.11	97.7	4050	1155	428	230	73	284	237	8.19					
203306	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	50.55	0.83	15.07	12.51	0.03	1.83	5.01	2.08	2.51	0.1	9.34	99.86	1100	503	183	413	32	24	115	3.93					
203307	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	49.76	1.13	19.83	2.09	0.04	2.16	9.63	1.96	0.25	0.75	10.96	98.56	100	710	100	198	72	31	195	8.67					
203308	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	56.13	0.88	16.27	3.08	0.02	1.76	2.49	1.43	7.84	0.12	8.44	98.46	4825	438	110	193	50	21	75	6.52					
203309	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	53.4	1.06	18.46	2.85	0.02	1.62	9.52	2.24	0.13	0.31	9.17	98.78	0	445	98	255	43	68	85	7.55					
203310	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	51.98	0.8	14.88	7.24	0.04	2.25	4.9	1.34	3.64	0.16	12.38	99.61	2000	1193	213	293	127	69	220	8.83					
203311	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	54.2	0.86	16.05	2.45	0.04	2.23	2.91	1.19	8.11	0.2	10.48	98.72	3750	1515	173	180	50	50	310	8.28					
203312	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	55.32	0.83	15.6	3.33	0.02	1.33	3.26	1.32	7.13	0.23	10.8	99.17	4875	1385	215	228	35	20	308	8.23					
203313	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	52.11	0.82	14.73	5.26	0.04	2.83	2.1	1.54	5.56	0.31	12.97	98.27	9075	785	235	230	39	100	245	9.76					
203314	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	50.54	0.82	15.77	5.15	0.03	2.1	5.08	1.59	3.7	0.19	13.14	98.11	7450	685	223	227	39	47	275	9.98					
203315	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	48.37	0.76	14.31	10.76	0.04	1.89	3.83	1.28	6.29	0.18	11.3	99.01	3000	1028	333	553	33	234	220	7.38					
203316	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	51.15	0.81	14.32	7.86	0.04	2.47	4.98	2.62	2.33	0.29	11.78	98.65	1250	1193	373	300	83	56	328	7.98					
203317	Rongstrand	20	Langesund	U-Cambr. + Dictyonema (2e)	Schist	540334	6537969	54.06	0.76	14.53	4.92	0.03	1.94	2.9	1.14	6.7	0.22	11.07	98.27	3200	1280	208	225	37	56	263	8.14					
223301	Ulvåa	22	Hamar-Nes	U-Cambr. + Dictyonema (2e)	Schist	627323	6764406	59.08	0.97	20.11	4.9	0	1.49	0.19	0.09	5.58	0.06	6.86	99.33													
223302	Ulvåa	22	Hamar-Nes	U-Cambr. + Dictyonema (2e)	Schist	627323	6764406	56.24	0.91	19.83	6.71	0	1.99	0.06	0.1	5.4	0.09	6.86	98.19													
233301	Røne	23	Hamar-Nes	U-Cambr. + Dictyonema (2e)	Schist	620342	6730733	56.37	0.87	15.9	1.27	0	1.08	0.65	0.57	5.06	0.04	17.51	99.32													
233302	Røne	23	Hamar-Nes	U-Cambr. + Dictyonema (2e)	Schist	620342	6730733	56.92	0.81	14.97	1.23	0	0.88	1.32	0.55	5.03	0.05	17.62	99.38													
253301	Byrud	25	Feiring	U-Cambr. + Dictyonema (2e)	Schist	620869	6700227	53.83	0.95	16.50	4.02	0.00	1.28	1.26	0.63	8.71	0.08	11.71	98.97									51.7	18.3	0.35	8.71	
253302	Byrud	25	Feiring	U-Cambr. + Dictyonema (2e)	Schist	620869	6700227	49.34	0.86	14.61	13.78	0.01	1.30	0.57	0.57	9.76	0.12	8.90	99.82									47.6	17	0.35	9.76	
263301	Løven	26	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	592421	6642958	53.07	0.83	15.61	6.72	0.00	1.00	0.24	0.82	4.89	0.14	17.32	100.64													
263302	Løven	26	Oslo-Asker	U-Cambr. + Dictyonema (2e)	Schist	592421	6642958	54.80	0.85	15.87	5.49	0.00	0.84	0.24	1.03	5.07	0.19	13.52	97.9													
283301	Sponbekken	28	Modum	U-Cambr. + Dictyonema (2e)	Schist	555593	6645005	61.06	1.08	16.09	1.36	0.00	1.11	0.32	0.54	4.57	0.02	11.36	97.508									15.1	8.1	0.54	4.57	
293301	Sønsteby	29	Modum	U-Cambr. + Dictyonema (2e)	Schist	555036	6643367	52.21	0.84	15.86	2.54	0.00	1.08	0.48	0.14	4.43	0.06	19.28	96.92									10.7	4.5	0.42	4.43	
293302	Sønsteby	29	Modum	U-Cambr. + Dictyonema (2e)	Schist	555036	6643367	52.26	0.87	16.27	3.37	0.00	1.18	0.38	0.41	4.44	0.08	18.49	97.75									24	6.8	0.28	4.44	
303301	Rajesetra	30	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	532268	6600051	51.17	0.81	15.55	0.33	0.00	0.00	1.05	0.41	6.65	0.06	10.83	86.86									35.8	12	0.34	6.65	
303302	Rajesetra	30	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	532268	6600051	53.44	0.87	15.55	3.50	0.10	1.54	2.50	0.16	8.39	0.23	13.36	99.64									102.9	14	0.14	8.39	
303303	Rajesetra	30	Eiker-Sandsvær	U-Cambr. + Dictyonema (2e)	Schist	532268	6600051	56.59	1.01	15.50	2.96	0.10	1.07	3.89	0.54	6.08	0.24	11.50	99.48									47.3	14	0.3	6.08	
101302	Steinsodden	10	Ringsaker	L-Cambr.	Schist	592019	6753575	77.64	0.62	9.37	4.96	0.07	0.6	0.1	0	2.41	0.12	2.32	98.21	275	85	55	175	27	18	15	0.03					
102124	Steinsodden	10	Ringsaker	L-Cambr.	Schist	592019	6753575	61.32	0.43	7.65	20.15	0.03	0.53	0.21	0.93	2.57	0.12	4.41	98.35	625	165	38	460	68	182	48	0.18	14.6	6.3	0.43	2.57	290
111301	Flagstadelva	11	Hamar-Nes	L-Cambr.	Schist	614334	6753422	58.02	1	19.49	6.68	0.04	1.95	0	0.18	5.75	0.08	4.33	97.52	370	165	95	145	90	23	20	0.07					
121101	Lauselva	12	Snertingdal-Toten	L-Cambr.	Schist	573778	6733713	75.65	0.19	8.79	2.7	0.14	0.91	3.64	0.36	2.12	0.34	4.82	99.66	750	145	30	130	35	31	10	0.11					
241201	Braåstad	24	Toten	L-Cambr.	Schist	591270	6744264	67.38	0.83	14.77	7.18	0.01	1.33	0.15	0.27	4.08	0.1	3.03	99.13					74	65	15	0.00					
241202	Braåstad	24	Toten	L-Cambr.	Schist	591270	6744264	65.38	0.79	15.44	6.58	0	1.3	0.14	0.39	4.48	0.08	3.25	97.83					71	43	13	0.10					
241303	Braåstad	24	Toten	L-Cambr.	Schist	591270	6744264	59.96	1.11	19.77	4.05	0	1.7	0.29	0.37	5.36	0.14	5.87	98.62					148	113	3	1.19					
104339	Steinsodden	10	Ringsaker	U-Ord.	Schist	592019	6753575	65.34	0.97	16.74	4.05	0.04	1.11	0.53	0.65	5.54	0.21	3.68	98.86	1675	310	78	203	70	73	25	0.13	6.3	14.5	2.32	5.54	210
104340	Steinsodden	10	Ringsaker	U-Ord.	Schist	592019	6753575	64.33	0.75	12.98	3.04	0.07	1.02	5.65	0.21	4.12	0.22	6.75	99.14	2175	245	60	203	49	34	18	0.34	5	13.3	2.66	4.12	230
104341	Steinsodden	10	Ringsaker	U-Ord.	Schist	592019	6753575	63.44	1.03	18.28	4.02	0.03	1.18	0.19	0.55	5.96	0.17	3.52	98.37	1375	450	65	225	61	52	13	0.13	9.2	15.3	1.66	5.96	240
104342	Steinsodden	10	Ringsaker	U-Ord.	Schist	592019	6753575	61.96	0.94	16.38	5.99	0.05	1.4	0.43	0.46	5.25	0.3	3.63	96.79	2100	180	108	240	94	34	25	0.00	6.5	13.7	2.11	5.25	285
124326	Lauselva	12	Snertingdal-Toten	U-Ord.	Schist	573778	6733713	61.45	1.05	17.34	6.8	0.02	1.32	0.21	0.11	4.82	0.15	7.45	100.72	270	1225	150	190	98	207	80	1.95					
124327	Lauselva	12	Snertingdal-	U-Ord.	Schist	573778	6733713	59.05	1.12	18.91	5.85	0.02	1.41	0	0.1	5.11	0.13	7.23	98.93	355	670	125	165	102	86	55	1.76					

			Toten																													
144305	Klekken	14	Ringerike	U-Ord.	Schist	573031	6670377	59.97	0.91	16.85	6.98	0.11	1.2	0.25	0.38	4.92	0.13	6.04	97.74	940	2360	390	180	668	180	200	1.24					
144306	Klekken	14	Ringerike	U-Ord.	Schist	573031	6670377	53.92	1.02	18.61	10.55	0.01	1.55	0.08	0.28	5.4	0.22	6.49	98.13	665	390	105	215	219	184	35	0.64					
144307	Klekken	14	Ringerike	U-Ord.	Schist	573031	6670377	58.41	1.12	19.56	5.07	0.01	1.57	0.04	0.54	5.73	0.14	5.98	98.17	615	900	65	145	127	67	30	1.01					
144308	Klekken	14	Ringerike	U-Ord.	Schist	573031	6670377	58.77	0.99	18.39	5.91	0.06	1.8	0.78	0.49	5.08	0.56	4.42	97.25	890	250	80	155	81	44	15	0.30					
144309	Klekken	14	Ringerike	U-Ord.	Schist	573031	6670377	56.64	1.04	19.27	7.85	0.01	1.55	0.09	0.31	5.48	0.19	7.19	99.62	535	725	90	180	128	126	100	1.56					
144310	Klekken	14	Ringerike	U-Ord.	Schist	573031	6670377	55.18	1.02	18.89	6.85	0.02	1.77	0.4	0.51	5.04	0.16	8	97.84													
154310	Slemmestad	15	Oslo-Asker	U-Ord.	Schist	583859	6628048	60.35	0.96	17.56	1.18	0	1.19	1.05	1.08	5.95	0.04	9.73	99.09	2240	750	95	103	45	35	73	3.79					
154311	Slemmestad	15	Oslo-Asker	U-Ord.	Schist	583859	6628048	59.34	1.04	19.42	1.32	0	1.28	0.64	0.63	6.45	0.03	8.66	98.81	2645	570	73	117	59	45	165	2.91					
164311	Nærsnes	16	Oslo-Asker	U-Ord.	Schist	584671	6625508	63.32	1.03	18.21	1.08	0.01	1.48	0	0.64	5.83	0.07	8.09	99.76	875	2738	93	133	35	32	105	4.47	34.8	15.7	0.45	5.83	860
164312	Nærsnes	16	Oslo-Asker	U-Ord.	Schist	584671	6625508	59.25	1.01	17.67	1.44	0.01	1.32	0.01	0.65	5.82	0.05	8.36	95.59	2400	1585	78	145	34	18	73	3.63	21.6	12.1	0.56	5.82	580
174322	Krekling	17	Eiker-Sandsvær	U-Ord.	Schist	543224	6614755	61.15	1.15	21.08	1.34	0	1.33	0.06	0.95	5.95	0.19	5.43	98.63	475	203	63	107	42	74	63	1.93	15.5	19.7	1.27	5.95	320
174323	Krekling	17	Eiker-Sandsvær	U-Ord.	Schist	543224	6614755	62.53	1.09	20.53	1.99	0	1.53	0.36	0.72	5.79	0.26	4.7	99.5	618	368	77	115	61	40	63	0.80					
184313	Stablum gård	18	Eiker-Sandsvær	U-Ord.	Schist	542029	6612812	52.97	0.85	15.39	5.09	0	1.26	0.94	0.7	5.01	0.18	13.99	96.38	2725	5088	570	288	720	206	310	8.21					
184314	Stablum gård	18	Eiker-Sandsvær	U-Ord.	Schist	542029	6612812	60.22	0.82	15.24	3.83	0	1.21	1.51	0.82	4.53	0.52	9.99	98.69	925	328	328	210	507	88	325	5.40					
184315	Stablum gård	18	Eiker-Sandsvær	U-Ord.	Schist	542029	6612812	60.21	1.06	20.66	2.76	0	1.5	0.46	0.7	6.03	0.21	6.21	99.8	550	103	103	147	97	19	40	1.73					
184316	Stablum gård	18	Eiker-Sandsvær	U-Ord.	Schist	542029	6612812	60.5	1.15	20.68	2.57	0.01	1.61	0.86	0.7	6.02	0.21	6.05	100.36	700	80	83	168	180	16	25	1.50					
194314	Teigen	19	Eiker-Sandsvær		Schist	541932	6612579	56.54	0.75	13.99	6.25	0.03	1.85	2.3	0.72	3.91	0.28	12.77	99.39	2100	3392	150	300	693	158	355	6.19					
194315	Teigen	19	Eiker-Sandsvær		Schist	541932	6612579	59.61	1.16	19.44	3.49	0	1.73	0.86	0.79	5.64	0.24	6.61	99.57	2200	325	115	255	622	50	23	2.03					
194316	Teigen	19	Eiker-Sandsvær		Schist	541932	6612579	61.05	1.22	19.31	3.61	0	1.5	0.71	0.91	5.64	0.2	5.6	99.75	3250	195	98	175	124	29	5	1.16					