Table 1. Generalized stratigraphic succession of the Cretaceous deposits along the Ikushumbetsu Valley, central Hokkaido

Rock-stratigraphic units			Thickness (in m)		General lithology	Characteristic fossils	Stages	
Upper Yezo Group	Main part	Um	20(+)		Mudstone and sandy mudstone	*Inoceramus nihoensis* — *Inoceramus naumanni*	Upper Urakawan	Santonian
		Ul	50		Mudstone, occasionally sandy			
		Uk	40		Sandy mudstone, occasionally laminated			
		Uj	30		Mudstone, occasionally sandy			
		Ui	25		Siltstone, occasionally sandy			
		Uh	40		Mudstone and sandy mudstone			
		Ug	60		Mudstone, occasionally laminated			
		Uf	20		Sandy mudstone			
		Ue	30		Fine-sandy siltstone and silty fine-grained sandstone		Lower Urakawan	Coniacian
		Ud	30		Fine-sandy siltstone			
		Uc	30		Fine-sandy siltstone and silty fine-grained sandstone			
	Lowermost part	Ub	60		Fine-sandy siltstone	*Inoceramus amakusensis* — *Inoceramus japonicus*		
					Fine-sandy siltstone and silty fine-grained sandstone			
		Ua	80(?)		Fine-sandy siltstone	*Inoceramus teshioensis* — *Inoceramus uwajimensis* — *Reesidites minimus*	Upper Gyliakian	Turonian
					Fine-sandy siltstone and silty fine-grained sandstone			
Middle Yezo Group	Mikasa Formation	Td	170		Medium-grained sandstone with conglomerate			
					Fine-grained sandstone			
					Fine-sandy siltstone with fine-grained sandstone			
		Tc	65		Siltstone	*Inoceramus hobetsensis*		
		Tb	140		Fine-sandy siltstone and silty fine-grained sandstone			
					Silty fine-grained sandstone			
					Fine-grained sandstone, occasionally silty			
		Ta	35		Fine-sandy siltstone	*Desmoceras* (*Pseudouhligella*) *japonicum*	Lower Gyliakian	Cenomanian
	Main part	Me	Me_2	35	Laminated sandy siltstone	*Inoceramus* cf. *labiatus*	Infra-gyliakian	
			Me_1	75	Medium- to coarse-grained sandstone, massive to thick-bedded			
		Md	Md_3	100	Laminated sandy mudstone	*Mortoniceras* (*Durnovarites*) sp.	Miyakoan	Albian
			Md_2	120	Laminated sandy mudstone and laminated mudstone			
			Md_1	80	Laminated mudstone and laminated sandy mudstone			
		Mc	120		Medium- to coarse-grained sandstone	*Mortoniceras* (*Cantabrigites*) *imaii*		
		Mb	Mb_2	140	Sandstone and mudstone in alternation and laminated sandy mudstone	*Desmoceras kossmati*		
			Mb_1	80	Sandstone and mudstone in thin-bedded alternation			
		Ma	Ma_3	80	Laminated sandy mudstone			
			Ma_2	170	Laminated sandy mudstone and laminated mudstone			
			Ma_1	50 (+)	Sandstone and mudstone in thin-bedded alternation			

Table 2. Lithological data from some selected sections in the Cretaceous flysch sequence of the Ikushumbetsu area

The data are given in percentages. The percentages shown in item of sole markings are calculated on the basis of the number of soles exposed.

	Mb_1			Mb_2			Mc	Me		
	Facies α Ikushumbetsu Valley	Facies β Nunobiki-no-sawa	Facies γ Honsawa	Facies α Ikushumbetsu Valley	Facies β Nunobiki-no-sawa	Facies γ Honsawa	Facies α Ikushumbetsu Valley	Facies δ Pombetsu Valley		
								Division B	Division E	Division F
THICKNESS OF THE SECTION (IN M)	9.10	9.99	7.13	40.17	10.87	8.14	36.74	10.71	14.32	8.63
NUMBER OF GRADED UNITS	86	57	80	67	52	66	91	134	105	81
LOWER CONTACT OF SANDSTONE LAYER										
Sharp — Strongly undulating	—	—	—	6.0	—	—	—	—	—	—
Sharp — Moderately undulating	4.6	31.6	—	50.8	51.9	3.0	31.9	9.0	6.7	2.5
Sharp — Weakly undulating	38.4	66.6	11.2	25.4	34.6	22.7	62.6	89.5	54.3	63.0
Sharp — Flat	37.2	1.8	62.5	13.3	13.5	50.1	5.5	1.5	34.3	32.0
Gradual Irregular	19.8	—	26.3	4.5	—	24.2	—	—	4.7	2.5
BOUNDARY BETWEEN SANDSTONE LAYER AND OVERLYING SHALE LAYER										
Sharp	29.1	17.5	26.2	62.7	31.4	25.8	32.8	52.2	33.5	16.0
Gradual	70.9	82.5	73.8	37.3	68.6	74.2	67.2	47.8	66.5	84.0
GRAIN SIZE AT BASE OF SANDSTONE LAYER										
Very coarse- to coarse-grained sand	—	—	—	—	—	—	3.3	—	—	—
Coarse-grained sand	—	3.5	—	—	—	—	9.9	—	—	—
Coarse- to medium-grained sand	—	1.8	—	13.3	—	—	21.9	—	—	—
Medium-grained sand	—	19.3	—	22.4	3.8	—	26.4	—	—	—
Medium- to fine-grained sand	19.8	21.1	—	22.4	25.0	1.5	16.5	23.1	10.5	11.1
Fine-grained sand	51.2	52.5	41.3	32.9	55.8	28.8	18.7	76.9	82.9	72.9
Very fine-grained sand	20.9	1.8	37.5	6.0	15.4	60.6	3.3	—	6.6	14.8
Sandy silt	8.1	—	21.2	3.0	—	9.1	—	—	—	1.2
GRADED BEDDING IN SANDSTONE LAYER										
Distinct	1.2	33.3	2.5	29.9	13.5	—	26.4	11.2	6.3*	6.2
Rather distinct	4.7	7.0	—	—	9.6	—	11.0	0.7	1.0*	1.2
Composite graded bedding	—	—	—	1.5	—	—	6.5	—	—	—
Multiple graded bedding	—	—	—	—	—	—	33.0	—	1.0*	—
LITHOLOGICAL COMPOSITION OF GRADED UNIT										
Shale layer absent	—	—	—	—	—	—	33.0	—	1.0	—
Graded sandstone division present	24.4	68.4	33.7	89.4	82.7	45.5	95.6	64.9	41.0	76.5
Massive mudstone division present	74.4	50.9	70.0	34.8**	45.1**	51.5	5.5	23.9	54.5**	46.9
PROPORTION OF GRADED DIVISION TO SANDSTONE LAYER (IN PERCENT)										
0 – 20	94.2	38.6	66.3	13.4	19.3	62.2	5.5	38.1	67.6	27.2
20 – 40	4.7	24.6	16.2	6.0	15.4	10.6	—	18.7	11.4	11.1
40 – 60	—	12.3	7.5	10.4	11.5	13.6	2.2	8.2	6.7	11.1
60 – 80	—	14.0	7.5	6.0	13.5	10.6	12.1	23.1	3.8	23.4
80 –100	1.1	10.5	2.5	64.2	40.3	3.0	80.2	11.9	10.5	27.2
SOLE MARKINGS										
Number of soles exposed (in percent)	74.4	26.3	55.0	79.1	51.9	59.1	60.4	63.4	57.1	58.0
Flute casts	21.9	6.7	2.3	24.5	14.8	—	29.1	27.0	26.7	17.0
Longitudinal furrows and ridges	—	—	—	3.8	—	—	1.8	—	—	—
Groove casts	1.6	—	2.3	32.1	3.7	—	1.8	2.4	3.3	—
Bounce casts	—	—	—	8.8	—	2.6	—	3.5	3.3	—
Prod casts	—	6.7	—	1.9	—	—	—	1.2	—	—
Striation casts	4.7	20.0	2.3	24.5	—	2.6	12.7	14.1	11.7	4.3
Load casts	12.5	—	—	43.5	—	5.1	9.1	35.3	21.7	19.1
Tracks and burrows	12.5	—	—	7.5	—	—	9.1	35.3	20.0	6.4
INTERNAL STRUCTURES AND TOP SURFACE STRUCTURES										
Parallel lamination	80.2	93.0	81.3	98.5	70.6	77.3	71.4	67.9	74.3	75.3
Cross-lamination	89.5	86.0	75.0	43.3	53.8	78.8	20.9	78.3	84.8	53.1
Current ripple lamination	10.5	3.5	1.3	11.9	—	—	1.1	3.7	2.9	1.2
Wavy lamination	2.3	1.8	1.3	1.5	1.9	1.5	1.8	6.0	15.2	8.6
Convolute lamination	3.5	7.0	1.3	3.0	—	10.6	1.1	—	4.8	3.7
Current ripple marks	8.2	—	—	3.0	—	—	3.3	3.7	11.4	—
SHALE FRAGMENTS IN SANDSTONE LAYER	2.3	1.8	—	10.4	—	1.5	5.5	2.2	1.9	—
CARBONACEOUS FLAKES IN SANDSTONE LAYER										
Abundant	—	10.5	—	6.0	—	—	1.1	1.5	1.9	1.2
Common	32.6	45.6	3.7	11.9	7.7	27.3	4.4	13.4	19.0	4.9
Scarce	62.8	43.9	43.8	26.9	26.9	37.9	24.2	82.1	76.2	85.3
Rare or not found	4.6	—	52.5	55.2	65.4	34.8	70.3	3.0	2.9	8.6

* For number of sandstone layers see Table 16.
** For number of graded units see Table 4.

Table 22. Number of palaeocurrent measurements for the main part of the Middle Yezo Group in the Ikushumbetsu area

The data are given in numbers of sandstone layers dealt with for measurements. Bounce casts, prod casts and striation casts that have the same orientation as the flute casts or groove casts on the same sole are omitted here. For locations of station-members see Fig. 36.

Area	Station-member	Member or unit	Type of facies	Sole markings									Internal structures					Top surface structures	
				Flute casts	Longitudinal furrows and ridges	Groove casts	Bounce casts	Prod casts	Brush casts	Striation casts	Frondescent casts	Load casts	Cross-lamination	Current ripple lamination	Parting lineation	Shale fragment lineation	Carbonaceous flake lineation	Current ripple marks	
Pombetsu Valley	1	Up.(?).Me	δ	4															
	2	Low. Md_2	δ	10		1				1			2	1					
	3	Ma_3	δ	2															
	4	Mb_1	α	5		1													
	5	Up. Md_2	δ	2		1			1										
	6	Md_3	δ	4										1					
	7	Ma_3	α			1													
	8	Me A	δ	8			1	2						1	7		3		
		B		26		2	1			4			3	3	22	1	13		4
		C		11	1	3	1			3			4		21		4		
		D		4		1		1		1					8				
		E		16		2	2		1				1	3	7		2		6
		F		7						1		1			2				
		G		6											5				
		Total		78	1	8	5	3	1	9		1	8	7	72	1	22		10
	9	Ma_3	α	2		1													
	10	Mb_1	α	4										1					
Ikushumbetsu Valley	11	Up. Me	δ	2										2			5		
	12	Ma_2	α	2															
	13	Ma_1	α	2															
	14	Ma_2	α	4		2													
		Ma_3	α	1		1													
	15	Ma_1	α	1															
	16	Ma_3	α	1															
	17	Mb_1	α	17		1							4	5	7	1	2		5
		Mb_2	α	31	1	28*	2				1		1			2			
	18	Mc Low.	α	16	1	1										1			1
		Mid.		10		1				1									
		Up.		4		2	1	1											1
		Upm.		4															
		Total		34	1	4	1	1		1						1			2
	19	Md_1	α	2															
		Md_2	α	2															
Takambetsu	20	Me	α	6												1			
	21	Mb_1	β	3															
	22	Ma_3	β	3															
	23	Mb_1	β	2										3	2		1		
		Mb_2	β	1															
	24	Mc	β			3											5		
Pomporonai	25	Mb_1	β							1									
	26	Ma_3	β	1															
	27	Mb_1	β	3		1								3					
		Mb_2	β	3			1												
	28	Mc	β	3		1													
	29	Me	γ											1					
Nunobiki-no-sawa	30	Ma_2	β	1															
	31	Ma_3	β	1															
	32	Mb_1	β	2				1		3				1	5		2		
		Mb_2	β	4		1							1		6		3		
	33	Mb_1	β										1						
	34	Mb_1	β	2		1													
	35	Mb_1	β	1															
Honsawa	36	Mb_1	γ	3															
	37	Mb_1	γ	3		1				1			4		1		2		
		Mb_2	γ	2			1			2			2		2				
	38	Mc	γ	6		3													
Yamamoto-no-sawa	39	Mc	γ														5		
	40	Mb_1	γ	2		1													
		Mb_2	γ	3															
	41	Mb_1	γ	1															
		Mb_2	γ	3															
	42	Mc	γ	2															
Washi-no-sawa	43	Md	γ	2															
	44	Mc	γ	2						1									
Total				275	3	61	11	5	2	19	1	1	23	25	95	6	47		17

* 31 readings due to multiple orientation on some soles.