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Exploration of element contents in the selected rocks of the Slezské Beskydy Mts. (Czech Republic)

Průzkum obsahů prvků ve vybraných horninách Slezských Beskyd (Česká republika)

Keywords: Cenoman, Godula formation, REE, Slezské Beskydy Mts.

The Slezské Beskydy Mts. (309-1257 m a.s.l.) are border elevation of the West Carpathian Range in Central Europe (49°40´37,2´´N, 18°56´27,6´´E). In the south-western range in the Czech Republic we sampled rocks in the nine characteristic places. These places were selected according to the exploration of the forest site heterogeneity (SAMEC et al. 2010) (Tab. 1). The dating of the investigated rock samples was based on literature survey only (BUDAY et al. 1967; SKUPIEN 2005; STRÁNÍK & ŠVABENICKÁ 2004; GRADSTEIN & OGG 1996; GIBBARD & KOLFSCHOTEN 2004) (Tab. 2). We sampled sedimentary rocks dated from Upper Jurassic, Lower and Upper Ctretaceous to Oligocene and Quarter. The chemical analyses of the samples were made by the induced coupled plasma mass spectrometry (ICP-MS) concentrated to biogene plant nutrition-important macroelements (Ca, Mg, K, Na, P, Fe, Al) as well as to rare Earth elements (REE) (Tab. 3). An principal component analysis (PCA) was used for comparison of analytical results at aspects of similarities in macro- (MaE) and microelementar (MiE) rock compositions. Multivariate comparisons by MANOVA of the component vectors (SAMEC 2008) among the particular localities was applied for evaluation of significances in their elementar dissimilarities.

MaE contents are relativelly homogeneous in all observed strata. Cattel's index graphs confirmed that sums of the elementar majority were significantly depended on one genetic distribution factor (Fig. 1). Especially, the MiE have explainable about 70 % of the variability in distribution by one factor only. However, some unspecific component influences from element's distribution correspond with detection of outliers from the samples. The contents of alluminium, iron and potassium are correlative potentially in all observed cases. The contents of calcium, phosphorus and natrium are influenced by some different factors (Fig. 2). Contents of magnesium, plumbum and cobalt seem as difficultly correlative with any different element in factor's level. In contrast, the two clusters were obtained from MiE: first, the cluster of REE; and second, the cluster of another microelements or heavy metals (Fig. 3). Relative common signs in elementar distribution are driven by similarities of the sampled localities. Significant similar compositions of the observed MaEs were detected for all samples of the Godula sandstones. Another samples have definitely unprecedent contents of the soil forming MaE (Fig. 4).

The PCA for the MiE detected that the only two Jurassic nad Lower Cretaceous samples had very similar REE contents but not directly depended on any component factors. The sample of the loams has unprecedent contents of the REE so that it is the outlier. REE from the Godula sandstones are significantly influenced by the most mark component factor with slow affects by another low significant factor (Fig. 5).

The analysed rocks could be evaluated in two aspects after a special MiE presence. Some elements have slightly higher contents in younger deposits than in older deposits. Contents of zirconium and barium occur in front of them (Fig. 6). They are higher order than main population of MiEs as well as they significantly increased in deposits after Cenoman (including Quaternary terrestrial loams). All MiEs have one common presence of local minimum in the sample from the Cenomanian sandstone (Střelma). On the other hand, the comparison of the possible differences between populations of the component vectors of elementar distributions are among the particular localities that did not confirm any significance in different chemistry. The ANOVA's *F*-test criterion did not reach over 1.99 at critical level $F_{0.05}$ (4.39).

The observed rock samples have significantly similar contents of acid making metals [Σ (Fe; Al; Mn)] and they have significant differences in contents of phosphorus and total bases (Ca, Mg, K). Using of the PCA for the selected rock samples elementar evaluations suggest that genetic factors in sedimentary evolution of the Slezské Beskydy Mts. could divide according to mainly ocean and semi-terrestrial cycles which could have been possible in cases of some obtained similarities. REE distribution and total content probably indicate some fluctuations in the evolution and provenance of the flysch deposits in Slezské Beskydy Mts.

Tab. 1. Geographical and petrographical parameters of the rock sample locations
Tab. 1. Geografická a petrografická specifika vybraných lokalit

No.	Locality	GPS (°)		Altitude (m)	Rock	Formation
		N	E			
1	Karpentná	49°37′48′′	18°40′8,4′′	407	siltstone	Quaternary Aeolian Formation
2	Kempa	49°33′10,8′′	18°50′9,6′′	520	slightly calcerous sandstone	the Krosno Formation
3	Ostrá hora	49°33′46,8′′	18°50′2,4′′	576	polymictic sandstone	the Istebna Formation
4	V Pasekách	49°37′33,6′′	18°45′46,8′′	533	sandy claystone	the upper part of the Godula Formation
5	Loučka	49°37′30′′	18°46′12′′	692	glauconitic sandstone	the middle part of the Godula Formation
6	Brandýs	49°41′31,2′′	18°45′32,4′′	597	siliceous claystone	the lower part of the Godula Formation
7	Střelma	49°39′25,2′′	18°47′27,6′′	499	The Ostravice (glauconitic) sandstone	the varried group of the Godula Formation
8	Mionší	49°39′10,8′′	18°47′38,4′′	550	siliceous claystone	the Lhoty Formation
9	Karpentná	49°38′2,4′′	18°40′8,4′′	407	calcerous claystone	the lower part of the Teschenite Formation

Tab. 2. Stratigraphy and identification of leading events according to the sampled rocks
Tab. 2. Stratigrafické zařazení a určení hlavních událostí formování vzorkovaných hornin

No.	Estimated age (Ma)	Strata	Event	Tectogenesis
1	1	würm	Kataglacial	Saxonian
2	33	Lower Oligocene	Sea trangression	Crosnenian
3	87	Upper Senon	Sea regression	Laramian
4	89	Turon/Senon	Sea trangression	Subhercynian
5	93	Turon	Sea trangression	
6	94	Cenoman/Turon	Sea regression	Mediterran
7	98	Cenoman	Sea trangression	
8	112	Alb	Sea trangression	
9	151	Tithon	Sea trangression	Upper Kimerian

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Tab. 3. ICP-MS analyses of the investigated sediment rocks
Tab. 3. Primární výsledky ICP-MS analýz vybraných vzorků hornin

Component	**Sample**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
Macroelements (%)	Na_2O	1.23	0.64	1.45	1.15	1.37	1.89	1.41	0.48	0.79
	MgO	0.94	1.63	1.29	0.31	1.24	1.16	0.28	1.28	0.85
	Al_2O_3	5.43	14.37	4.17	7.16	4.86	6.24	6.62	12.64	11.61
	P_2O_5	0.07	0.13	0.16	0.09	0.22	0.23	0.34	0.21	0.26
	K_2O	0.85	3.79	1.08	0.88	0.91	1.43	1.95	1.67	1.44
	CaO	1.78	0.97	1.14	0.78	0.62	0.85	0.37	0.54	1.52
	MnO	0.32	0.68	0.51	0.54	0.43	0.57	0.38	0.43	0.74
	FeO_{tot}	1.12	4.22	2.23	1.82	1.48	1.76	1.04	2.16	3.97
Microelements (ppm)	Li	33.75	36.56	7.55	29.43	62.18	10.45	25.11	54.54	29.93
	Be	1.29	0.80	0.37	1.31	1.41	0.74	1.03	1.19	1.20
	V	33.44	21.87	6.11	34.30	49.53	11.76	34.79	49.53	56.66
	Cr	15.46	14.30	0.00	38.12	35.69	8.83	17.99	36.66	54.65
	Co	43.74	12.24	0.68	5.35	7.51	0.63	3.17	6.75	5.10
	Ni	10.54	26.40	2.03	12.70	20.63	2.28	8.53	15.68	14.24
	Cu	3.83	9.35	1.70	7.73	6.52	1.46	3.00	7.04	8.13
	Zn	31.42	62.93	10.64	43.94	78.64	12.53	31.82	65.72	45.44
	Ga	7.39	4.92	2.09	8.56	10.95	5.05	7.45	10.38	11.61
	Rb	45.89	27.13	29.43	53.77	81.70	68.04	75.82	84.20	88.29
	Sr	36.98	76.14	13.36	46.72	85.47	38.75	57.50	56.36	75.01
	Y	6.93	17.57	1.92	14.91	14.38	8.64	5.37	11.29	27.90
	Zr	167.23	135.38	43.40	228.95	151.30	166.24	110.49	186.14	453.91
	Nb	6.55	5.15	1.79	10.46	8.98	3.88	4.81	8.13	17.51
	Mo	0.39	0.23	0.12	0.48	0.37	0.30	0.16	0.16	0.44
	Cs	1.13	1.56	0.88	1.84	3.61	1.45	2.23	3.02	3.27
	Ba	224.56	213.56	122.19	158.52	341.25	341.25	426.01	329.14	437.02
	La	20.86	12.20	4.29	24.40	25.25	9.20	12.81	15.01	30.74
	Ce	46.66	27.14	7.17	56.53	50.02	17.72	24.34	31.63	59.33
	Pr	4.52	3.18	0.68	5.34	5.51	2.05	2.37	3.47	6.63
	Nd	16.04	13.22	2.24	19.77	19.99	7.65	8.67	12.99	24.62
	Sm	2.64	3.23	0.32	3.91	3.51	1.54	1.38	2.55	4.83
	Eu	0.33	0.78	0.09	0.54	0.69	0.30	0.30	0.46	0.79
	Gd	1.94	3.43	0.31	3.08	2.91	1.24	1.10	1.97	4.07
	Tb	0.27	0.51	0.04	0.48	0.43	0.19	0.16	0.32	0.70
	Dy	1.48	2.95	0.31	2.80	2.66	1.40	0.90	1.83	4.33
	Ho	0.28	0.58	0.07	0.55	0.53	0.30	0.21	0.41	0.91
	Er	0.79	1.50	0.22	1.57	1.57	0.91	0.69	1.20	2.74
	Tm	0.13	0.24	0.04	0.26	0.25	0.14	0.11	0.19	0.43
	Yb	0.82	1.46	0.25	1.62	1.54	1.00	0.73	1.26	2.94
	Lu	0.12	0.20	0.04	0.24	0.24	0.15	0.12	0.21	0.44
	Hf	4.62	3.64	1.28	6.68	4.13	4.88	3.02	4.82	11.75
	Ta	0.57	0.43	0.19	1.01	0.84	0.41	0.40	0.73	1.38
	Pb	35.51	14.87	10.08	12.80	15.68	13.84	20.64	21.79	17.87
	Th	8.75	4.09	1.17	9.85	5.98	3.90	3.98	5.16	10.97
	U	1.35	1.48	0.56	2.37	1.85	1.12	0.89	1.71	2.86
Rations	U/Pb	0.04	0.10	0.06	0.19	0.12	0.08	0.04	0.08	0.16
	Th/Pb	0.25	0.28	0.12	0.77	0.38	0.28	0.19	0.24	0.61
	Th/U	6.49	2.77	2.10	4.15	3.23	3.47	4.46	3.01	3.84
	Nb/Ta	11.55	11.89	9.62	10.40	10.66	9.57	11.97	11.20	12.72

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Fig. 1. Cattel's index graphs of calculated component vectors influencing distributions of the macroelements and microelements

Obr. 1. Cattelův indexový graf zahrnutého rozptylu v komponentních vektorech ovlivňujících rozdíly v distribuci makroprvků a mikroprvků

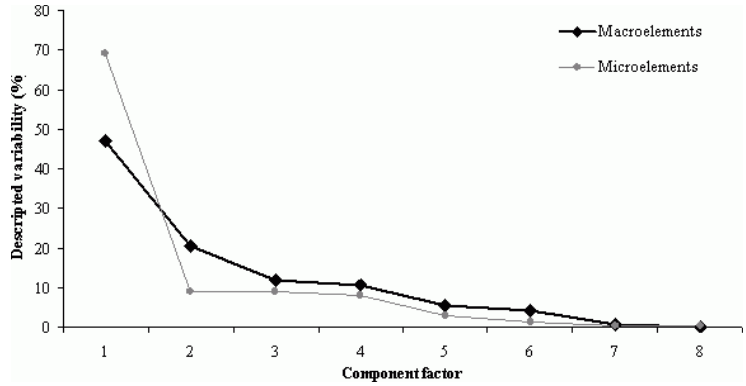


Fig. 2. Relations among component macroelemental variables

Obr. 2. Vztahy mezi komponentními proměnnými makroprvků

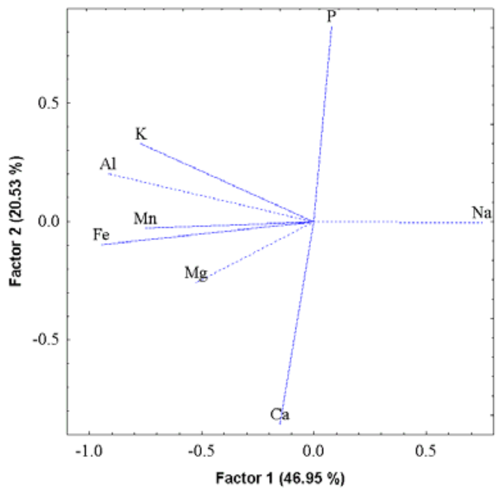


Fig. 3. Relations among component microelemental variables

Obr. 3. Vztahy mezi komponentními proměnnými mikroprvků

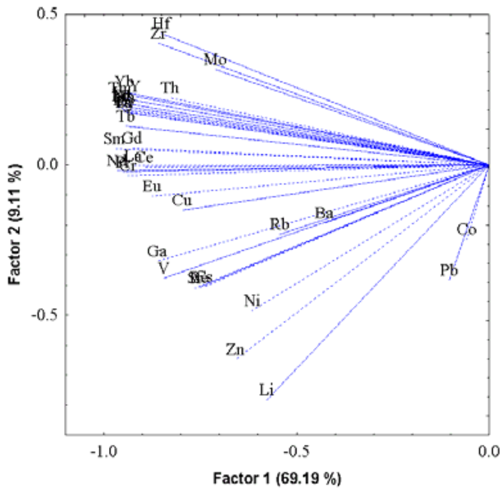


Fig. 4. Relations among macroelementar component levels of the particular samples
Obr. 4. Vztahy obsahů makroprvků z různých vzorků ve faktorové rovině

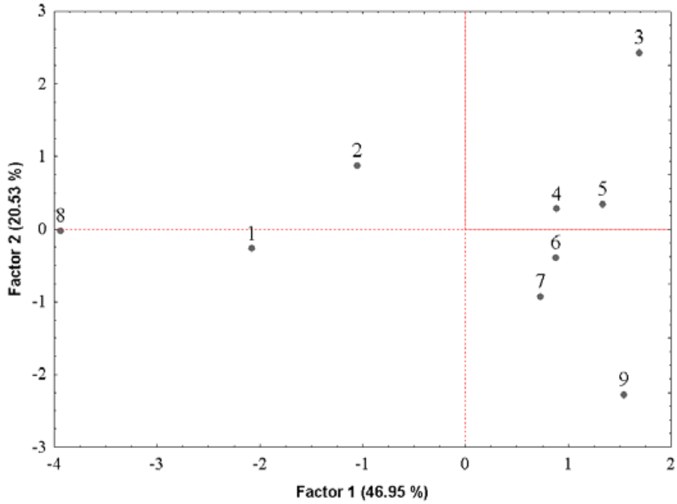


Fig. 5. Relations among microelementar component levels of the particular samples
Obr. 5. Vztahy obsahů mikroprvků z různých vzorků ve faktorové rovině

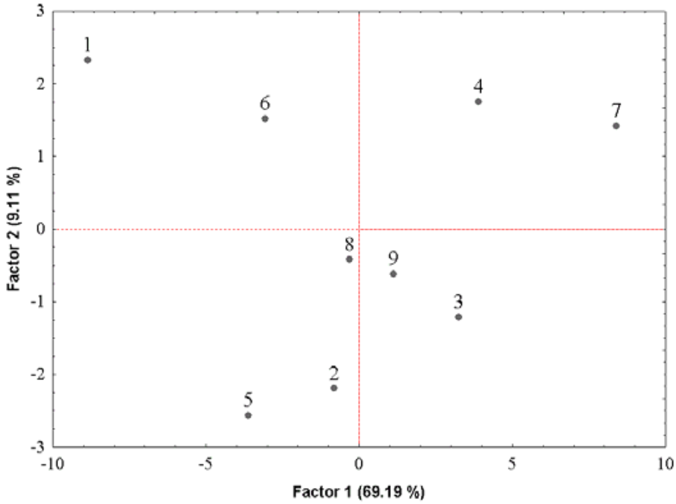
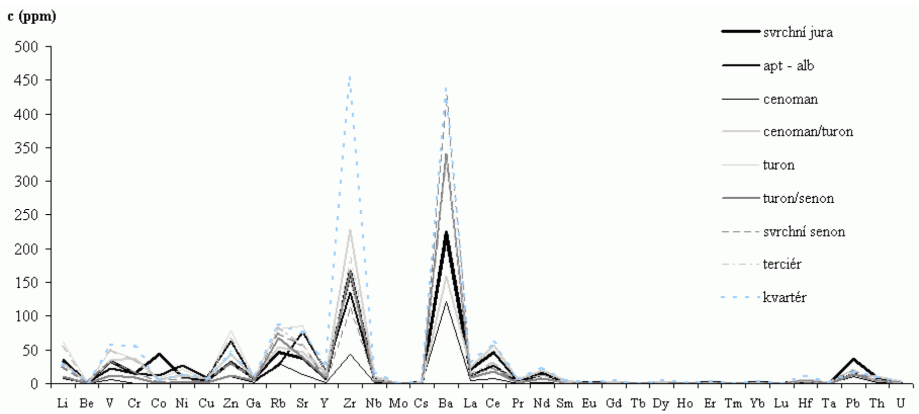


Fig. 6. Mass number natural line of microelemental occurence in sampled sediments of the Slezské Beskydy Mts.
Obr. 6. Přirozená posloupnost obsahů prvků ve vzorkovaných sedimentech ze Slezských Beskyd



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Large-areal land slide on Girová Mt., Jablunkovské mezihoří Intermountains (Czech Republic)

Velkoplošný sesuv zeminy na hoře Girová, Jablunkovské mezihoří (Česká republika)

Keywords: land slide, Planosols, Gleysols, Moravskoslezské Beskydy Mts., Czech Republic

In May 2010 extensive floods after several-days running rains afflicted Central Europe. The 20- and 50-years outflows of flood waters affected the major part of the Moravskoslezské Beskydy Mts. However, more than 100-years outflow afflicted for example the Olše (Olza) basin. During the floods more than 70 land slides occurred athwart the Moravian-Silesian District, another land slides occurred near Havířov, Skalice, Dolní Domaslavice, Fryčovice and Kunčice pod Ondřejníkem.

Evidently one from the largest land slide in the modern history of the Czech Republic arose on the 19.V.2010 during 5-6 a.m. on south slopes westward from the Girová Mt. top (840 m a.s.l.). We observed the stage of the land slide on the 25.V.2010. We explored the whole affected area and fixated as body of way points by GPS PDA. Vectorization of the generated point field was made in GIS TopoL 8.0. We obtained volumes and tree species compositions of affected woods by projection with graphical national database of the forest management plans/tissues using SQL Server 2000. During the field exploration we made reconnaissance of soil types. We created detail reconstruction of soil map of the afflicted area. Soil taxonomy was used according to the ISRIC-ISSS-FAO (DRIESSEN et al. 2001). According to the approach of ŽÁRNÍK (2008) based on the soil unit presence we executed review of forest site typological classification. The classification terminology was used according to VIEWEGH et al. (2003). Because definitions of some edaphic categories (EC) need informations about another macroscopical signs as well as the base saturation except basic knowledg on soil types (but chemical data are not disponsable), for identifications of the EC we had to respect known data about prevalent forest typological units from the whole Moravskoslezské Beskydy Mts. natural forest area (HOLUŠA et al. 2000). We pressume that whole area belongs to the fir-beech forest vegetation tier.