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Stratigraphy and correlation of the Upper Cretaceous

Roland Nádaskay, Jaroslav Valečka, Thomas Voigt, Doreen Müller



LANDESAMT FÜR UMWELT,
LANDWIRTSCHAFT
UND GEOLOGIE

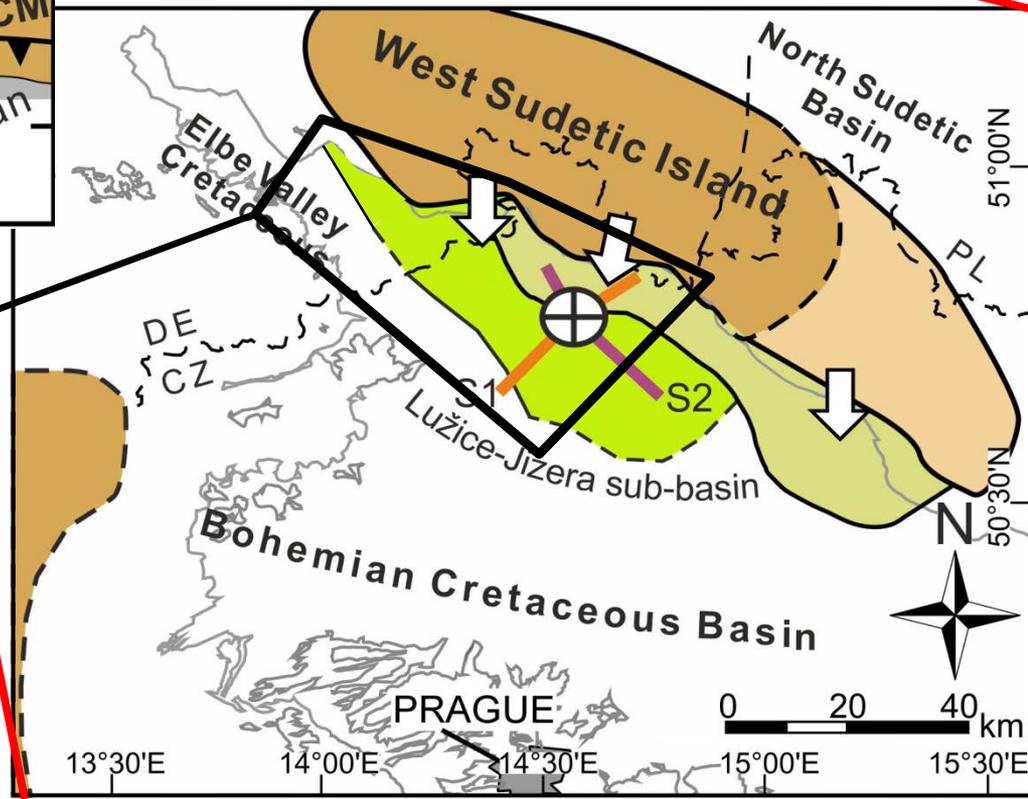
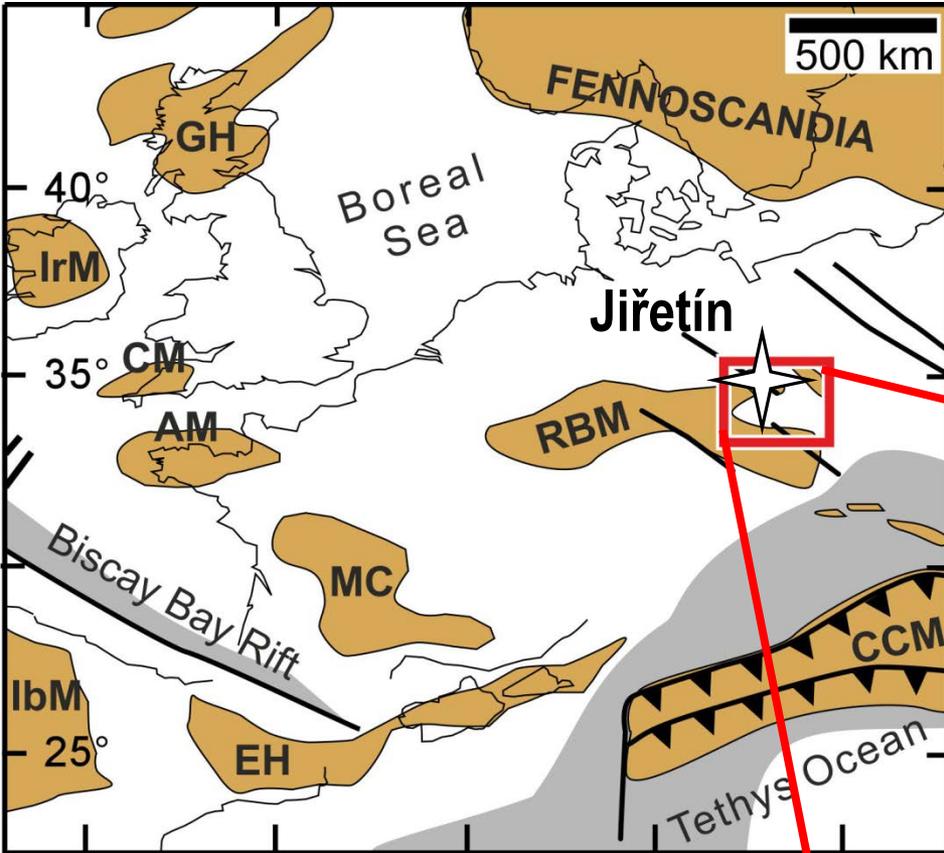


ČESKÁ
GEOLOGICKÁ
SLUŽBA



Bohemian Cretaceous Basin

within the Late Cretaceous Europe



Sandstone-dominated part of the Saxon-Bohemian Cretaceous Basin

Paleogeography of the Late Cretaceous (emerged lands vs. marine realms)

Large outcrops along the valley of the Elbe river (Saxony –Schrammsteine)



Schrammst.-Fm.

Postelwitz-Fm.

Sandstein e

Sandstein d

Sandstein c

Sandstein b

Sandstein a

Facies of sandstones 1



Middle Turonian (Postelwitz Formation,
sandstone b, Postelwitz quarries,
Winterberg)

coarse-grained to conglomeratic
sandstones, massive to indistinctly bedded
Important marker horizons

Facies of sandstones 2



Lower Turonian (Bila Hora fm. = Schmilka fm.), Tissaer Wände, Bielatal)

Cross-bedded, medium-grained sandstones, partly bioturbated

Facies of sandstones 3



Middle Turonian (Postelwitz Formation, sandstone a, Postelwitz quarries)

Fine- to medium-grained bioturbated sandstones with coarse and fine interlayers.

Facies of sandstones 4



Lower Turonian (Schmilka Formation, Pirna, Middle Turonian (Jizera Formation Belveder), Upper Turonian und Lower Coniacian

Fine-grained bioturbated sandstones, massive, rare calcareous cements

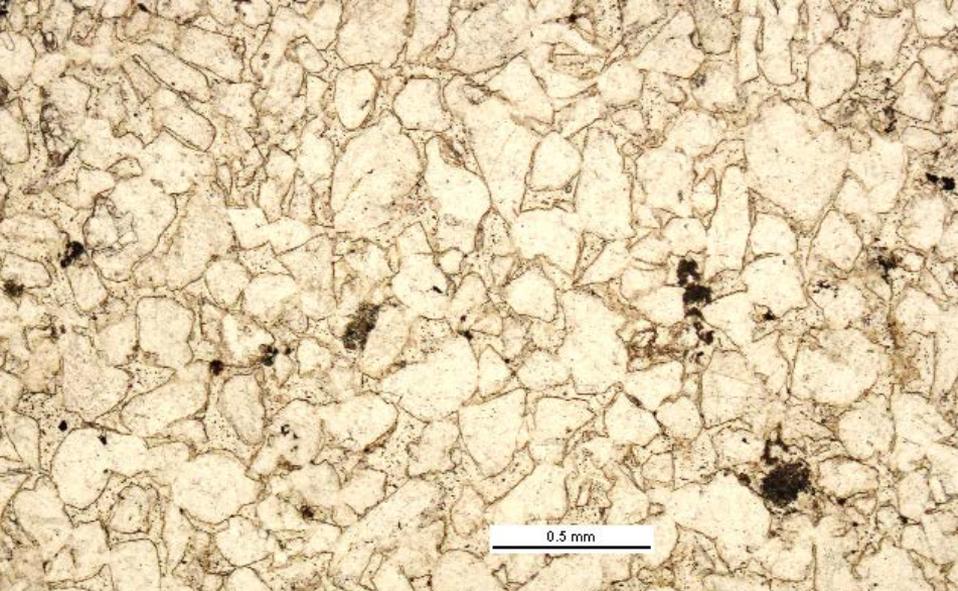
gradually transitions to siltstones and mudstones!

Facies of mudstones

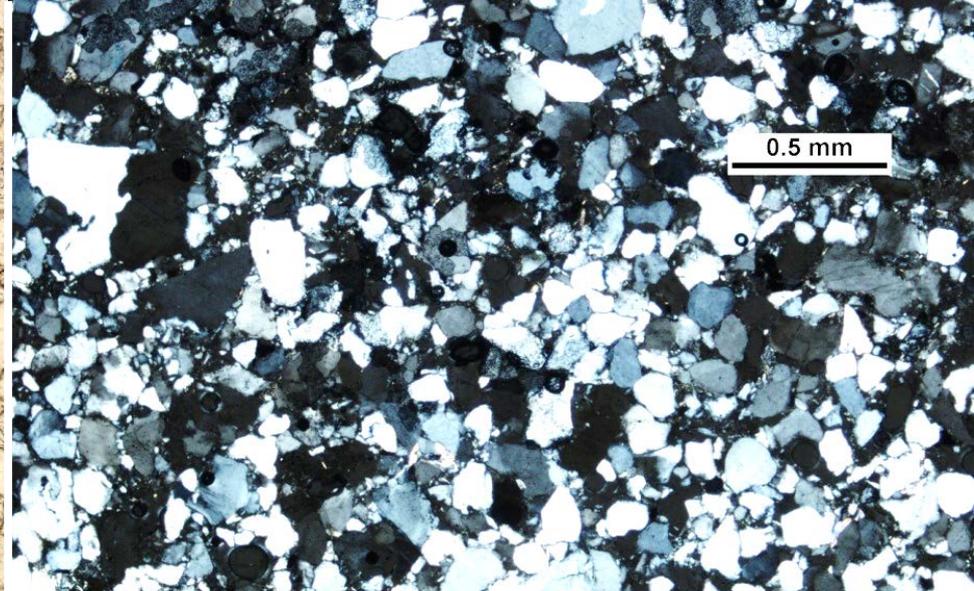


Middle Turonian (Postelwitz Formation, Lamarcki Pläner, Raum) Lower Turonian (Briesnitz formation, borehole Nasser Grund)

Sandy and clayey siltstones with (with sandstone interlayers and sand-filled burrows)



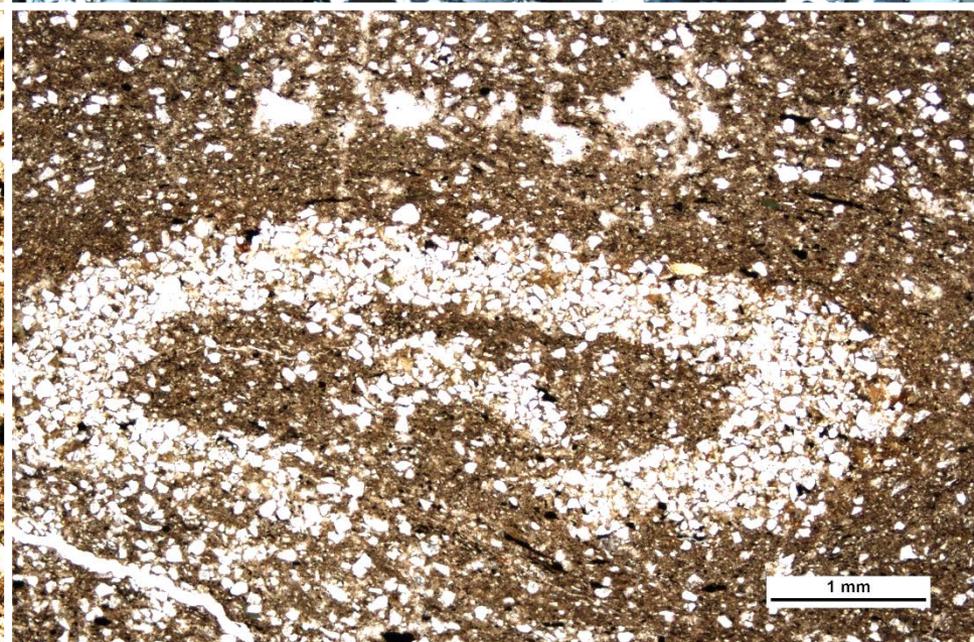
Medium-grained Qtz-sandstone, well-sorted
(borehole 4650_X Svor)



Fine-medium-grained Qtz-sandstone (6412_L Lesné)

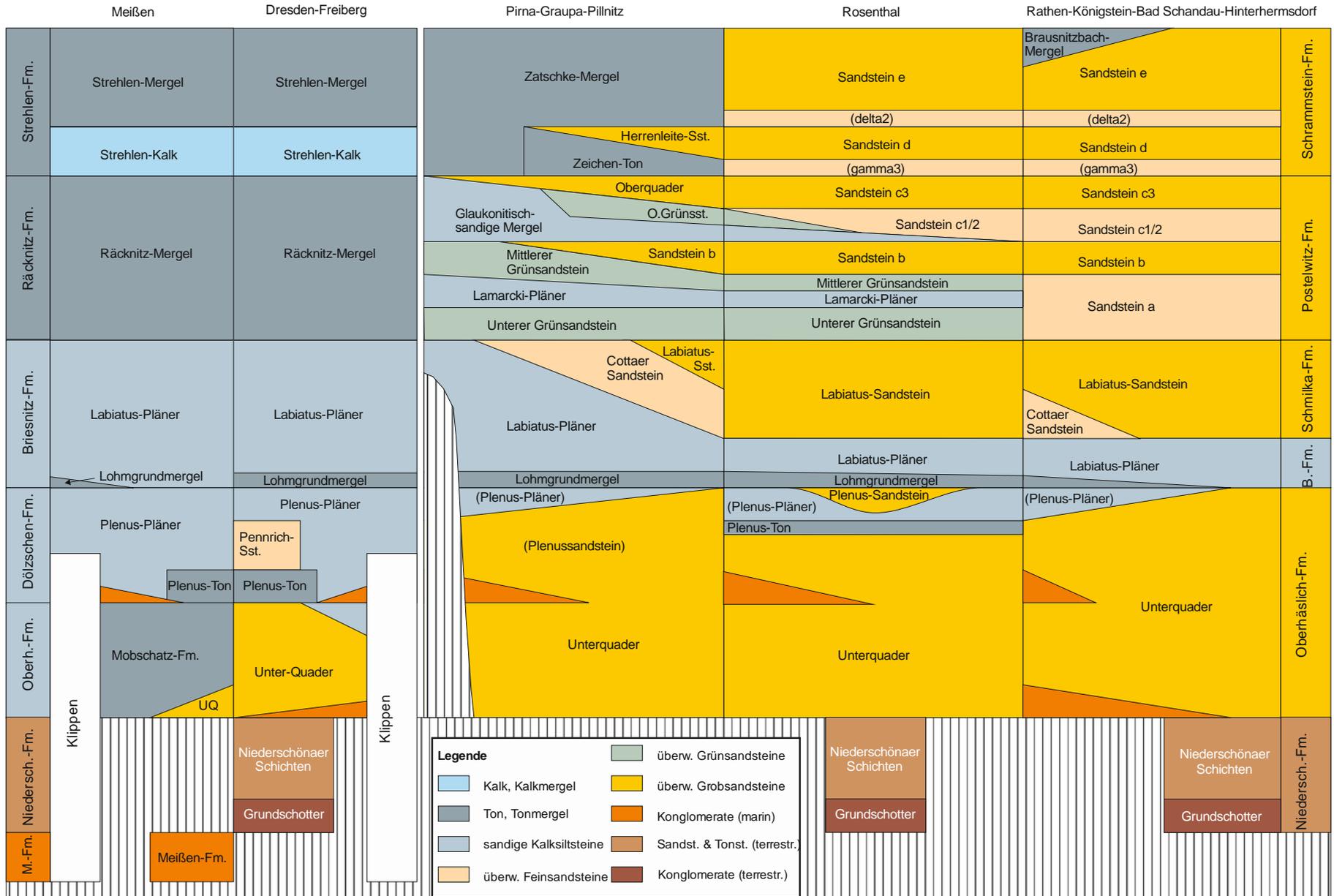


Mudstone, calcareous, with admixture of
sand and glauconite (4650_X Svor)



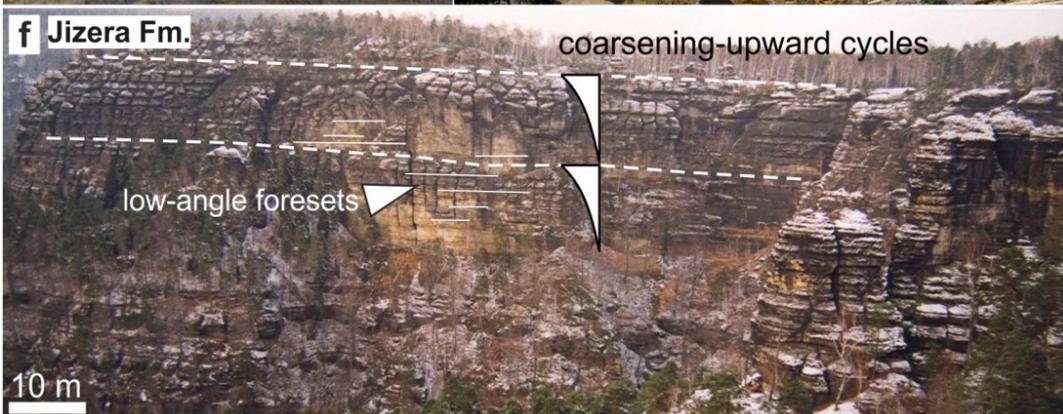
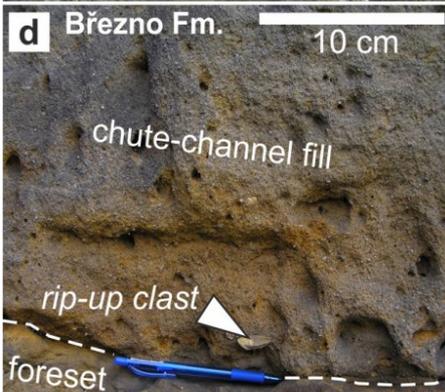
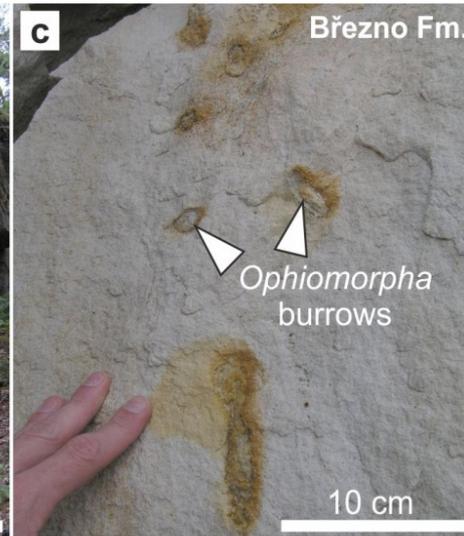
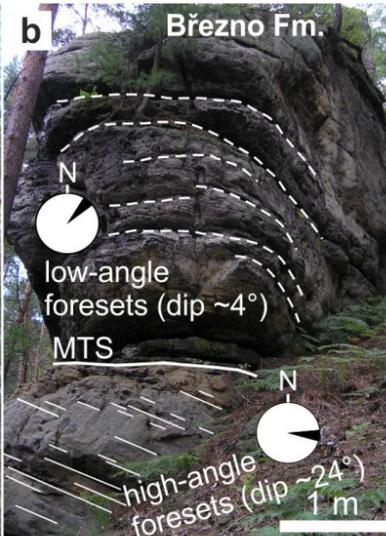
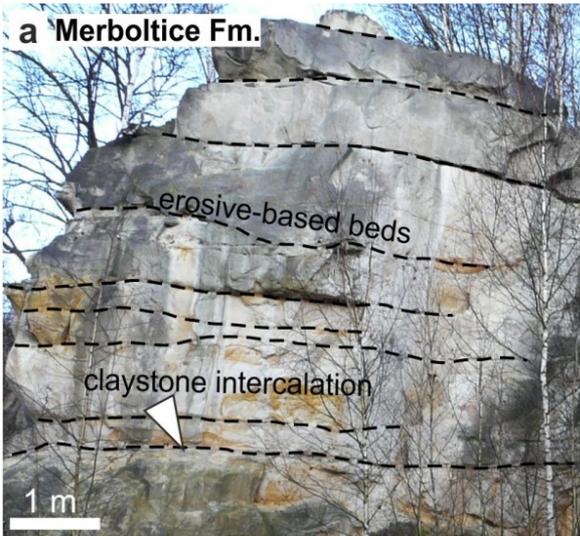
Sandy mudstone with burrows (4650_A Skalice)

Formal lithostratigraphic units and correlation in Germany (Formalisation for HYK50)



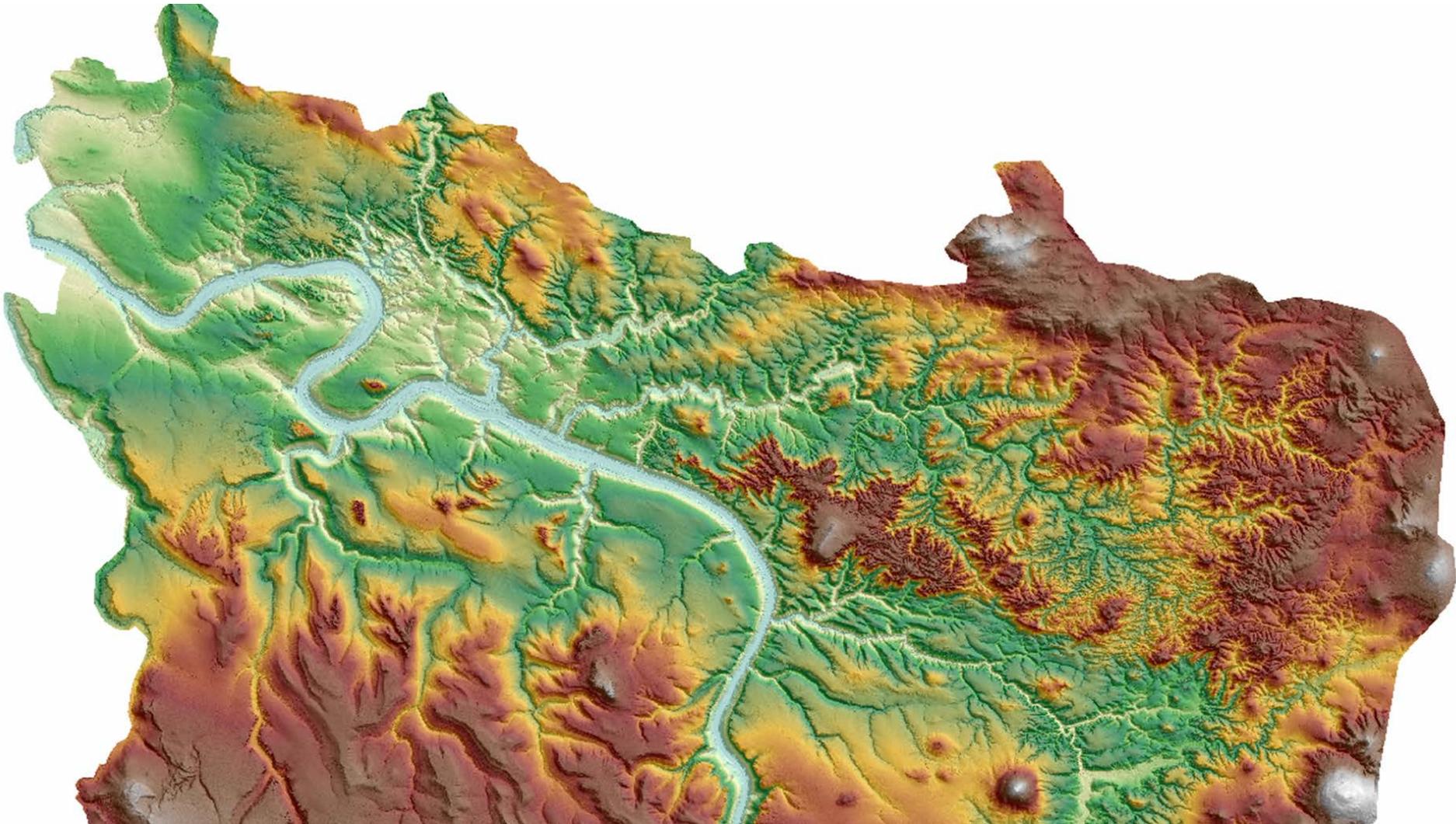
Shallow-marine (nearshore to deltaic) sandstones on the NW part of the BCB (top to bottom: younger to older formations)

Different geometries and internal arrangement of the sandstone strata result from slightly different depositional setting

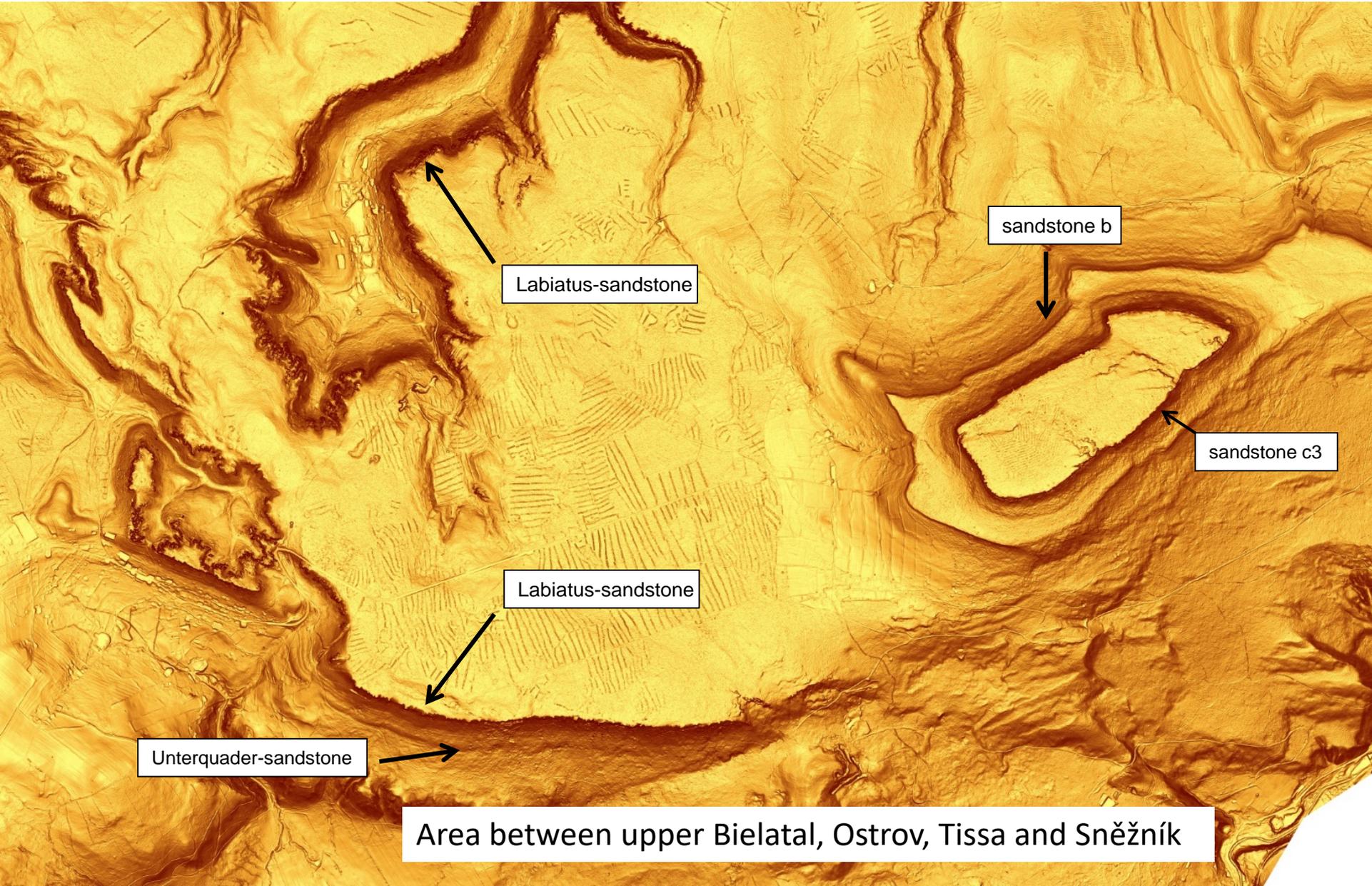


3D-Model for groundwater use

Necessary: borehole data and surface mapping



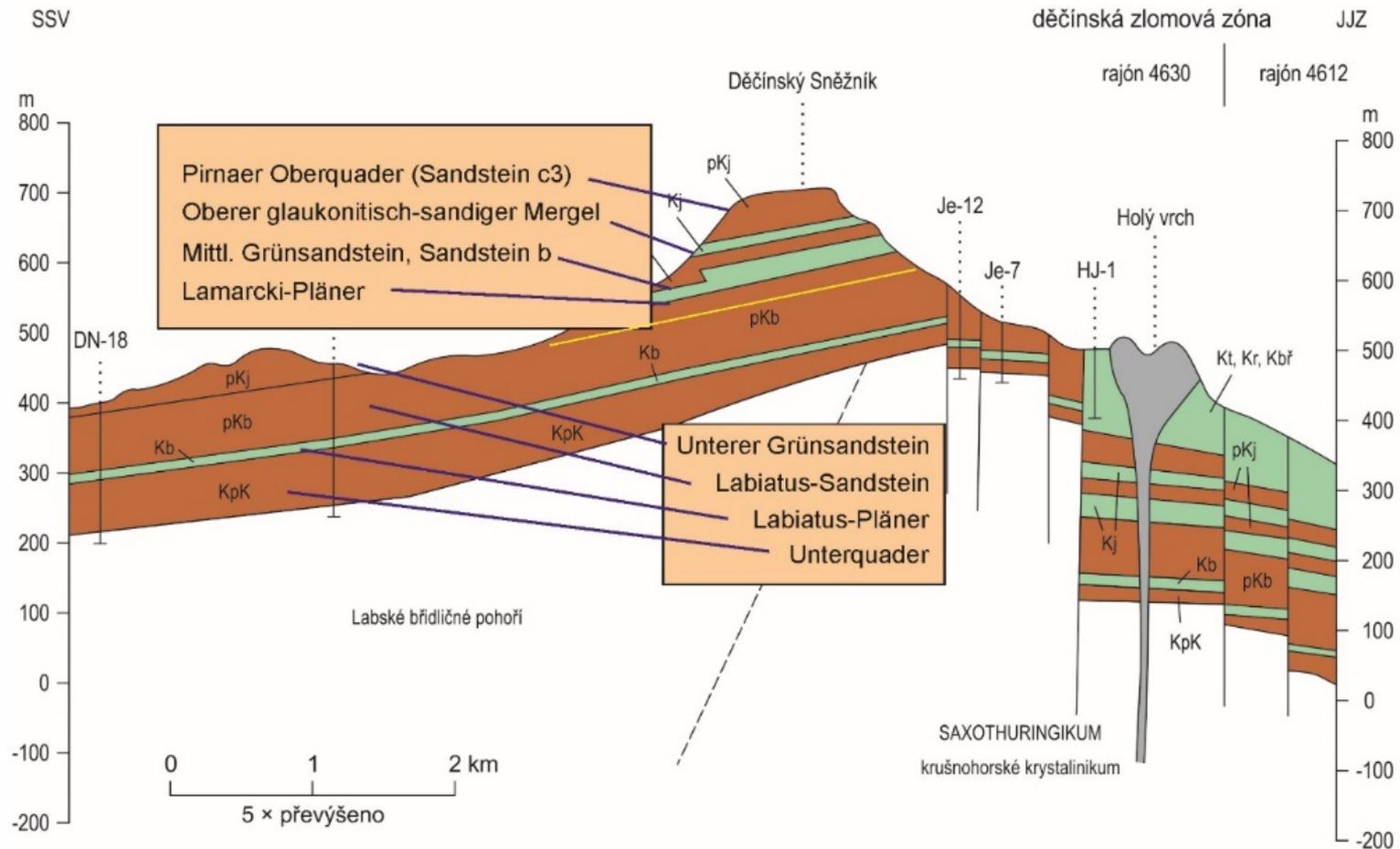
Digital Elevation Model: lithostratigraphy across the borders,
Additionally: occurrence and absence of faults



Key region 1 for correlation of the Jizera Formation with the Postelwitz Formation

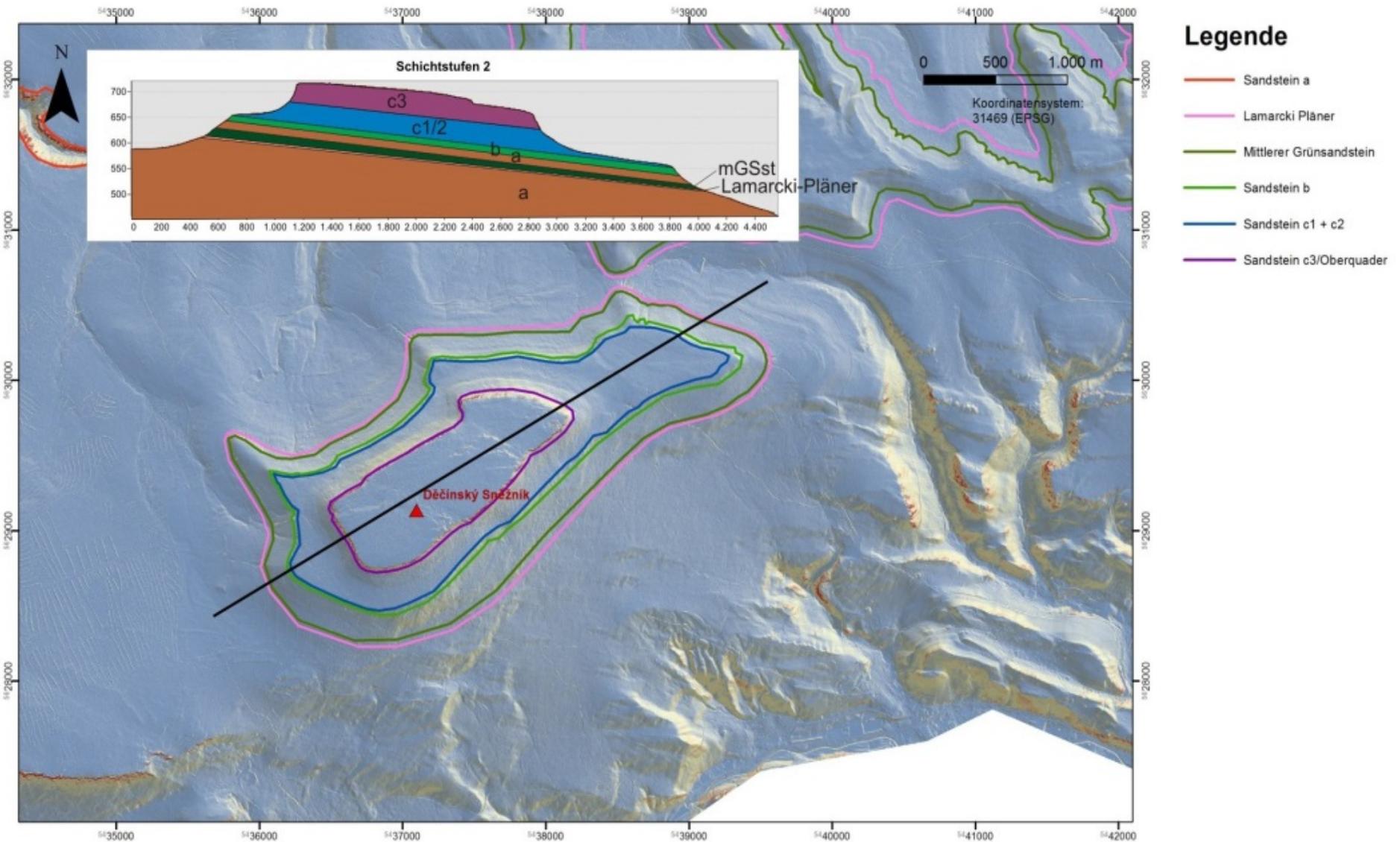


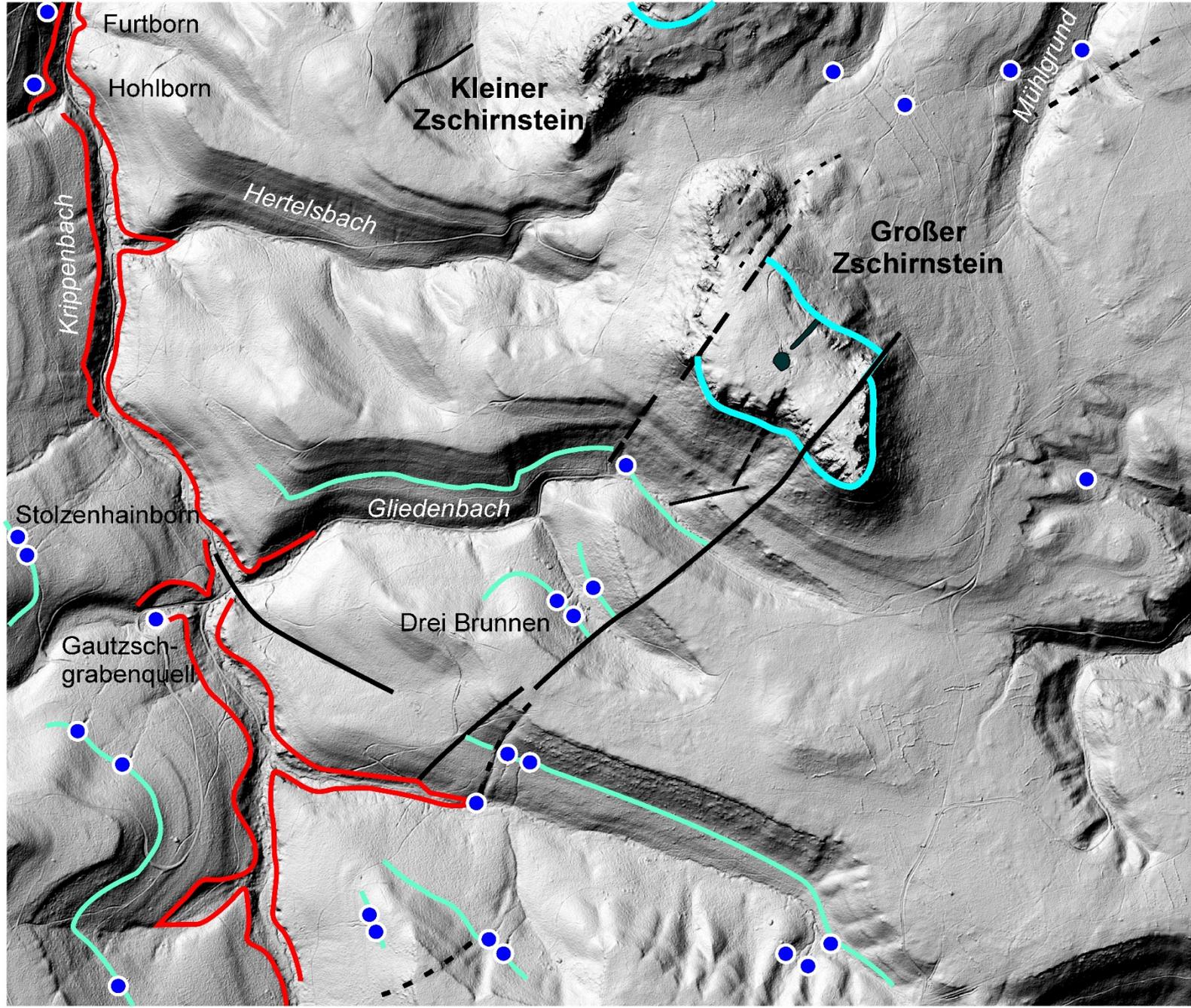
Příloha 4-1 (rajón 4630)
sestavil: J. Valečka



- 1 **KpK** perucko-korycanské s., pískovce, jílovce; 2 **Kb** bělohorské s., slínovce; 3 **pKb** bělohorské s., pískovce;
- 4 **Kj** jizerské s., slínovce, prachovce; 5 **pKj** jizerské s., pískovce; 6 **Kt, Kr, Kbř** teplické s., rohatecké vrstvy, březenské s., slínovce, vápnité jílovce, vápence zčásti silicifikované; 7 **intruzivní terciární vulkanity**;

Cross-section on the base of the DEM: Note the typical morphology!





— Top Schmilka Formation
 — Top Lamarcki-Pläner
 — Top Postelwitz-Formation
 ● spring
 / faults

Correlation of the Turonian succession between Bohemia and Saxony

Postelwitz Formation – Jizera Formation



Formationen Sachsen	Subformationen	Formationen Böhmen	Subformationen
Postelwitz-Formation	Pirnaer Oberquader	Jizera-Formation	Sandstein der Jizera-Fm.
	Oberer Grünsandstein		Mergel der Jizera-Fm.
	Obere glaukonitisch-sandige Mergel		Sandstein der Jizera-Fm.
	Mittlerer Grünsandstein		Mergel der Jizera-Fm.
	Lamarcki-Pläner		Sandstein der Jizera-Fm.
	Unterer Grünsandstein		
	(Unterer Mergel)		
Schmilka-Formation	Labiatus-Sandstein	Bila Hora Formation	Sandstein der Bila Hora-Formation
	Cottaer Sandstein		
Briesnitz-Formation	Labiatus-Pläner		Mergel und Tonsteine der Bila Hora-Formation
	Lohmgrundmergel		

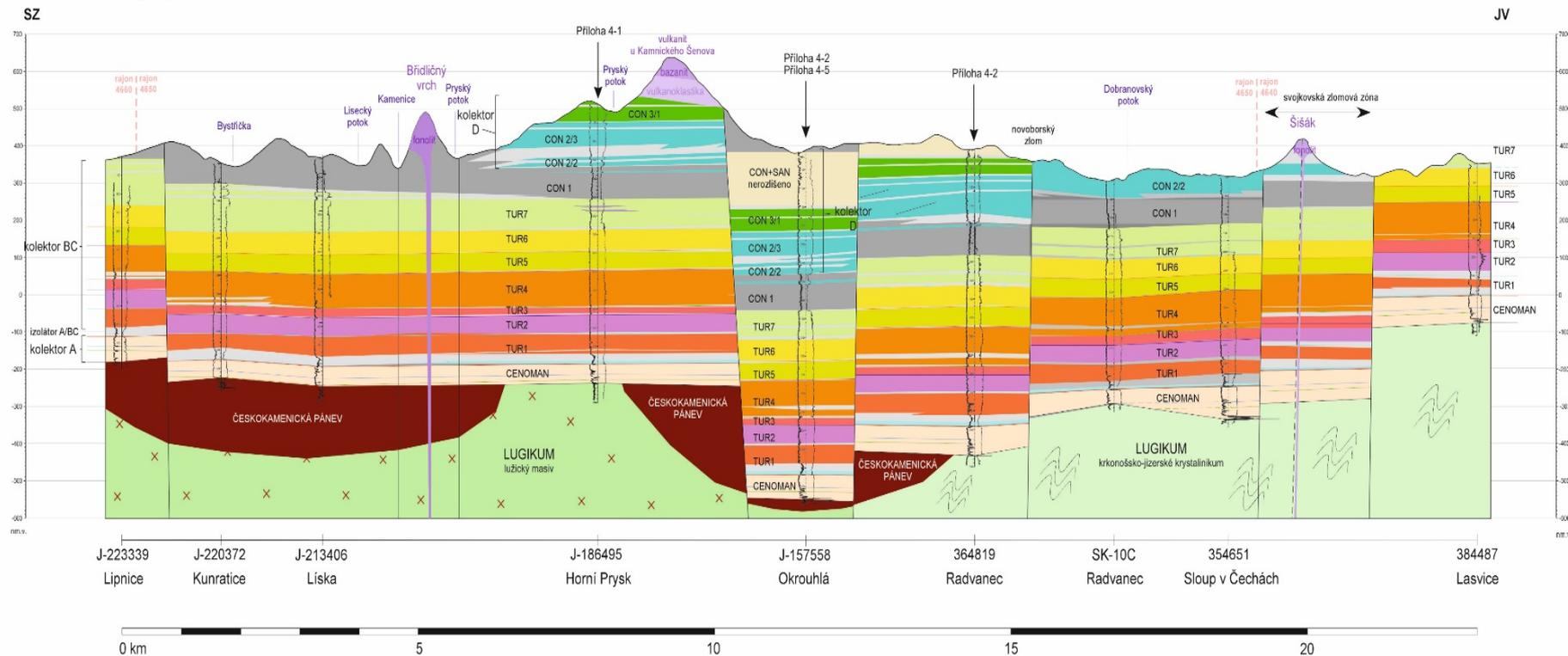
Result: Sandstone c3 represents the top of the Jizera Formation, the conspicuous, 50 m thick sandstone d in Saxony is in Bohemia only exposed at the south slope of the Großer Winterberg!



	Sachsen		Böhmen	
	Bohrung Graupa	Winterberg	bisherige Ansicht	Vorschlag
Unter-Coniac	Zatschker Mergel	Sandstein e	Jizera-Formation (Mittel-Turon)	Brezno-Formation
Ober-Turon	Herrenleite-Sandstein	Sandstein d		Teplice-Formation
	Zeichener Ton	gamma 3		Jizera-Formation
	Oberquader	Sandstein c3		
	Oberer Grünsandstein	Sandstein c1/2		
	glaukonitisch-sandiger Mergel			
Mittel-Turon	Sandstein b	Sandstein b		Jizera-Formation
	Mittlerer Grünsandstein	Sandstein a		
	Lamarcki-Pläner			

Príloha 4-4: Geologický rez SZ-JV

HGR 4650 - Křída Dolní Ploučnice a Horní Kamenice



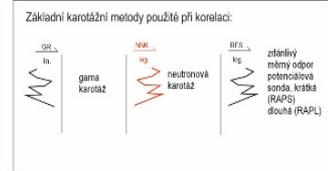
Vysvětlivky:

TERCIÉR	
	vulkanoklastika
	bazanit
	fonolit
	tefrit

SVRCHNÍ KŘÍDA (cenoman - santon)	
	převládající litofacie na přechodu kolektor - izolátor: jílovité/prachovité pískovce, případně prachovce/sílnovce s vložkami pískovců
	převládající litofacie s vlastnostmi hg. izolátoru: jílovce, prachovce, sílnovce s různou mírou cementace
	hemipelagické vápence/sílnovce teplického soustředí
	ROH - sílnovce až prachovce rohatčických vrstev s různou mírou silicifikace, převládající litofacie s vlastnostmi hg. izolátoru
CEN	TUR 6 převládající litofacie s vlastnostmi hg. kolektorů; bany čle příslušnosti ke geneticko-stratigrafickým jednotkám podle Uličného et al. (2009a)
TUR 1	TUR 7
TUR 2	CON 1
TUR 3	CON 2
TUR 4	CON 3
TUR 5	SAN

ROZHRANÍ GENETICKO-STRATIGRAFICKÝCH JEDNOTEK	
	báze cenomanu
	báze TUR3
	báze TUR4
	báze TUR5
	báze TUR6
	báze TUR7
	báze CON 1
	báze CON 2
	báze CON 3
	báze SAN

PODLOŽÍ SVRCHNÍ KŘÍDY	
	permokarbon klasické sedimenty, vulkanity
	lugičium; lugičský masiv
	lugičium; svrchní proterozoikum - sporný paleozoikum



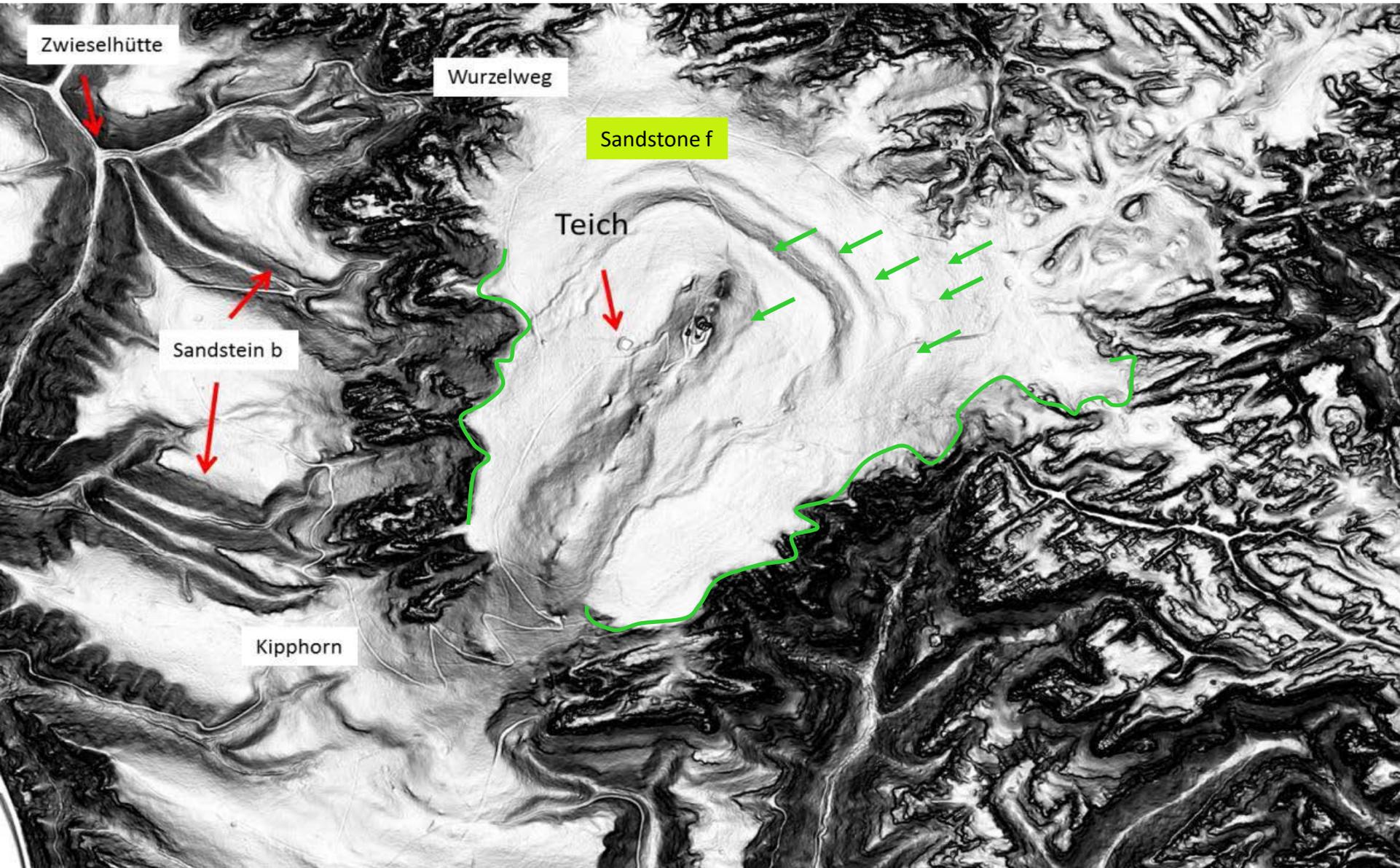
Key region 2: Großer Winterberg - Pravicka Brana: Highest exposed thickness in the working area (from Bila Hora Fm. to Teplice Fm. 500 m)! About 150 m thick succession above sandstone c3: Teplice Formation or very thick Jizera Formation?



Result of mapping: typical prograding cycles of the Czech lithostratigraphy
Tu6-7 and Co1 correspond to sandstone d and e of Saxony, gamma3 and delta 2
represent transgressive surfaces



New unit on top of sandstone e!



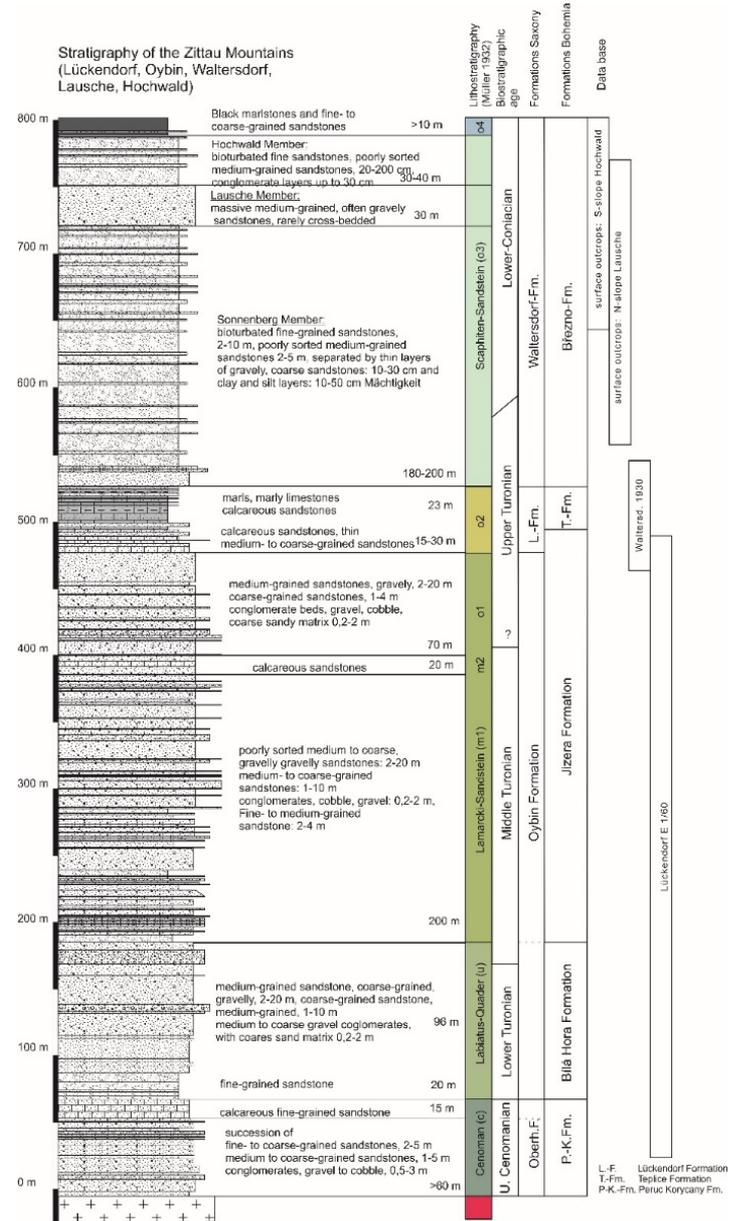
Difficult: correlation of Zittau Mountains and Bohemian Basin (end of GRACE 2013)

Zittau Mountains
(Oybin, Lückendorf, Waltersdorf)

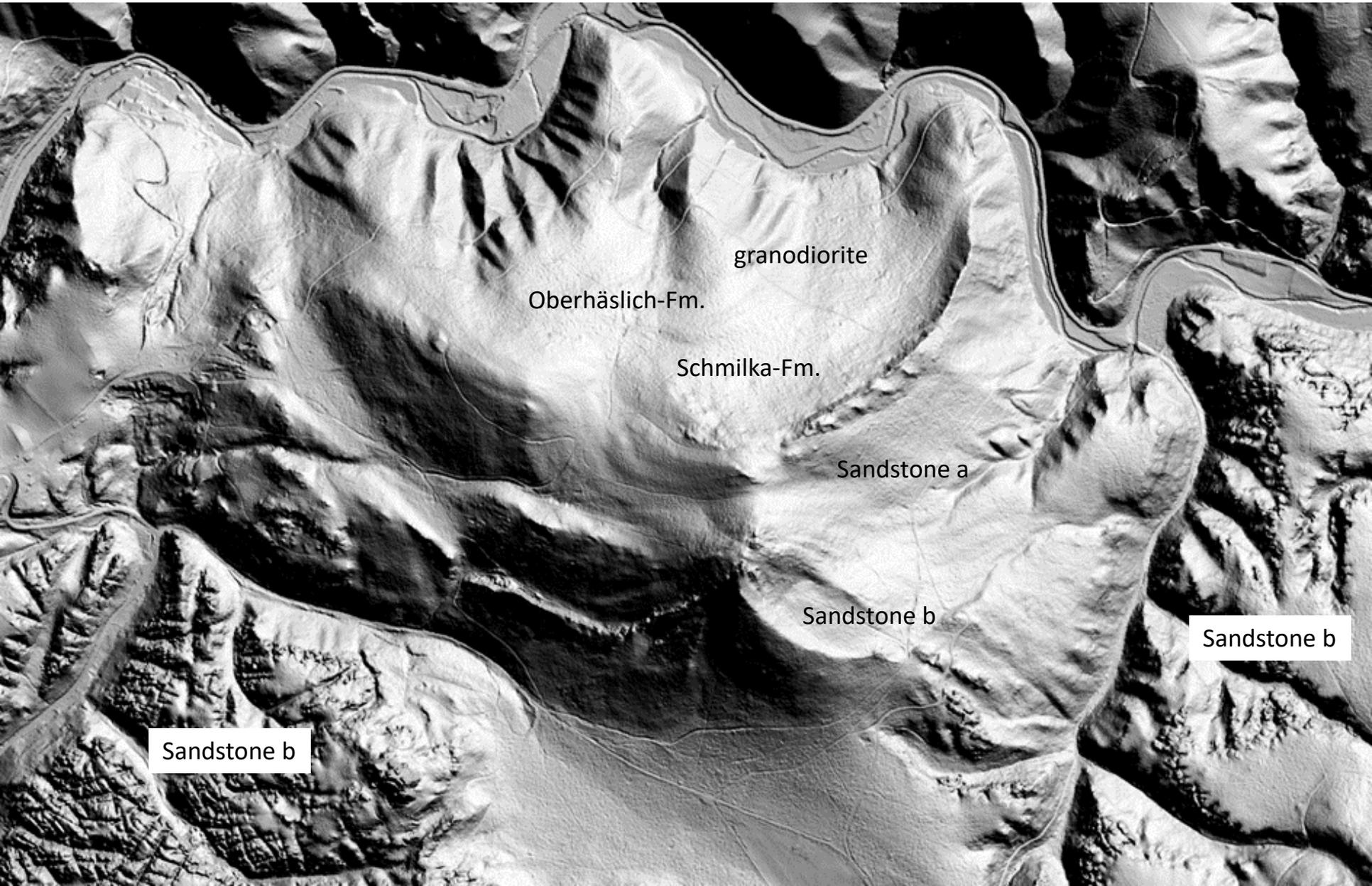
Dolní Podluží

Zittau Mountains		Dolní Podluží	
Waltersdorf Formation	330 m	<p>Hochwald and Lausche sections</p> <p>Hochwald-Sandstein (>70 m): fine- to medium-grained sandstone, bioturbated, rich in fossils</p> <p>Lausche-Sandstein (>40 m): massive to thick-bedded, medium to coarse-grained sandstone</p> <p>Sonnenberg-Sandstein (25 m): thick, bioturbated fine- to medium-grained, massive sandstone beds, separated by coarse-grained sandstones and gravel beds (10-30 cm), followed by clay layers (10 cm)</p> <p><i>borehole Waltersdorf 1930</i></p>	Březno Formation
Lückendorf F.	20-40 m	<p>grey marlstones with some thin sandstone beds</p> <p><i>borehole Lückendorf E 1/60</i></p> <p>fine-grained, bioturbated sandstones, admixture of coarse-sand and gravel, marlstone layers, Calcit-Zement (17 m)</p>	Teplice Formation
Oybin Fm.	350-410 m	<p>massive, medium- to coarse-grained, gravelly sandstones (bed thickness 2-5 m), sharply separated by 20 cm to 2 m thick conglomerates, well-sorted, well-rounded, size of pebbles 2-6 cm, maximum 15 cm (290 m)</p>	Jizera Formation
	95-105 m	<p>no distinct boundary!</p> <p>coarse-grained sandstones with conglomerates (70 m)</p> <p>medium-grained sandstones (26 m)</p> <p>fine-grained sandstones (20 m)</p>	Bílá Hora Fm.
Oberhäsllich F.	50-130 m	<p>medium to coarse-grained, pebbly sandstone beds, massive to bioturbated, (2-5 m, separated by conglomerate beds (10-60 cm)</p>	Peruc-Korycany Fm.
		Lausitz granodiorite	

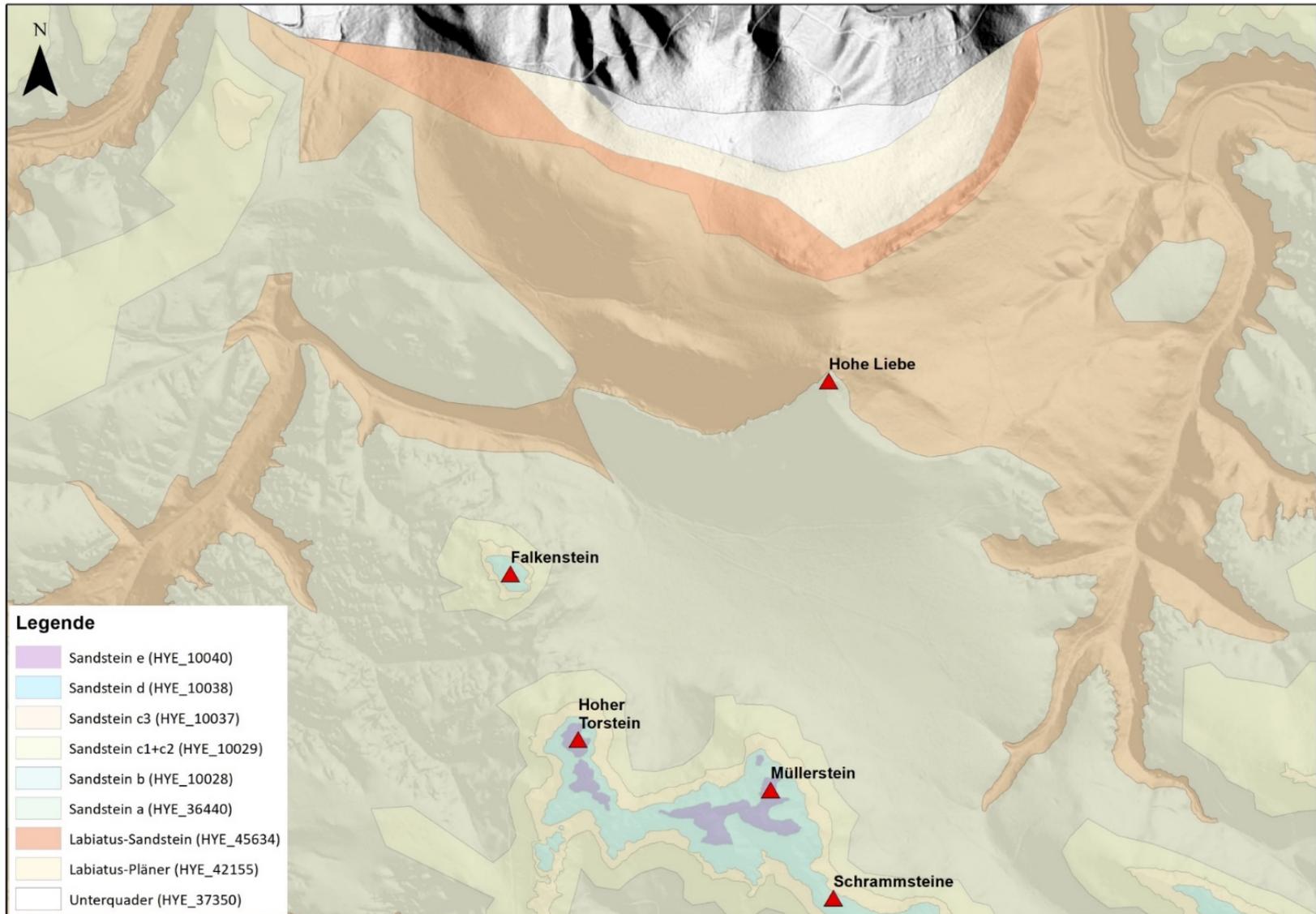
Stratigraphy of the Zittau Mountains
(Lückendorf, Oybin, Waltersdorf, Lausche, Hochwald)



DEM: support of mapping at the most striking tectonic feature: Hohe Liebe

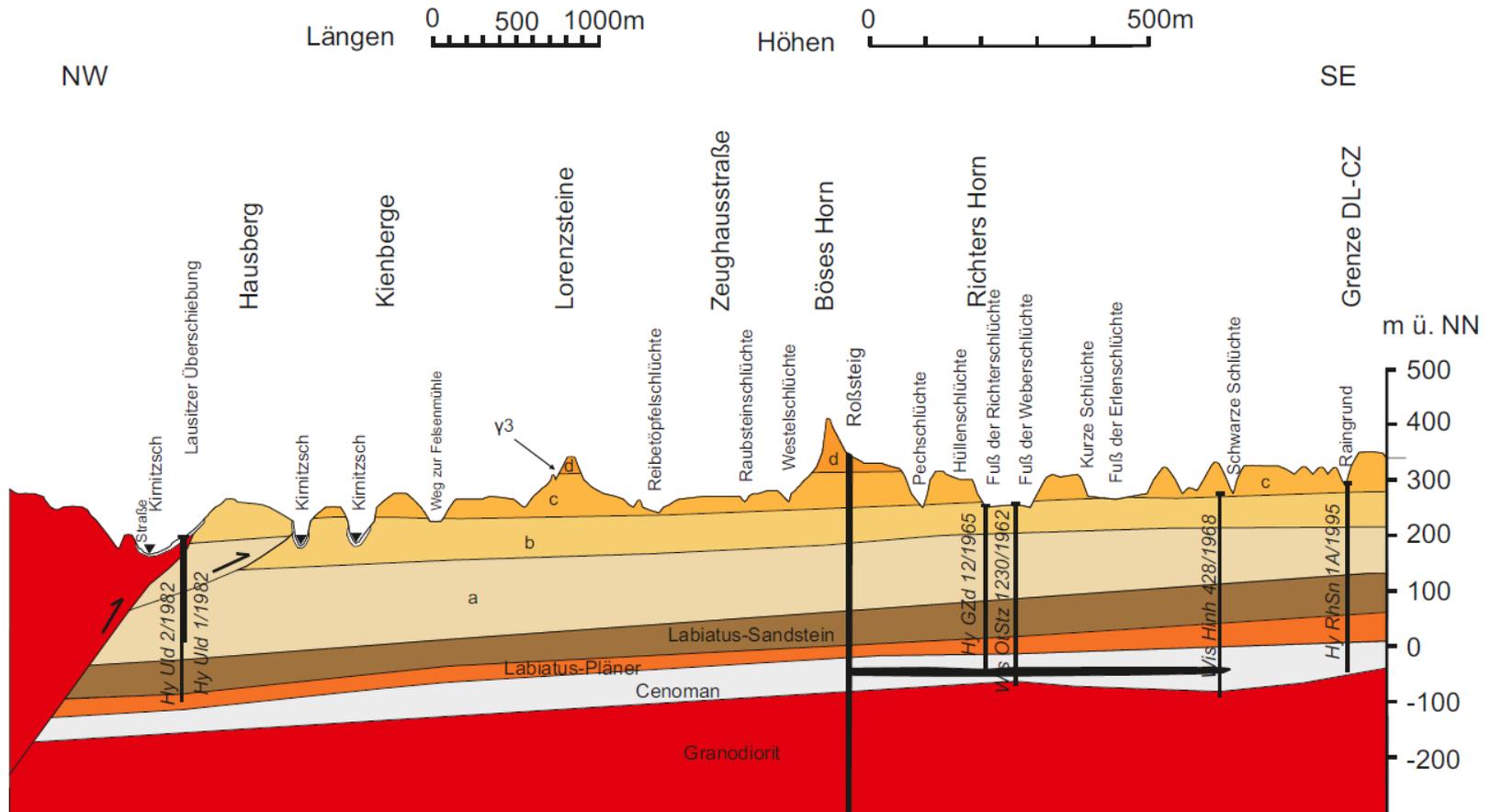


In some parts in Saxony: new geological map



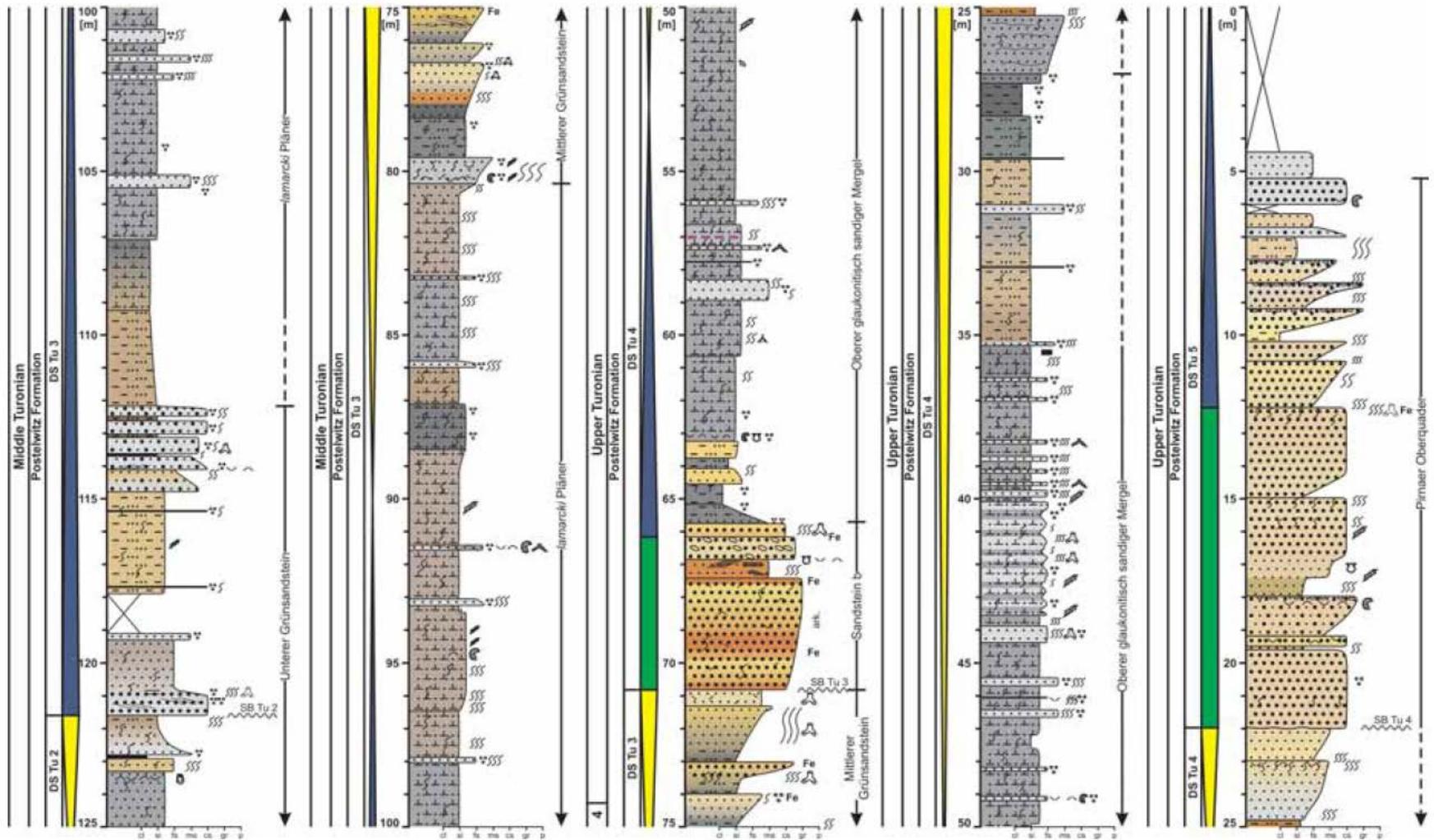
Cross-sections on the base of borehole data

Kirnitzsch - Hausberg - Lorenzsteine - Böses Horn - Richters Horn - Grenze DL-CZ



Documentation of borehole data (published and unpublished)

1 HG 7006 Krietzschwitz core

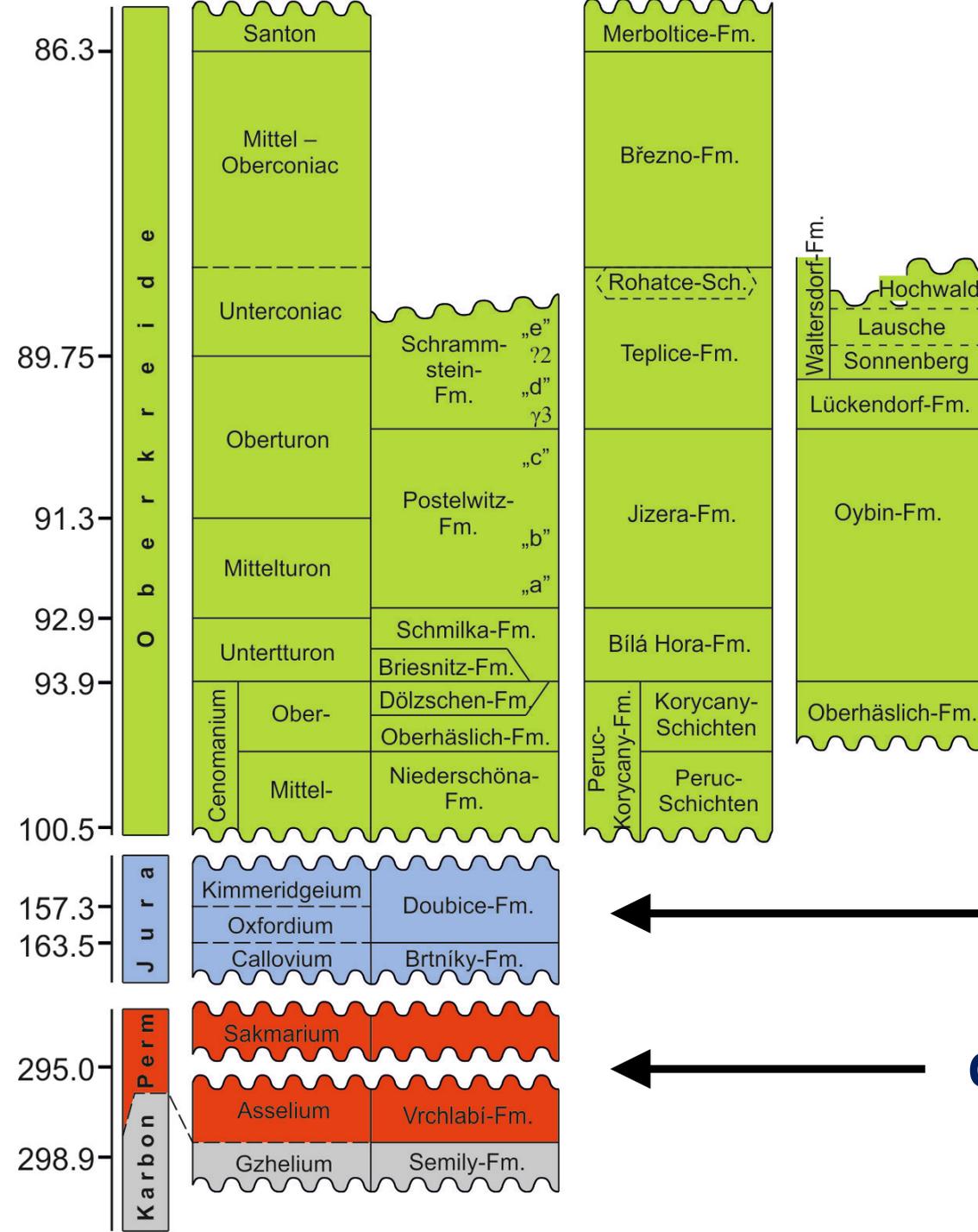


Sedimentary formations within the Resibil project area

← **Upper Cretaceous**

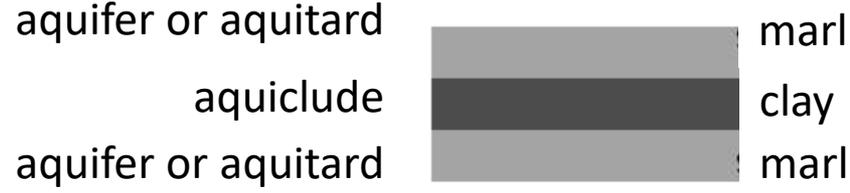
← **Jurassic**

← **Carboniferous–Permian**

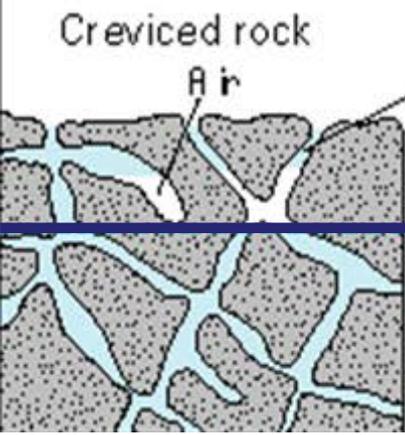
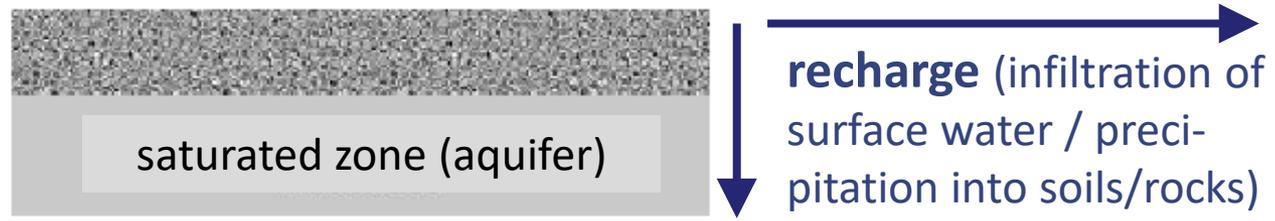


Aquifer – rock body with relatively higher permeability compared to neighboring rock units with relatively lower permeability – **aquitards**

Non-permeable rock units are called **aquicludes**



runoff => surface water flows

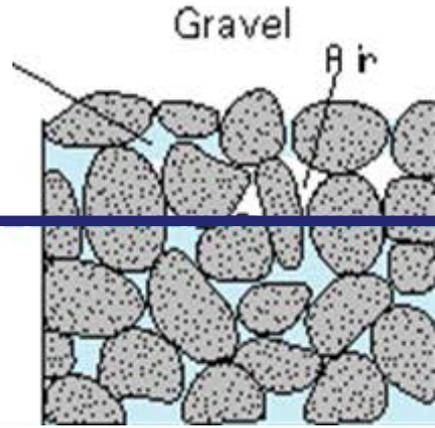


fissure, karst

vadose zone (unsaturated, with capillary fringe)

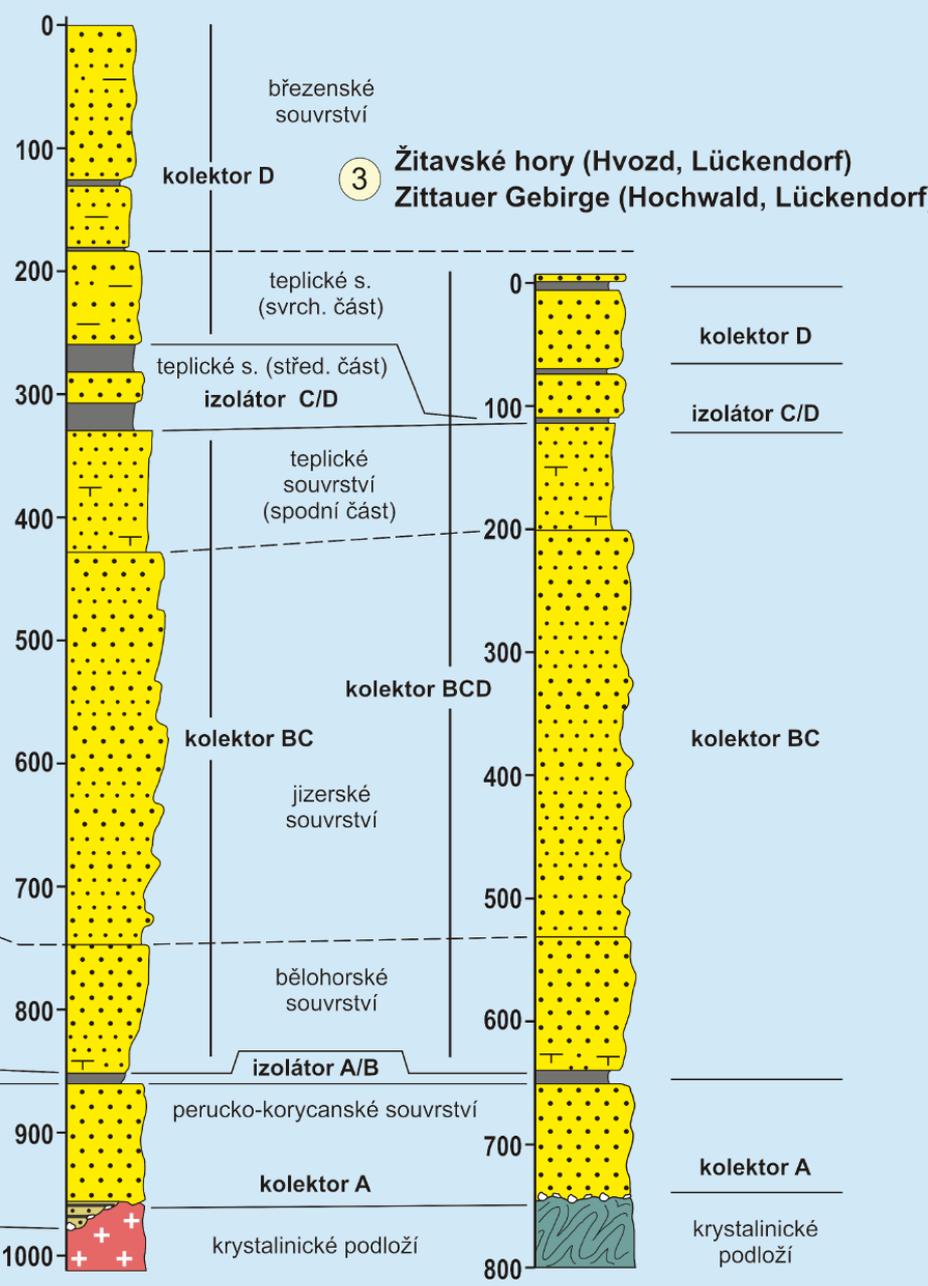
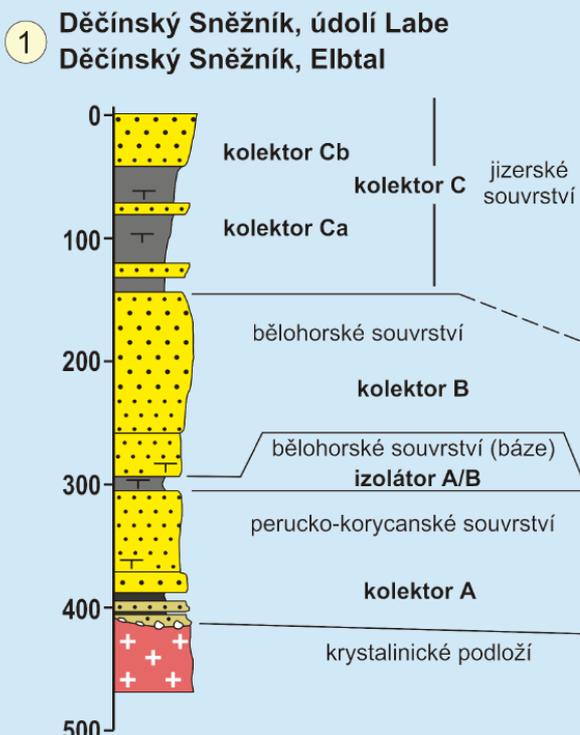
groundwater table

permeability type porous
 full of ground water



Upper Cretaceous groundwater
Aquifers
 and
aquitards in the
 Resibil project
 area:

What rocks
 actually represent
 them?



Stratigraphic correlation of the Saxony(lef) and Czech (right) parts of the basin: it is crucial for hydrogeology to know the equivalence of stratigraphic units!



		Formation	Members		Formation (incl. members)		Aqui- fers		
			Pirna area	Sax.-Boh. Switzerland	Lusatian Mts.	Zittau Mts.			
Conacian	middle				Březno	Jedlová top of Hochwald	D		
	lower				eqv. Rohatce Mb. 4640_C				
Turonian	upper	Schrammstein	Zatschke Marl	Rathewalde S. Sandstone f		Teplice	Waltersdorf	Hochwald S.	C/D* BCD
			Brausnitzbach Marl	Porschendorf S. Sandstone e				Lausche S.	
			Lohmen Marl	Horizon δ2				Sonnenberg S.	
			Herrenleite S. Sandstone d						
			Zeichen Clay	Horizon γ3	Pravčická brána			Lückendorf marlstones calcareous s.	
	middle	Postelwitz	Sandstone c3, Pirna Oberquader S.	Sandstone c3		Jizera	Oybin		C BC
	Upper glauconitic S.		Sandstone c1-c2						
	Middle Green S.		Sandstone b						
	Lamarcki P.		Sandstone a						
lower	Briesnitz	Labiatus P.	Labiatus S. Bielatal H.		Bílá Hora	Bielatal H.	Weißbach Mb.	B	
		Lohmgrund Marl	Schmilka				Lohmgrund Horizon	A/B*	
Cenomanian	upper	Dölzschen	Plenus Horizon	Pläner S.			Pennrich		
		Mobschatz	Unterquader S.		Peruc-Korycany	Korycany Mb.	Oberhäslich		
	middle	Niederschöna				Peruc Mb.		A	