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POTENTIALS AND RISKS OF KARST WATER FOR HUMAN NEEDS

By

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SUMMARY

One fifth of the population of our planet uses Karstwater for its basic needs. Because of their occurrence and of the recharge abilities of carbonatic rocks - which is the highest amongst all aquiferous rock - the waters from karst areas represent the most important groundwater reserve for the future. Especially in third-world-countries with missing or small or seasonal rainfall rates.

In contrast to these positive effects of underground water storage the following risks must be mentioned :

- High flow velocities (› 10 ‹ 1000 m/h)
- Large, often unknown catchment areas, which might change during time
- Missing or little screening or filtration effects
- Risks of natural and/or man made contamination
- Risks of unsufficient water quality due to natural conditions or
- Due to excessive yields.

Pure Limestone areas are more seriously affected by these risks, whereas Dolomite karst seems to show better conditions. The research of these effects and the fact that in nature we will often find interfingerings of both types of carbonatic rocks will often allow water management.

RAINFALL AND UNDERGROUND WATER RECHARGE

The recharge of underground water within the carbonatic rocks is twice the recharge of sands or gravels and 2 to 3 times higher than in other aquiferous and non-carbonatic rock.

QUANTITIES OF UNDERGROUND WATER - FIELDS

example: SW of Germany

Given in this example we can see that two third of the underground water is bound by the specific retention to silts and clays, thus not exploitable. The storage within the non-carbonatic aquifers is just one half of the quantities within the carbonatic rocks.

* Potentials and risks of karst water for human needs.

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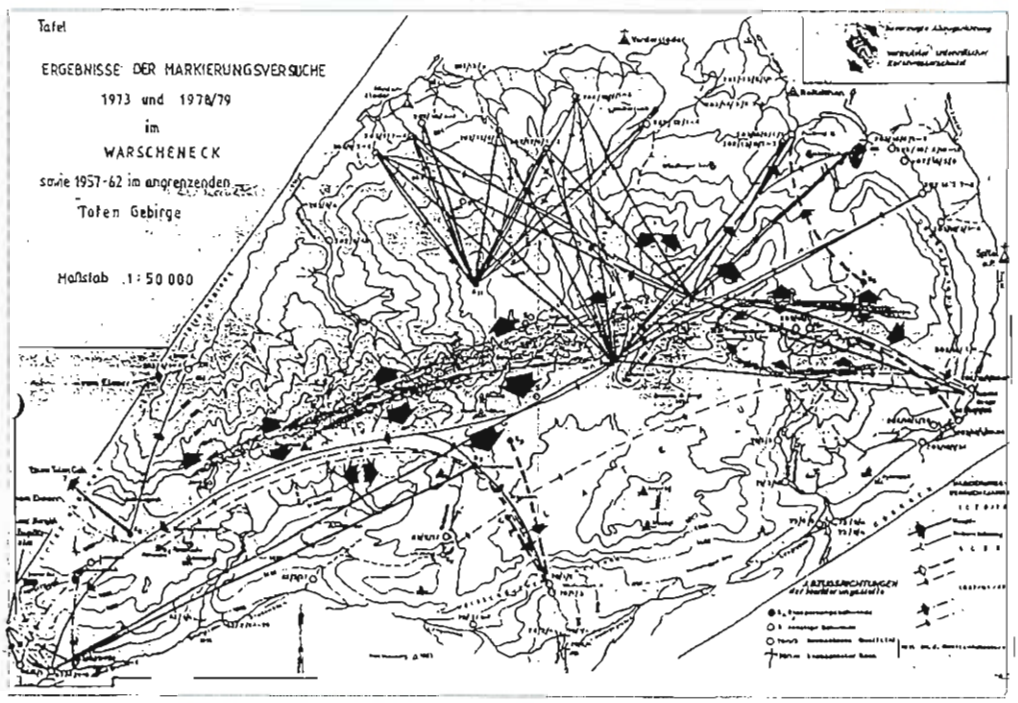
KARST IN EUROPE



	Gebiet (Unter-	Flächen	Unter-	N	Grundwasser-	Grundwasser-	% infiltation
	suchungsort	Größe	suchungs-	(mm)	neubildungs-	neubildungs-	
	und -zeitraum)	(Km^2)	methode		höhe(mm)	spende	
						($l/s \cdot km^2$)	
sands	SW 'Münster-		Lysimeter	770	277	8,8	36
	land	663					
	(langjährig)						
sands	Niederrhein-						
+	Krefeld	122	Wasser-	715	235	7,4	33
gravel	Mittelterasse		haushalt				
	(?)						
	Oberrhein-						
Sand	ebene Heidel-	ca.	Lysimeter,				
	berg-Freiburg	2600	Boden-	i.M.	i.M.	i.M.	30
	(N: 1931-1960		wasser-	756	155	4,9	
	Lys.: 1965-73		haushalt				
	Festgesteine						
	Hessen						
Sandstone	ob.Fulda	540	MoMNq	807	164-148	5,2-4,7	27-30
	Paläoz.Btsdst.						
	(1936-1955)						
Basement	Hessen -	Odenwald-Kristallin			60-95	1,9-3,0	11-30
an	andere Gebiete	Paläoz.Sedimentgest.			20-60	0,6-1,9	4-11
paleoroic		Diabase, Basalte			80-120	2,5-3,8	15-22
rocks		Zechstein			60-220	1,9-7,0	11-41
		Mittl. Btsdst.			60-140	1,9-4,4	11-26
Sandstone	Trierer Bucht						
	Sandstein	5-30	Natur-	750	ca.150	4,8	20
	(langjährig		Lysi-				
			meter				
	Bayer.Rhön		Wasser-				
Sandstone	Btsdst.	90,7	haushalt,	997	231	7,3	23
	(1954-1966)		Quell-				
			messungen				
	Schwäb.Alb						
Limestone	jura	72	Wasser-				
	-1967		haushalt	836	490	15,5	59

	Wasservorräte und ihre Regenerierung		
	Wassermengen in Mio m^3		Jährliche
			Regenerierung
	Mittel	Niedrig	Mio m^3
Neckarkies	23	20	11-15
Hauptmuschelkalk			
und Lettenkeuper	35	24	30-40
Weibjura delta			
bis epsilon	50	25	50-60
Kalktuff und Kies			
der Albtäler	2	1,8	2
Baggerseen	1,6	1,4	–
Lias alpha	6	2	4
Verwitterungsschutt			
und Spaltenwasser			
der übrigen Gesteine	17	3	etwa 20
Haftwasser der			
Böden und Lehme	400	250	–
	60		

KARST AREAS OF EUROPE (ONLY OUTCROPS OF CARBONATIC ROCKS)
without deep karst areas for example karst water supply in Austria :

Vienna
Innsbruck
Salzburg
Linz (planned)

= approx. › 50 % of the population

RESULTS OF TRACER TESTS IN THE WARSCHENECK / TOTES GEBIRGE / AUSTRIA

The tests show high-velocity underground runoff. At the same time it was proved that some part of the tracer crossed the mountain, probably through the fissured and few or not karstified core at great depths and at a speed of about some cm/h.

The morphology indicates by the drainage pattern that in the western part (see cross section) we have an area of dolomitic rock.

SUMMARY OF SOME HYDRAULIC CARACTERISTICS

LIMESTONE		DOLOMITE
accelerated	solution	retained
dm - m few	structure and joints	mm - cm many
subplastic low	rock mecanics caract. drainable.porosity (without joints)	fragile high
in line	flow path	fracture system
karstic near surface 0 -oo low	static head transmissivity power loss	deep low, but always given high
high 0 - low short terme (days - years)	travel time filtration exchange of water	low high long terme years - y x 10^6
good	storage factor	good