

BEER & HYDROGEOLOGY

The Perfect Combination

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Black Sheep Brewery, 18 April 2013



Management, regulation & sustainability

envireau
WATER

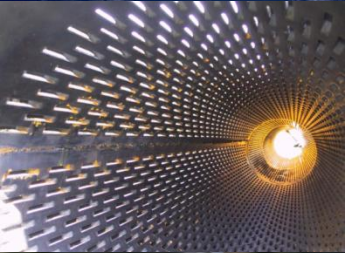
What We'll Talk About

- First half: Brief History
 - Development of breweries
 - Groundwater sources & composition
- Second half: Practicalities
 - Why have an independent water supply?
 - What makes a good supply?
 - Security of supply
- Concluding Remarks



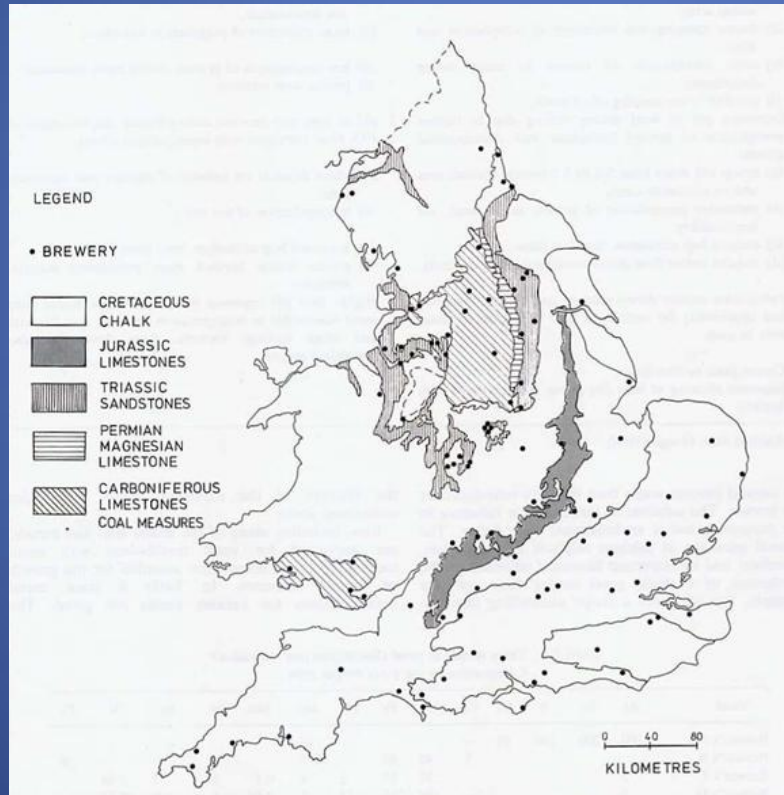
Sourcing & Composition

- History of Brewing in the UK
 - Prehistoric, Micro breweries
 - Medieval, Monasteries
 - Modern day, Burton-upon-Trent: ‘home of British Brewing’
 - Ale and Lager



Sourcing & Composition

- Location of Breweries & Principal Aquifers



Typical Chemistry (mg/l)

	TDS	Ca	Mg	Na	Cl	SO ₄	HCO ₃
Chalk	560	101	14	11	42	65	304
Jurassic Limestone	645	150	10	16	26	158	288
Triassic Sandstone	1300	352	24	54	16	820	320
Magnesian Limestone	568	46	24	30	62	198	290
Coal Measures	1400	140	70	270	300	350	225

Water Chemistry

- Different Aquifers = Different Water
 - Aquifer Chemistry & Beer Chemistry (mg/l)

Region	TDS	Ca	Mg	Na	Cl	SO ₄	HCO ₃
Burton	1300	352	24	54	16	820	320
Birmingham	750	148	48	28	77	240	260
London	560	101	14	11	42	65	304
Keighley	310	45	20	29	25	32	240
Masham	300	130	26	44	2	9	260
Blackburn	324	28	19	81	44	17	274
Wrexham	140	22	3	20	25	33	36
<i>Pilsen</i>	<i>50</i>	<i>10</i>	<i>1</i>	<i>1</i>	<i>5</i>	<i>4</i>	<i>15</i>

	ALE	LAGER
Ca	130	60
Mg	60	40
Na	80	60
K	350	280
Cl	250	150
SO ₄	400	150
HCO ₃	0	0

Black Sheep Brewery

- Borehole Records
 - No. 1 completed 1876, Well Garth Brewery
 - To obtain a ‘pure water’
 - Depth of 435’
 - Water struck at 126’, ‘neither sufficient in quantity nor quality for the purpose of brewing’
 - Cased to 179’
 - On completion, artesian, ‘clear and bright and very soft to the taste in comparison to the neighbouring springs’

Black Sheep Brewery

- Geology
 - Vertical variation/separation
 - Targeting formations with a different/suitable chemistry
 - Pumping, artesian conditions, water quality



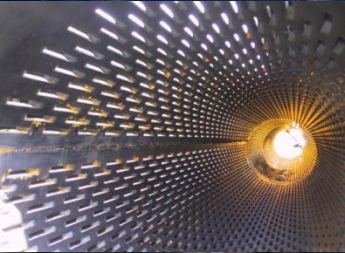
Why Have an Independent Water Supply?

- Groundwater sources:
 - Natural chemical composition provides the right quality of water; historical development of breweries around supplies
 - Quality of water is consistent; less pollution issues
- Cost (m³):

Year	1980	1985	2000	2012
Mains	15 - 23p	20 - 27p	50 - 90p	£0.95 - 1.50
PWS	5p			10p

What Makes a Good Supply?

- Favourable hydrogeology
- Borehole construction
- Maintenance
 - Monitoring
 - Efficiency
 - Survey
 - Rehabilitation



Concluding Remarks

- History of brewing based on groundwater supply
- Consistent groundwater chemistry
- Low cost
- Effective maintenance

