

# NORDISK FORUM FOR BYGNINGSKALK

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## Matured lime putty (kulekalk) and traditional lime mortars

The use of matured putty lime (“kulekalk”) in the Nordic mortar tradition

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# Some definitions

English	Danish	Norwegian	Swedish
Quicklime	Brændt kalk	Brent kalk	Bränd kalk (osläkt kalk)
Slaked lime / Lime putty	Vådlæsket kalk	Våtlesket kalk	Våtsläckt kalk
Matured lime putty	Kulekalk	Våtlesket kalk, lagret (Kulekalk)	Våtsläckt kalk, Lagrad (Kulekalk)
Hot-lime mortar	Varmlæsket kalkmørtel (læskemørtel)	Varmlesket kalkmørtel	Stukasläckt kalkbruk

Note: It is only about non-hydraulic lime!

# Kulekalk (matured lime putty)

Quicklime slaked with excess of water  
and matured in a “kule” (a covered pit dug into the ground)  
for a minimum of 2 years  
– sometimes up to 15 years or even more

Some of the benefits according to dealers and craftsmen:

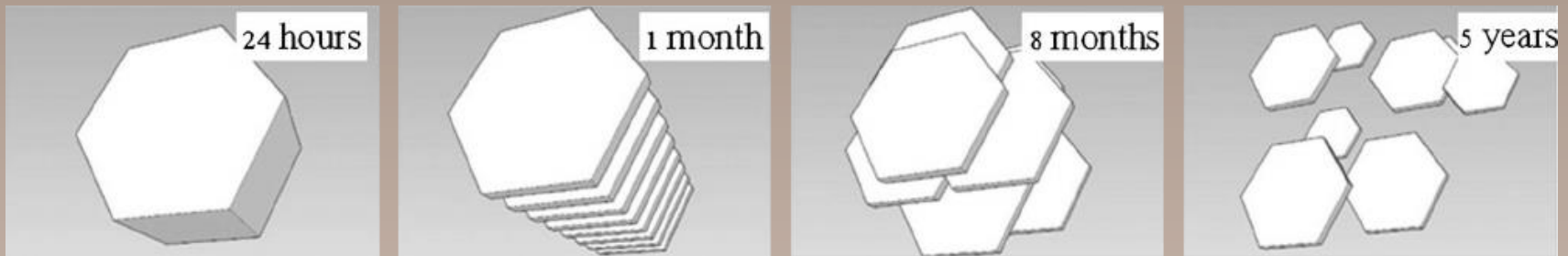
- Gives mortars with high plasticity/flexibility
- Very good properties when used for lime wash
- Good porosity when used for mortars

# Kulekalk (matured lime putty)

The explanation for the good properties of “Kulekalk” (matured lime putty).

The alteration of calcium hydroxide crystals (mineral portlandite) during aging (storing):

- Reduction in crystal size
- Change of crystal morphology



# Negative side effects of smaller particle size

Small particle size



Higher specific surface area



Higher water demand



Greater shrinkage

# Kulekalk (matured lime putty)

Water content of “Kulekalk” when used – an example:

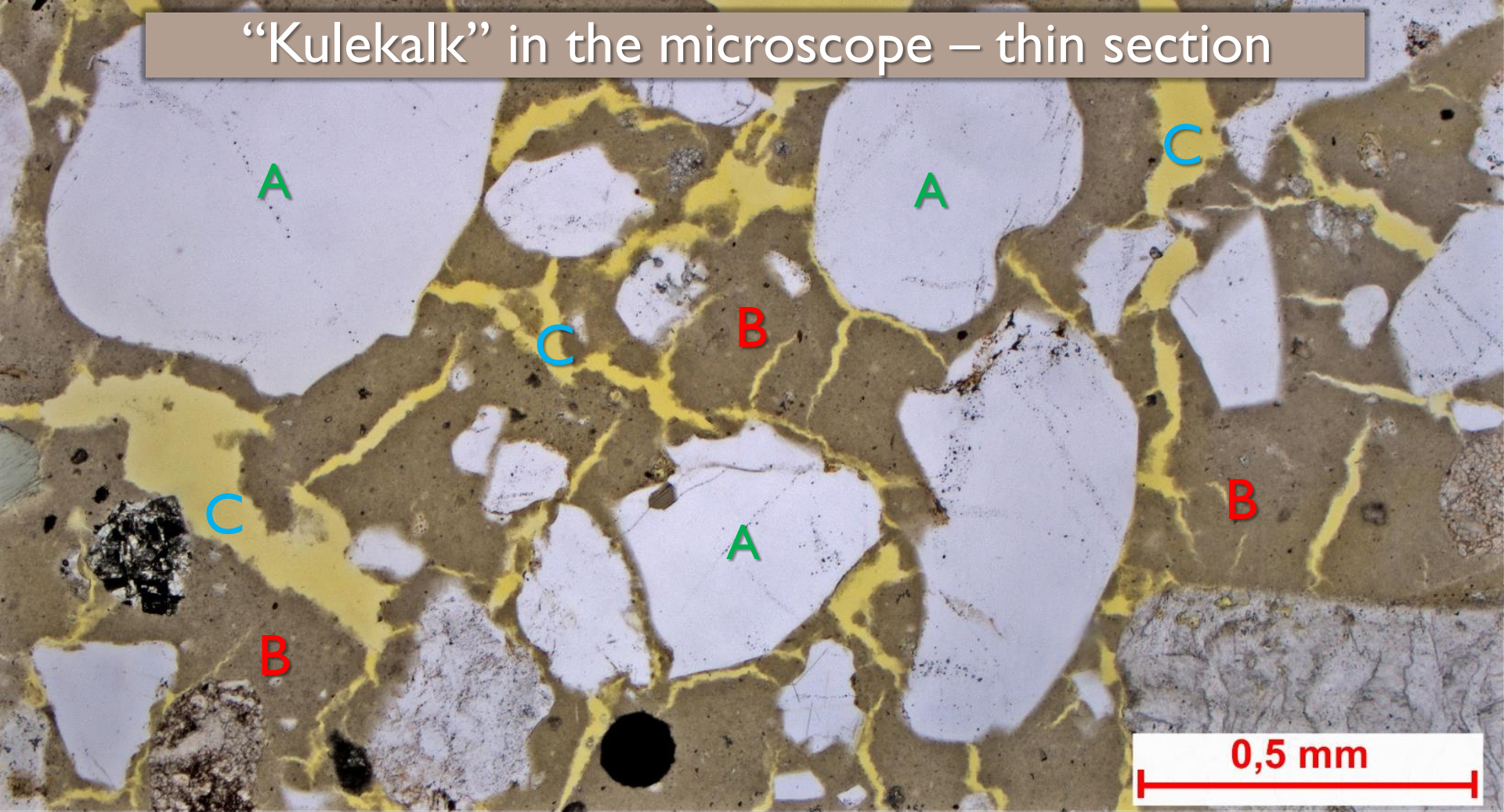
2-year old kulekalk: 70%

16-year old kulekalk: 84%

(measured at ASTM standard consistency 20 + 5mm)

The higher water content of the 16-year lime putty  
is caused by the smaller particle size

# “Kulekalk” in the microscope – thin section



- Binder (carbonated lime putty) **B**
- Aggregates (sand) **A**
- Very high content of shrinkage cracks **C**
- Fine crystalline and homogeneous binder (lime)  
- only rarely with lime lumps and particles of underburned limestone

# Hot-lime mortar - The medieval mortar tradition

Hot-lime mortar is prepared by mixing burned limestone (quicklime) with aggregates (sand) and water.

The mixing takes place at high temperature because of the chemical reaction during slaking.

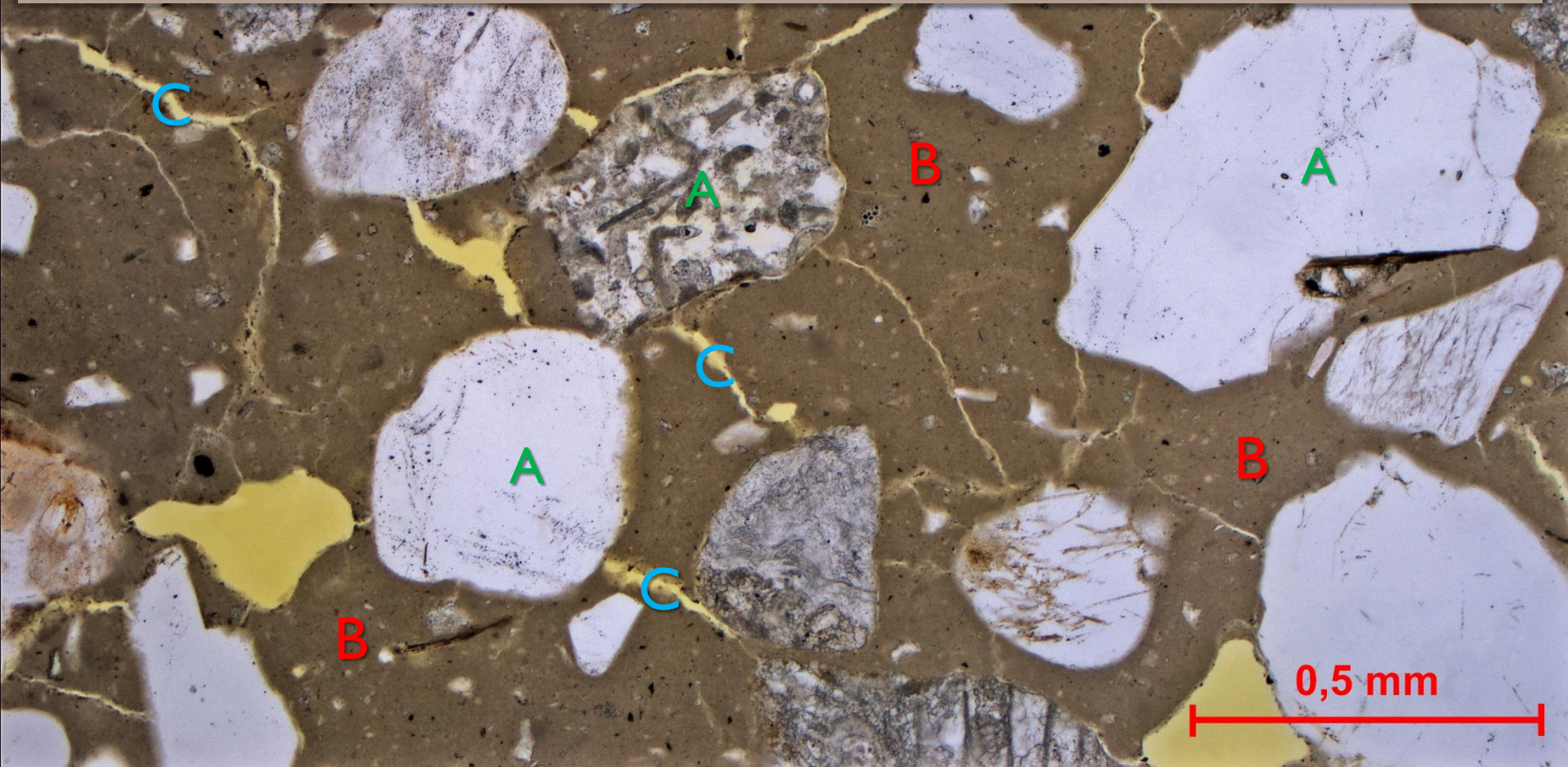
Some of the benefits according to dealers and craftsmen are:

- Gives sticky, workable mortars that adhere well to masonry
- High strength and good frost resistance
- Expands when slaked - good property when used as filling in walls

Hot-mixing was the predominant method until the 18<sup>th</sup> century (1700-tallet)

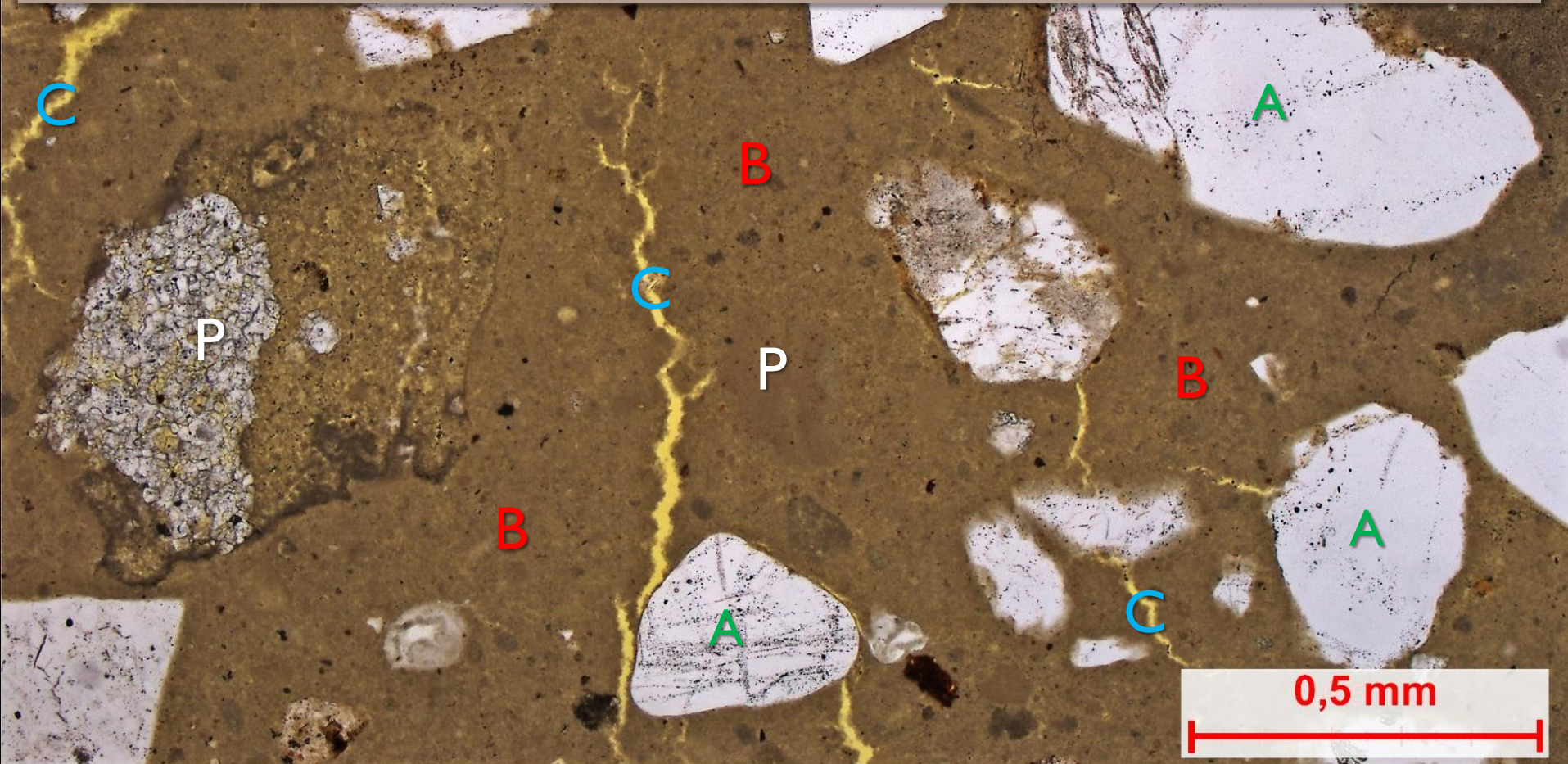


# Hot-lime mortar in the microscope – thin section



- Relatively high content of binder (carbonated slaked lime) **B**
- Relatively low content of aggregates **A**
- Low content of air voids and shrinkage cracks **C**
- Relatively coarse crystalline and inhomogeneous binder (lime) with many lime lumps and particles of underburned limestone

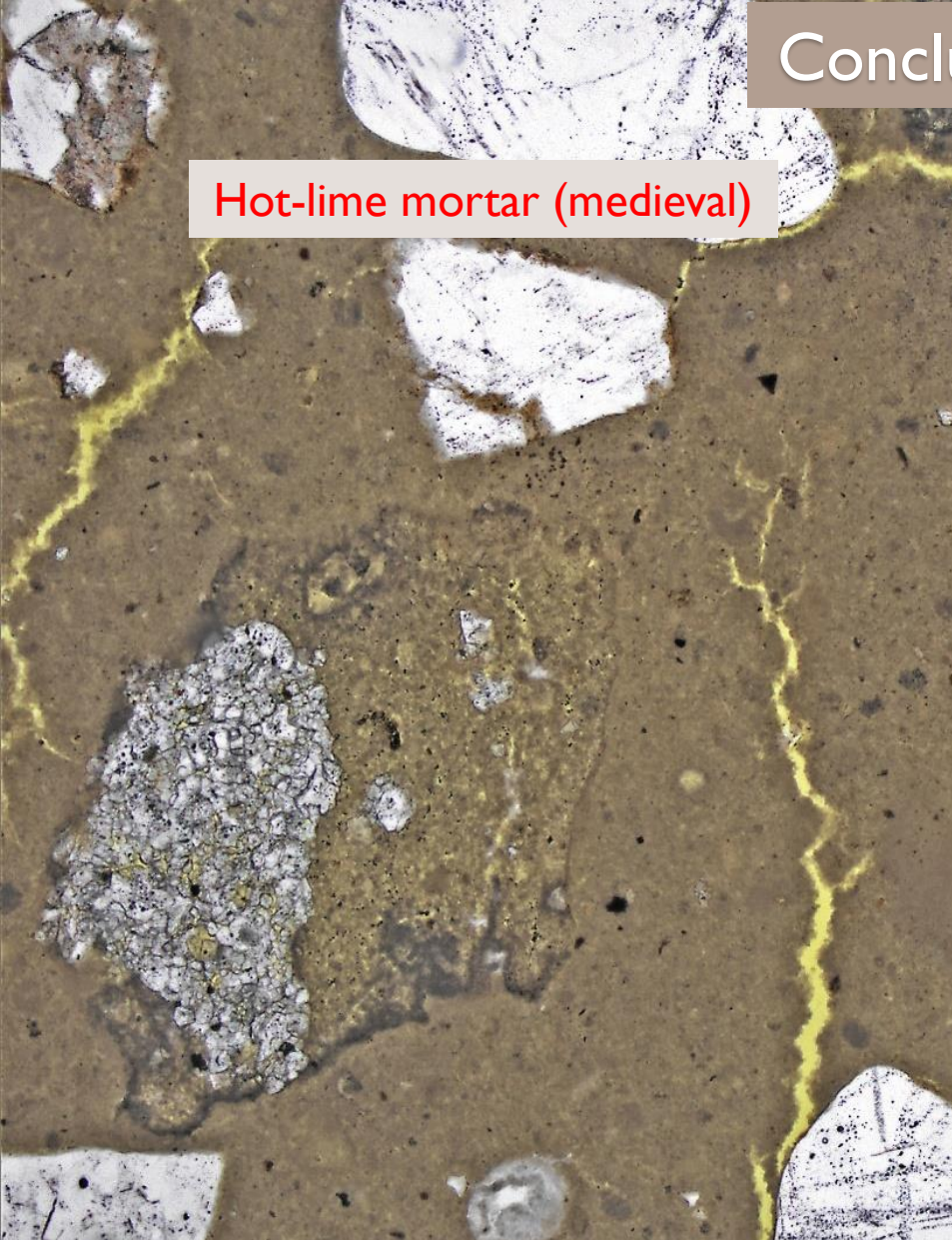
# Hot-lime mortar (historic) in the microscope – thin section



- High content of binder (carbonated slaked lime) **B**
- Low content of aggregates **A**
- Low content of air voids and shrinkage cracks **C**
- Relatively coarse crystalline and inhomogeneous binder (lime) with many lime lumps and particles of underburned limestone **P**

# Conclusion

Hot-lime mortar (medieval)



Kulekalk (matured lime putty)



Compact with few shrinkage cracks and air-voids  
→ Relatively high strength and high durability

Porous with high content of cracks and air-voids  
→ Relatively low strength and low durability

# Thank you for your attention!

You may wonder why I used the term  
“traditional lime mortars” as synonym for hot-lime mortars  
in the title of the lecture.

Because hot-lime mortars has been the prevailing mortar tradition in the Nordic countries  
for much longer time than kulekalk