

STENO-INJECTION

Modern injection technique for the restoration of wooden objects

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Photo: J. Bém



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INJECTION BY HAND

low working pressure: 2 - 4 bar



Thin glue consistency
or
thick cannulas

STENO-INJECTION

The goal of the technique:
injecting viscous materials
through small holes.

to $\varnothing 0,3$ mm



Photo:Marie Buhl

STENO-INJECTION

The injection hole in the picture:

$\varnothing 300 \mu\text{m}$ (0,3 mm)

The pore size of porous woods:

200 – 400 μm .



INJECTION HOLE

The injection hole is drilled with a
spring wire.



Photo:Marie Buhl

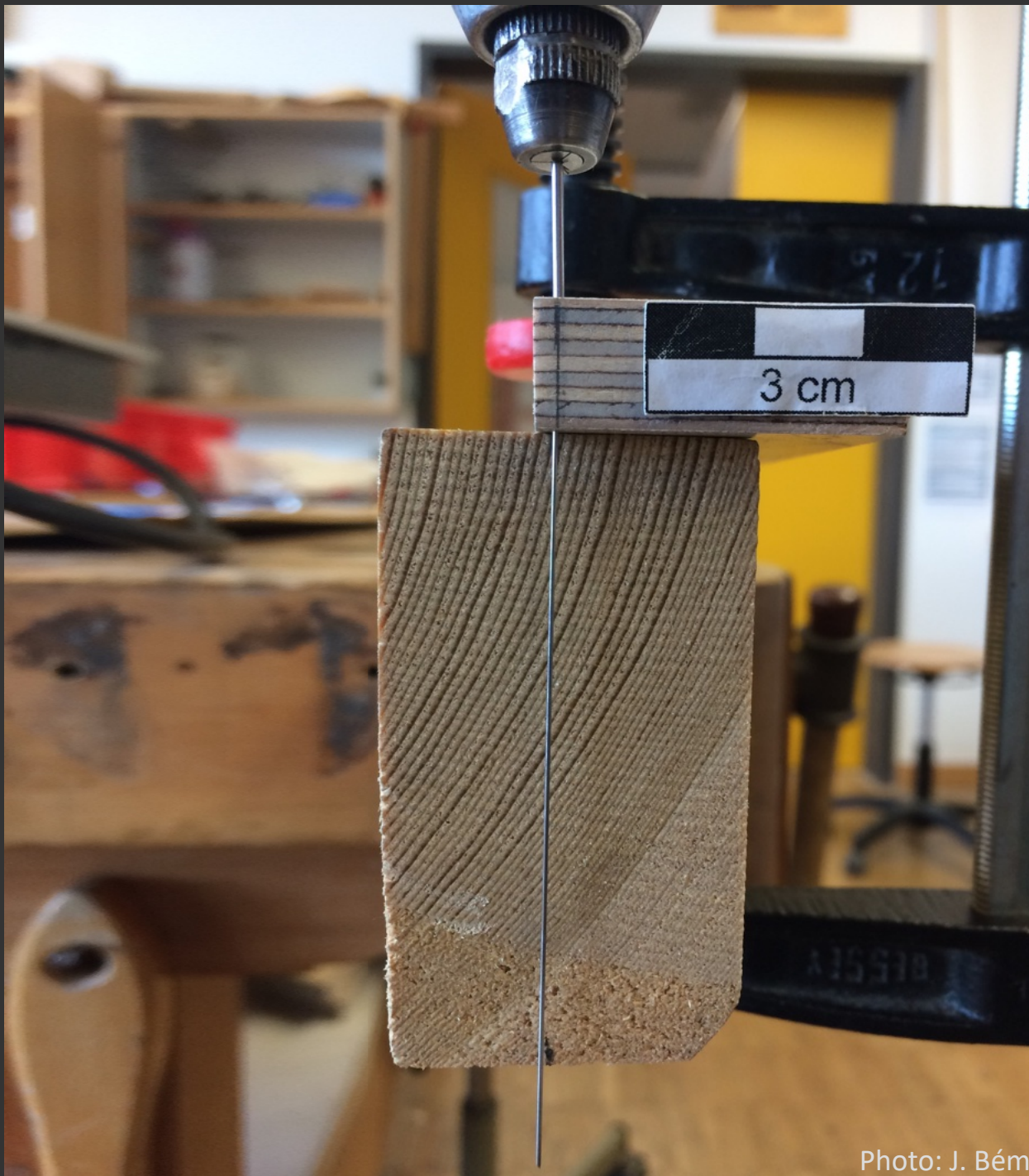


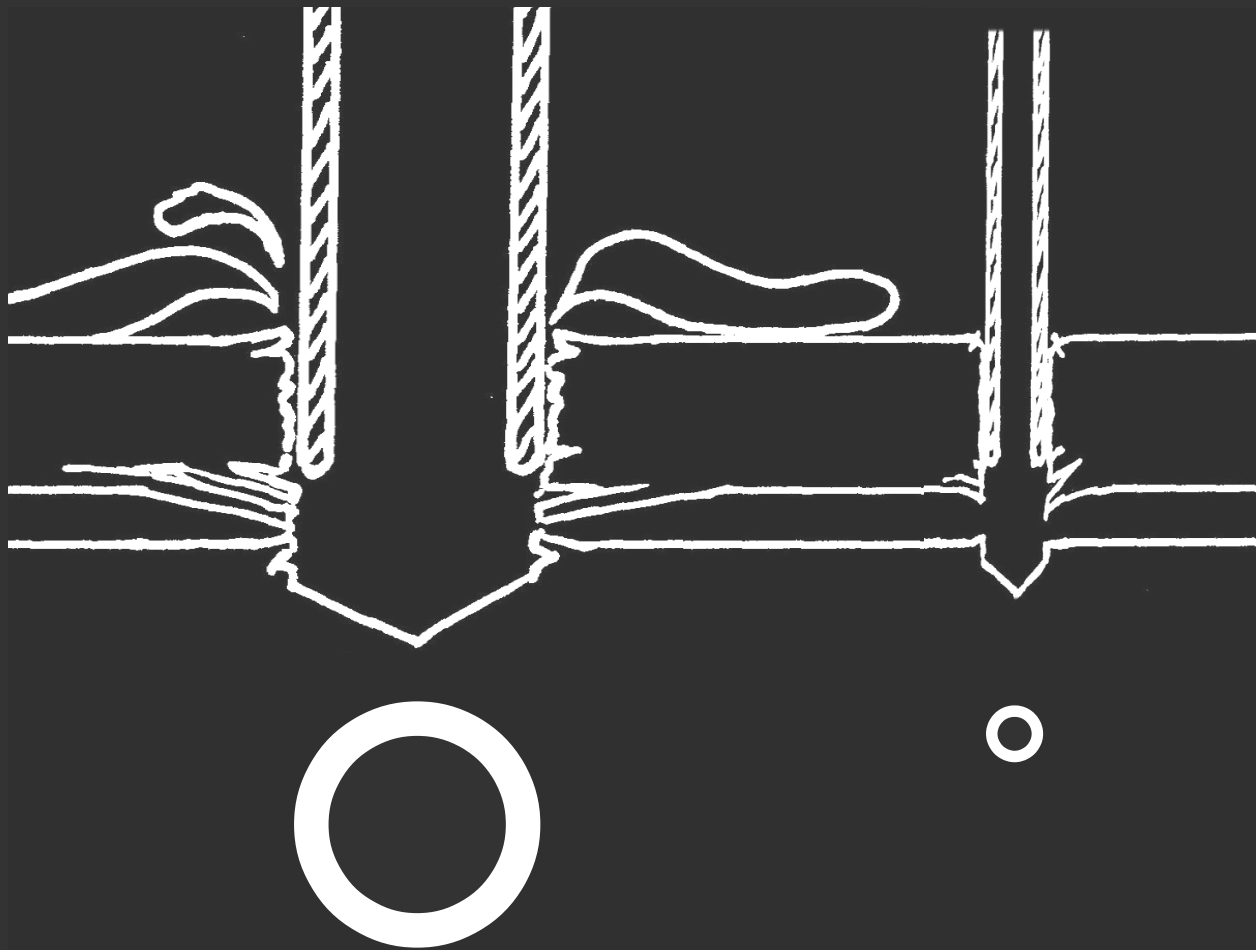
Photo: J. Bém

BOHRTIEFE

A $\varnothing$ 0.5 mm wire drill

can drill over 10 cm deep into
the wood

drilling depth = $\varnothing^2 \times 500$



cannula $\varnothing$ 1,2 mm (outer)

Inner surface: 2,8 mm²

cannula $\varnothing$ 0,3 mm (outer)

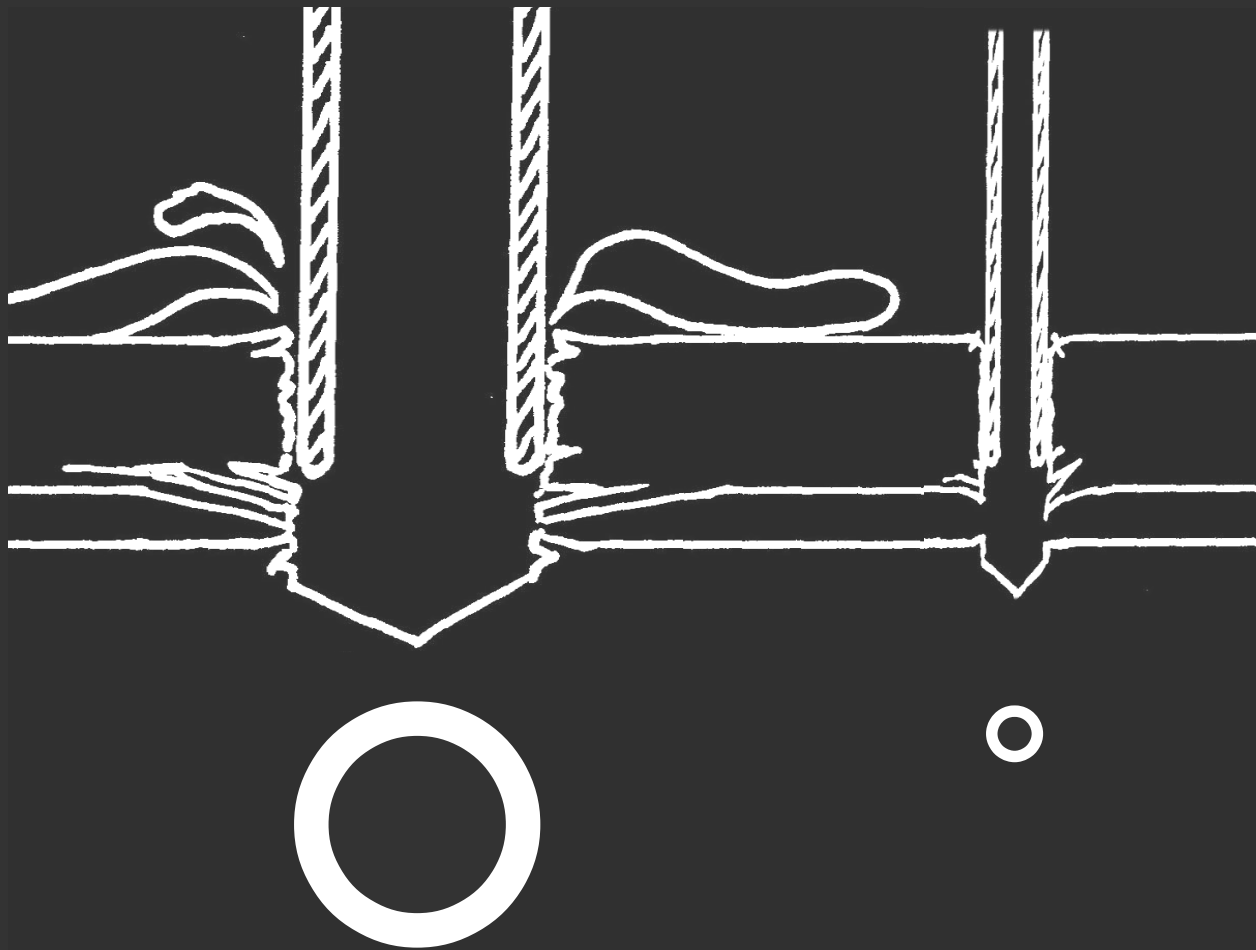
Inner surface: 0,07 mm²

The inner surface of the 0.3 cannula is **40 times** smaller than that of a 1.2-cannula

PROCEDURE

The smaller the diameter of the cannula, the more force needed for an injection.

The Steno injection uses high pressure to deliver the glue through the thin cannula.



cannula $\varnothing$ 1,2 mm (outer)

Inner surface: 2,8 mm²

cannula $\varnothing$ 0,3 mm (outer)

Inner surface: 0,07 mm²

The inner surface of the 0.3 cannula is **40 times** smaller
than that of a 1.2-cannula

INJECTION PRAMETERS

- Injection pressure
- Viscosity of the glue
- Speed of injection
- Inner diameter of the cannula
- Length of the cannula

WORKING PRESSURE

The working pressure offer defines the possibilities of injection.



bis 4 bar



bis 800 bar

INJECTION DEVICE

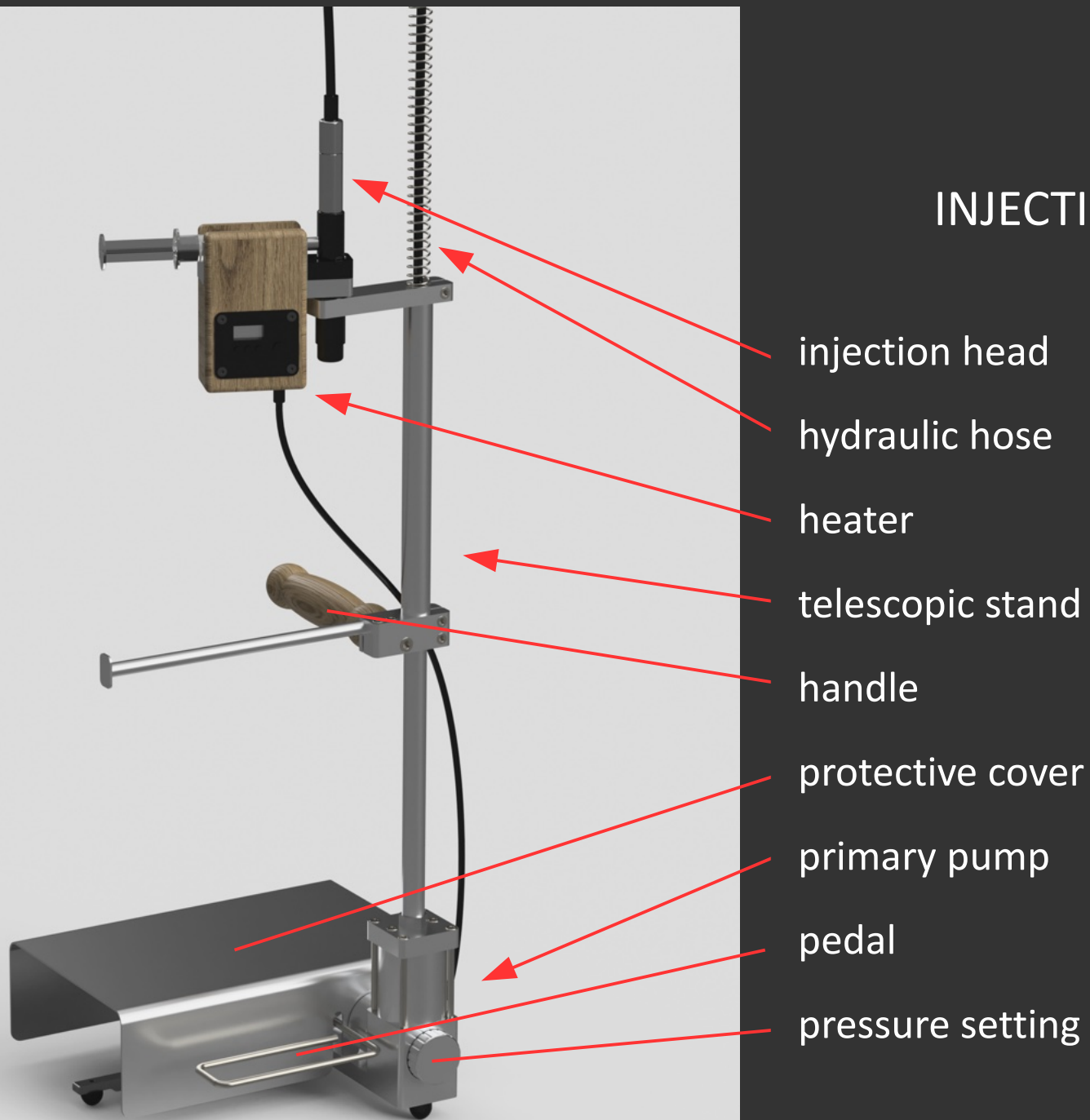


Image: J. Bém

INJECTION HEAD

hydraulic hose

cartridge

cannula

Photo: J. Bém



Photo: J. Bém

WHAT CAN BE INJECTED?

glues:

animal glues, PVAC-glues

solvents:

Water, ethanol, ethyl acetate, benzin.

fillers:

Lycopodium (up until $\varnothing$ 0,3mm)

Micro balloons (up until $\varnothing$ 0,5mm)

WHAT CAN **NOT** BE INJECTED?

Solvents that attack the seals or cartridges, for example: acetone

Abrasive fillers:

Chalk, gypsum, pumice ..

Strong acids or bases for
occupational safety.



Photo: J. Bém

PROJECTS



marquetry



floor



sculpture



Photo: J. Bém

FIXING A MARKETING TABLE TOP

Saloon table, Neo-Baroque

Historicism 1850 - 1870

MARQUETRY

On the table top is very detailed geometric marquetry, that has many unstable positions.



MARQUETRY

The marquetry consists of over 2000 small, accurately assembled pieces.



MARKING LOOSE AREAS

The glue positions were marked with adhesive arrows.



DRILL

For drilling, a spring wire of 0.2 mm diameter was used.

This was squeezed out at the tip to a 0.3 mm bore

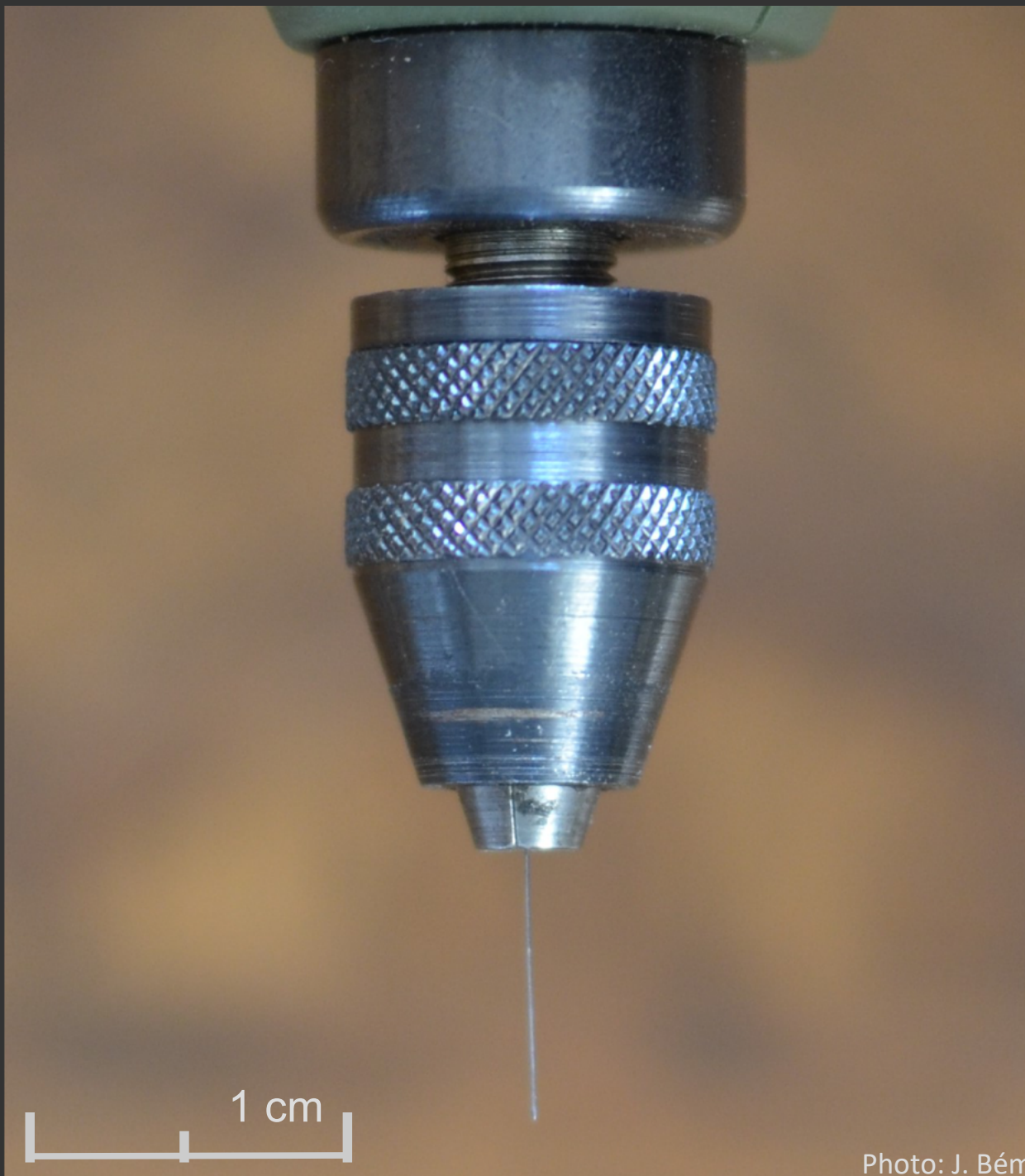
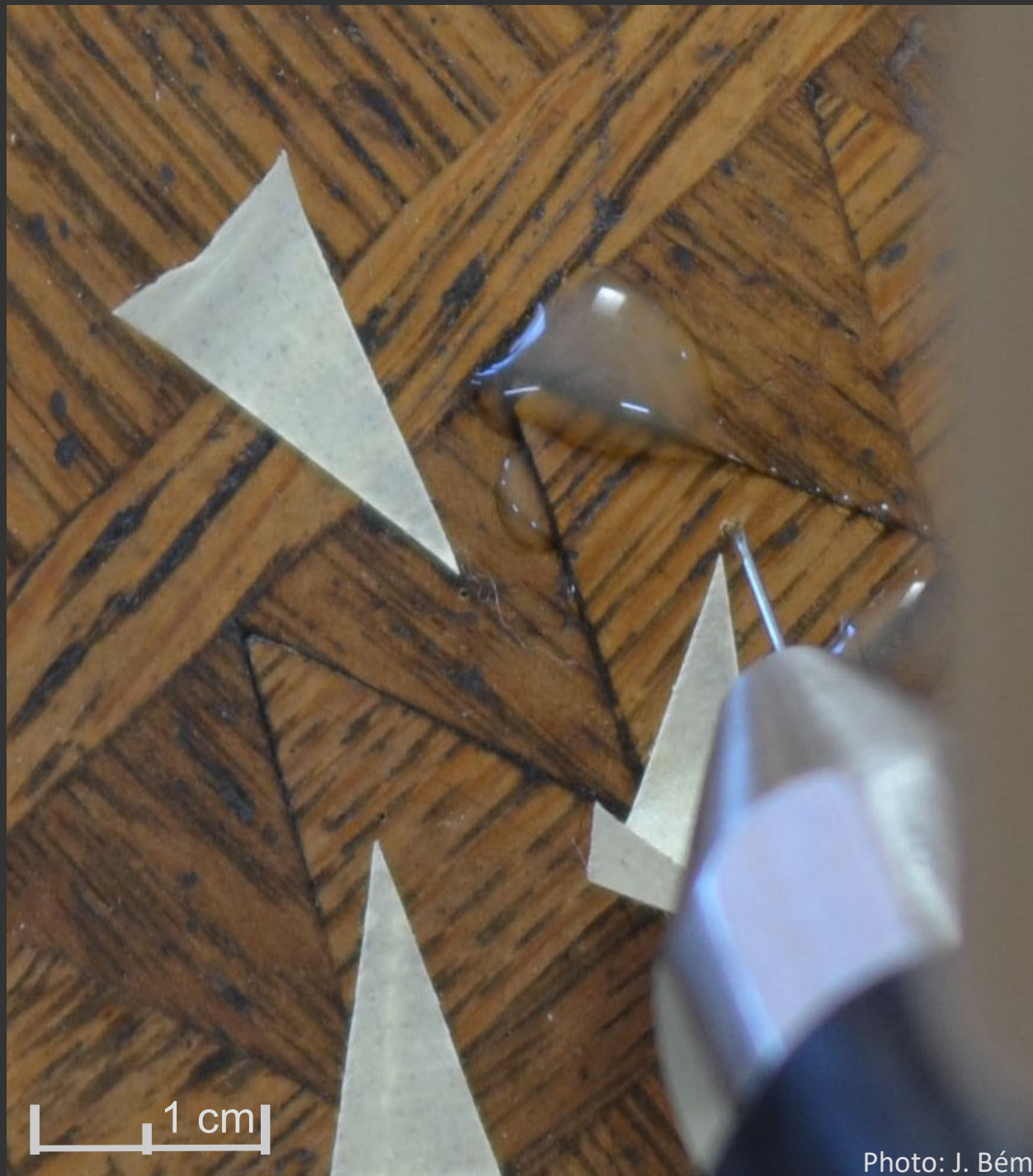


Photo: J. Bém

INJECTION

Warm 30% rabbit glue (G) was injected through a cannula of 0.3 mm external diameter.



CLAMPING

Afterwards the surface was pressed
with a warm caul.



Photo: J. Bém



Photo: J. Löwe, Akanthus GmbH

FIXING THE VENEER LAYER OF THE PARQUET FLOOR

the memorial:
„House of the Wannsee Conference“

1915

(project by Akanthus GmbH)

PARQUET FLOOR

In the memorial:

„House of the Wannsee Conference“



MARKING OF LOOSE AREAS

The floor was completely examined and the detached loose positions were marked with adhesives arrows.





WORKPLACE

Injection device

moving platform

toolbox

injection pen

drill

drill

weight

cartridges in a water bath

warm cauls

Photo: J. Bém

AFTER INJECTION

The gelled glue drops can easily be removed from the surface.



STENO-INJECTION TECHNIQUE FOR FLOOR STABILIZATION

- high work efficiency
- significant increase in the quality of work

Risk:

- the veneer can be lifted by excessive application of glue



Photo: J. Bém

CONSOLIDATION OF A POLYCHROMED SCULPTURE

Christ Triumphant



Photo: Patrick Kujas

UNSTABLE DOWEL JOINT

Due to strong insect infestations, cavities in the area of the dowel joint have been created.

The joint is movable, but can not be dismantled due to the risk of breakage.



Photos: Patrick Kujas

PREPARATION OF THE SCULPTURE

The surface was protected with
cyclododecane.

The anobia exit-holes were
numbered and used as drilling
positions.

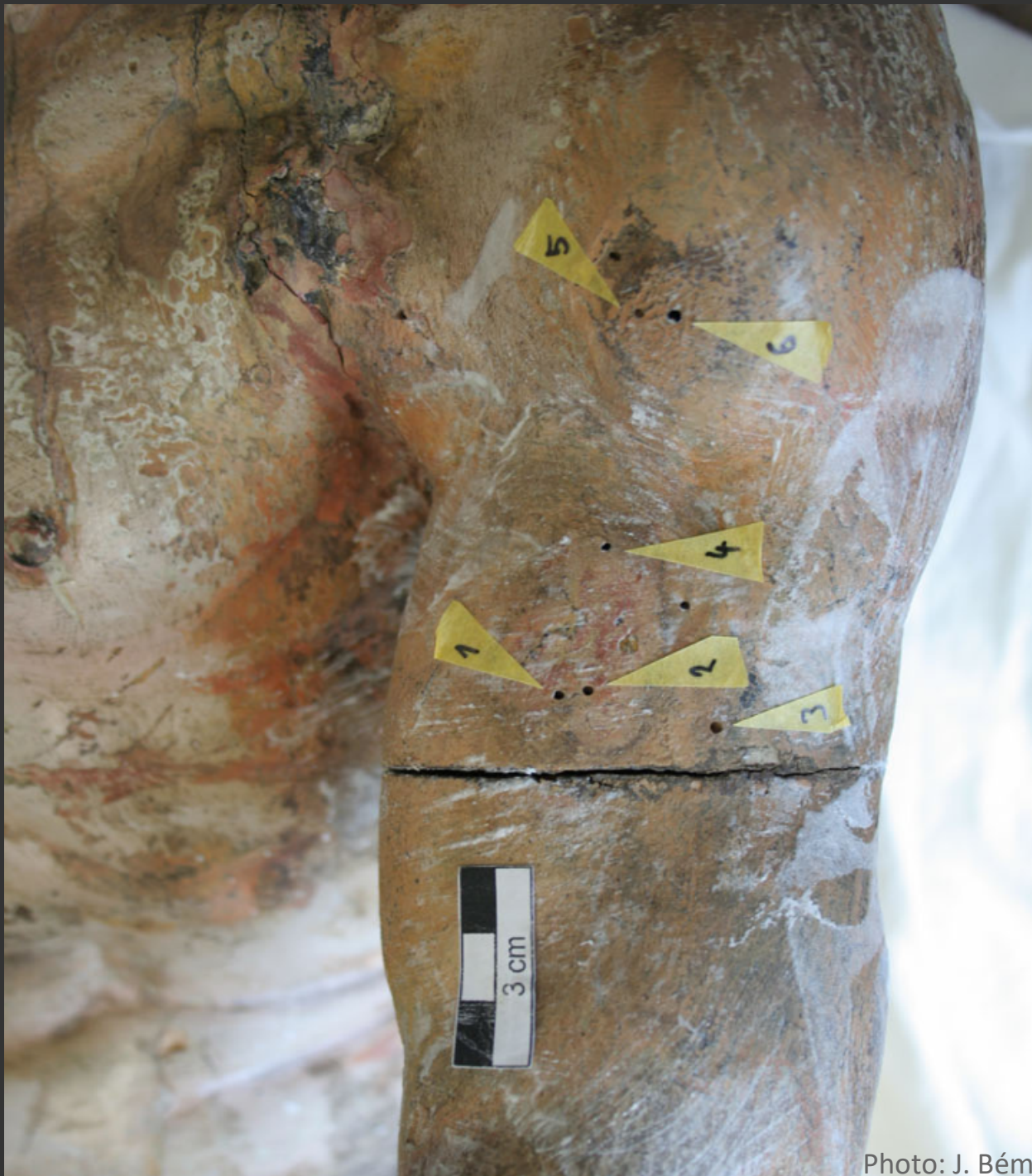


Photo: J. Bém

DRILL

For drilling, a spring wire of 0.6 mm diameter was used.

The drilling resistance provides important information about the cavity structure.

(Photo: Drill on the right arm)



INJECTION

First, about 3 ml glue was injected into the cavity in order to bind the wood flour.



Photo: J. Bém

INJECTION

The putty was injected immediately.



Photo: J. Bém

(Photo: Injection on the right arm)

INJECTION

A total of about 20 ml of putty was injected.

About 15 ml of injection putty remained in the dowel joint.



Photo: J. Bém

STABILISATION

The excess putty was removed and the joint was fixed in the correct position.



Photo: J. Bém

The drying time was estimated at about 6 weeks.



Photo: J. Bém



Photo:Marie Buhl



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THANK YOU FOR YOUR ATTENTION

www.steno-injection.com



Photo:Marie Buhl