

# MICROSCALE RADIOCARBON DATING OF PAINTINGS

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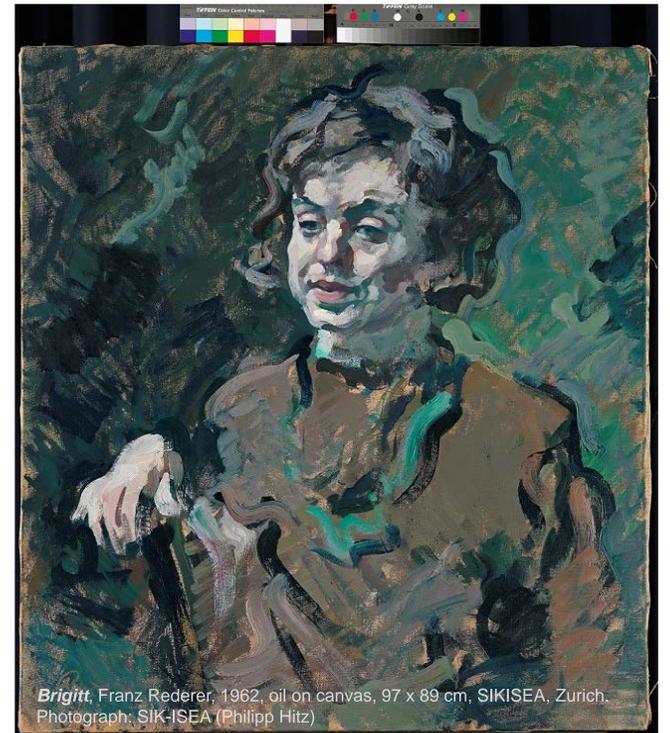
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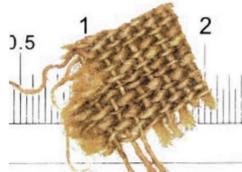
Brigitte, Franz Rederer, 1962, oil on canvas, 97 x 89 cm, SIKISEA, Zurich. Photograph: SIK-ISEA (Philipp Hitz)

## INTRODUCTION

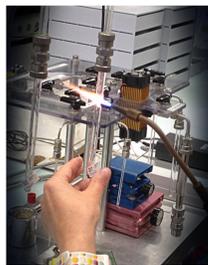
In this work radiocarbon dating of paintings using minimal sample sizes was investigated, in an effort to address the problem of limited access to sample material in paintings [1]. Indeed a minimum sampling of 10-20 mg of original material is commonly necessary and prevents sampling of many valuable objects. <sup>14</sup>C analyses were conducted on signed and dated paintings from two Swiss artists of the 20<sup>th</sup> century. Additionally a new approach was also explored, namely the feasibility of dating the natural organic binder.

## METHOD

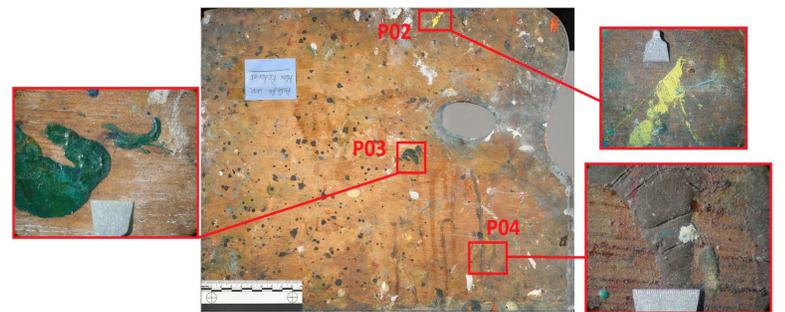
**Canvas samples** were analysed by Fourier transformed infrared spectroscopy and polarized light microscopy in order to identify the presence of any synthetic fibres. Following the assessment of only natural cellulose based fibres, samples of different sizes ranging from several milligrams down to hundreds of micrograms were cleaned by soxhlet and treated following the conventional ABA procedure [2].



**Paint samples'** composition were characterized by X-ray fluorescence spectroscopy, Fourier transformed infrared spectroscopy, and Raman spectroscopy. Paints containing no other carbon source than the natural organic binder were hereby identified, sampled and cleaned by single acid wash.



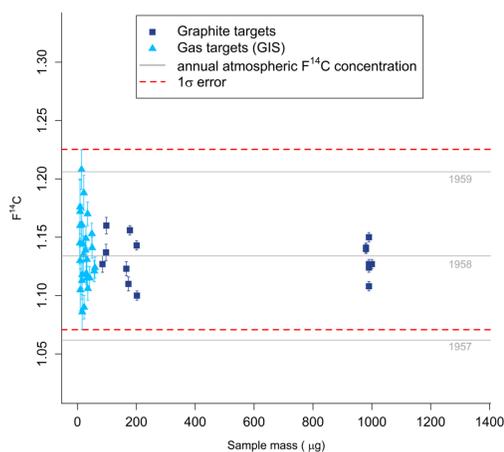
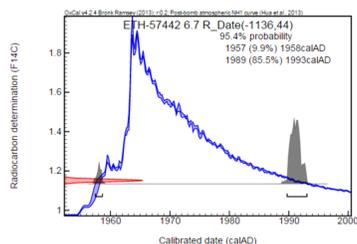
All samples in the microgram range were prepared as **gas targets** before subsequent <sup>14</sup>C measurement on the Gas Ion Source (GIS) of the MICADAS [3,4].



Palette of Franz Rederer (1899–1965), SIK-ISEA, Zurich. Photograph: SIK-ISEA (Philipp Hitz)

## RESULTS

**Canvas samples** of 200 µg were successfully dated, hereby offering the best compromise between minimal sampling amount, yield recovery after ABA treatment and measurement precision.

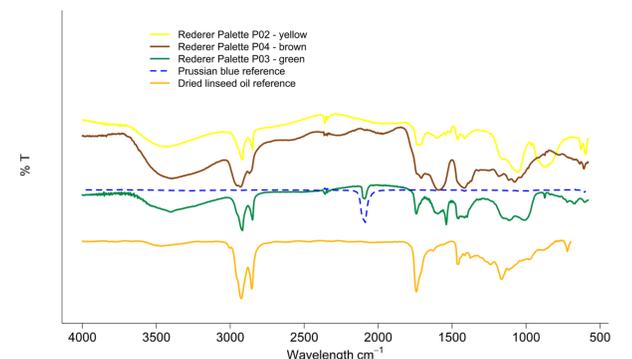


P04: **Brown paint** = mixture of carbon black, chalk, synthetic organic red (Raman analysis indicate alizarin) and iron oxide yellow

P03: **Green paint** = Mixture of prussian blue and phthalocyanine green (Raman)

→ Both are deemed unsuitable for <sup>14</sup>C analysis as they contain sources of dead carbon (synthetic organic pigment and phthalocyanine green)

P02: **Yellow paint** = lead chromate yellow in oil  
→ Carbon free pigment thus suitable for <sup>14</sup>C measurements of binding medium, which yields as result:  
<sup>14</sup>C = 177 ± 98 yr BP



Calibration of the radiocarbon age for P02 **yellow paint** results in different time ranges from the 16<sup>th</sup> to 20<sup>th</sup> century. One time interval (1908-1954) match expectations as it covers the first half of the twentieth century, which is perfectly consistent with the time frame of Franz Rederer's activity (1899–1965).

## CONCLUSION

In this work we report the **successful downscaling of canvas sampling** requirement prior <sup>14</sup>C analysis, namely from 10-20 mg (1-2 cm<sup>2</sup>) down to **200 µg** (single fibre of 0.5 cm). The binding medium in one carbon-free **paint was successfully dated** and successive calibration of the measured data correlates with the time frame of the painters' activity. Thus the feasibility of dating the organic binding medium is proven when a suitable carbon free pigment zone is identified.

## REFERENCES

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