

# IMAT Application in Art Conservation

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In November 2011, the IMAT (Intelligent Mobile Accurate Thermo-Electrical mild heating device) project under the European Commission's 7<sup>th</sup> Framework Program (FP7) for research has been launched. In the IMAT project the application of carbon nanotubes offered new opportunities to design radically new highly accurate mobile mild heating technology and devices. Thus multifunctional flexible "smart" mat heater was produced. Pranas Gudynas Restoration Centre (branch of the Lithuanian National Art Museum) took part in this project as a partner, so we were one of the first to try this film heater.

IMAT was successfully applied to consolidate paint and ground layers in polychromed sculptures and paintings conservation. We were exceptional and the first to try IMAT mat in treatments with enzymes.

The first attempts to use enzymes in conservation performed in seventies. In our days enzymes are becoming more and more popular. The conservators use them for adhesive, overpaints or varnish removal, spot and dirt cleaning.

Enzyme activity depends on substrate concentration, temperature and pH. Temperature is one of main factors affecting enzyme activity. While using enzymes in restoration it was a real challenge for conservators to achieve desired temperature and to keep it constant during all process.



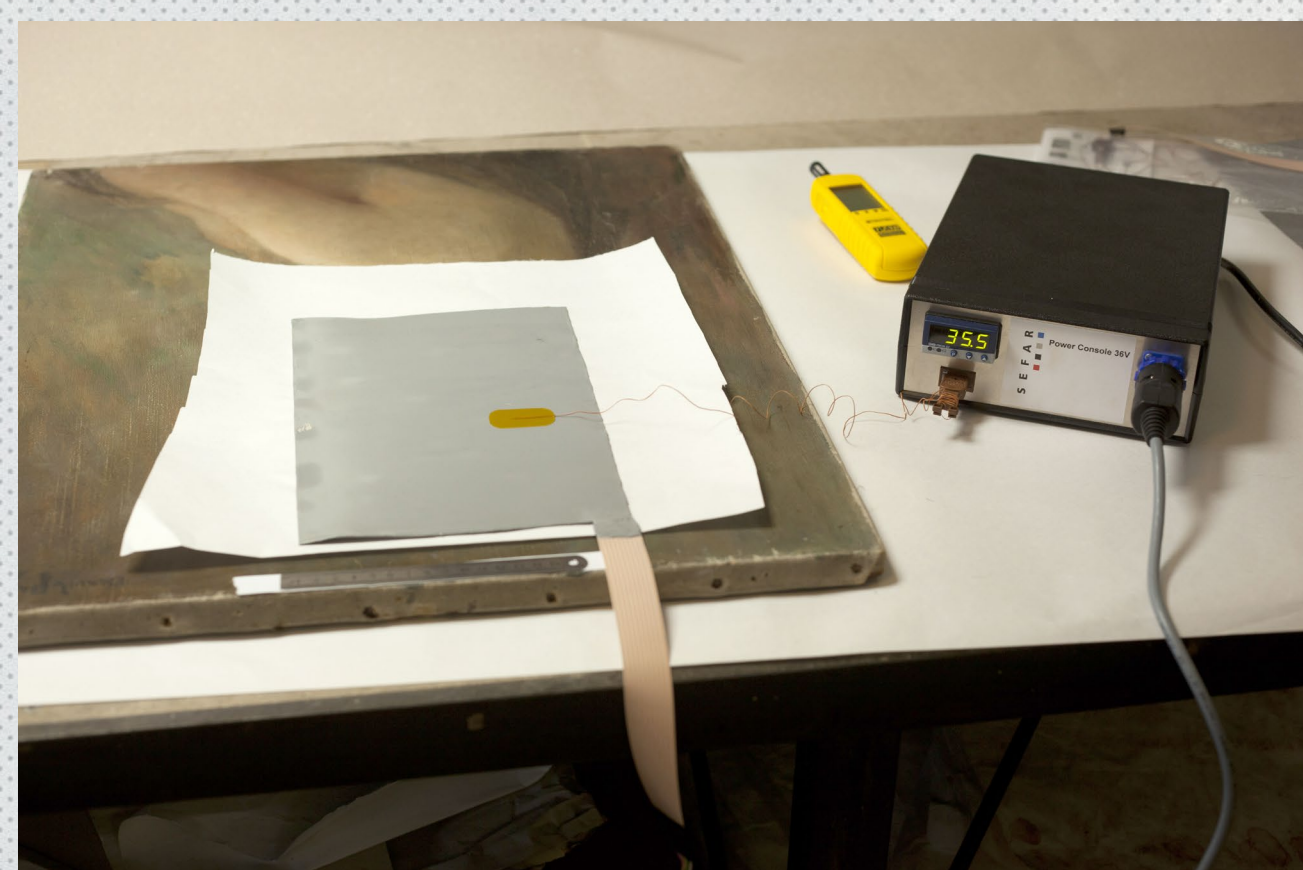
ill. 2 a. The consolidation of polychromed sculpture priming and paint layers. Skin glue dissolved in distilled water was pasted on the surface through the tissue paper. Conservator Rolandas Vičys.



ill. 2 b. Consolidated place was covered with filter paper and breathable heater (40 °C), pressed down with sand bags.



ill. 3 a. The consolidation of paint layer. Conservator Rūta Kasulytė.



ill. 3 b. The sturgeon glue was spread on surface with soft brush, covered with tissue paper and IMAT. 35-40 °C temperatures were used.



ill. 4 a. The engraving "The portrait of Cornelius Janssenius" before restoration. Old adhesive composed mostly of proteins. Conservation scientist Rūta Butkevičiūtė.



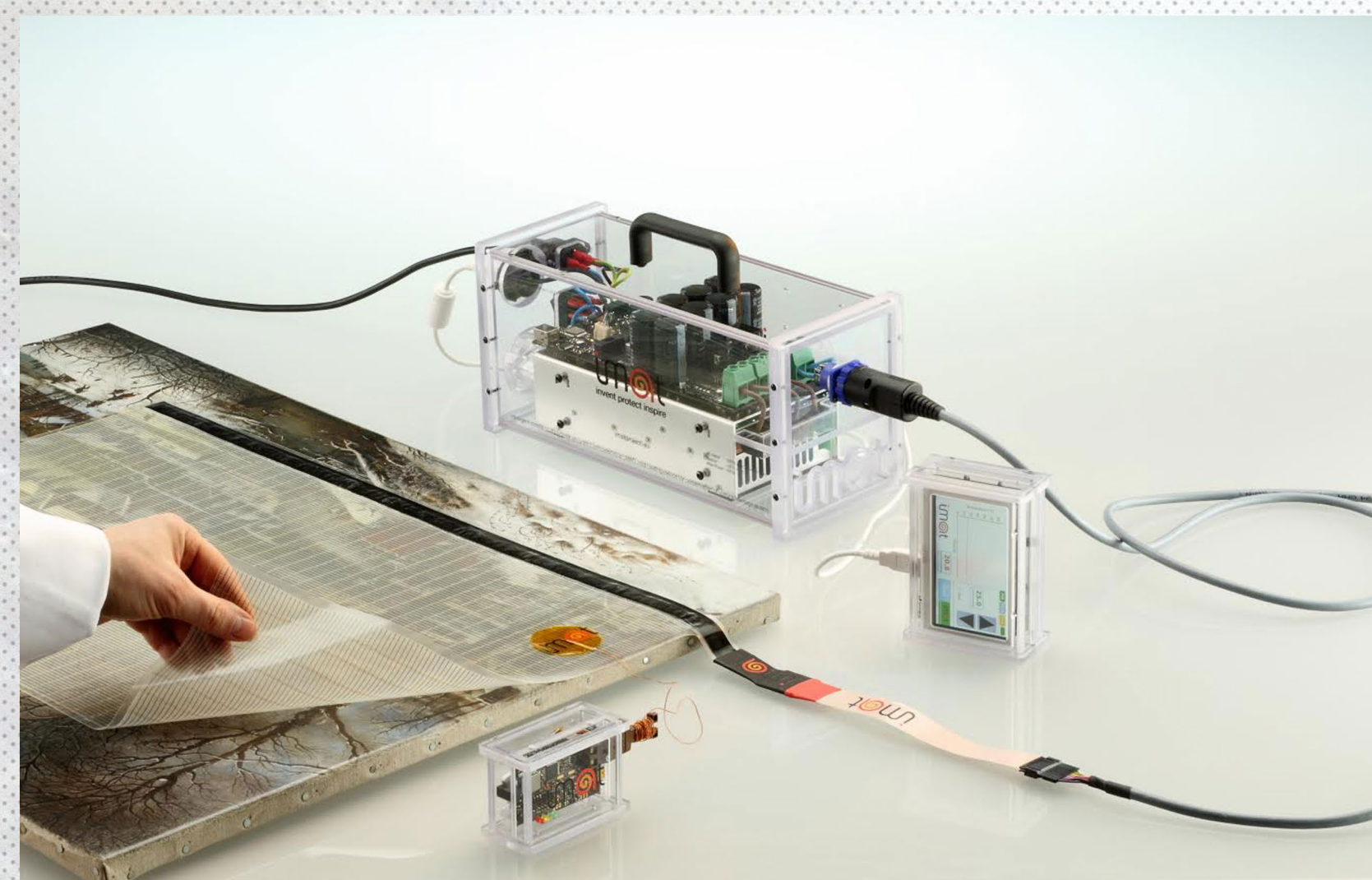
ill. 4 b. The enzyme *Alcalase 2.4 L FG* (Novozymes, Denmark) with *Tylose MH300* as a carrier was pasted on paper through nonwoven polypropylene fabric. Conservator Rytė Šimaitė.



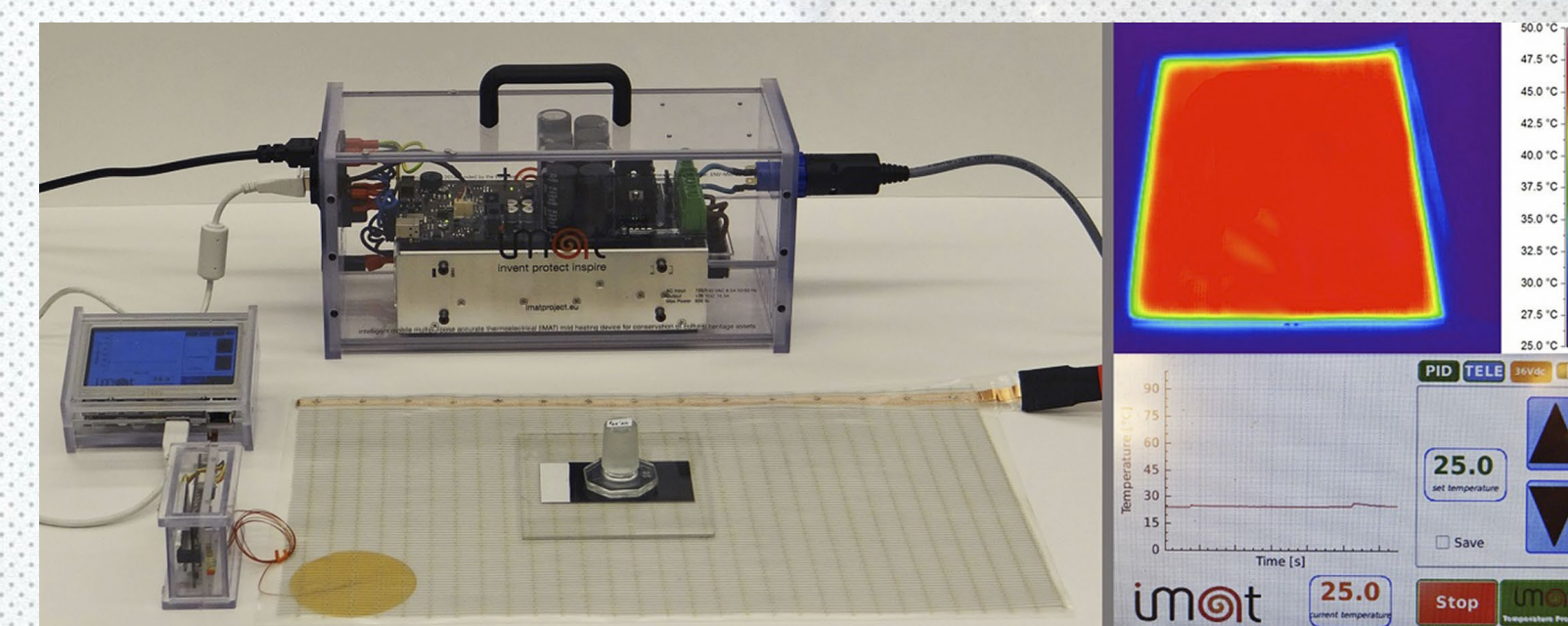
ill. 4 c. Folded extra flexible mat ensured heating from both sides.



ill. 4 d. The engraving after restoration.



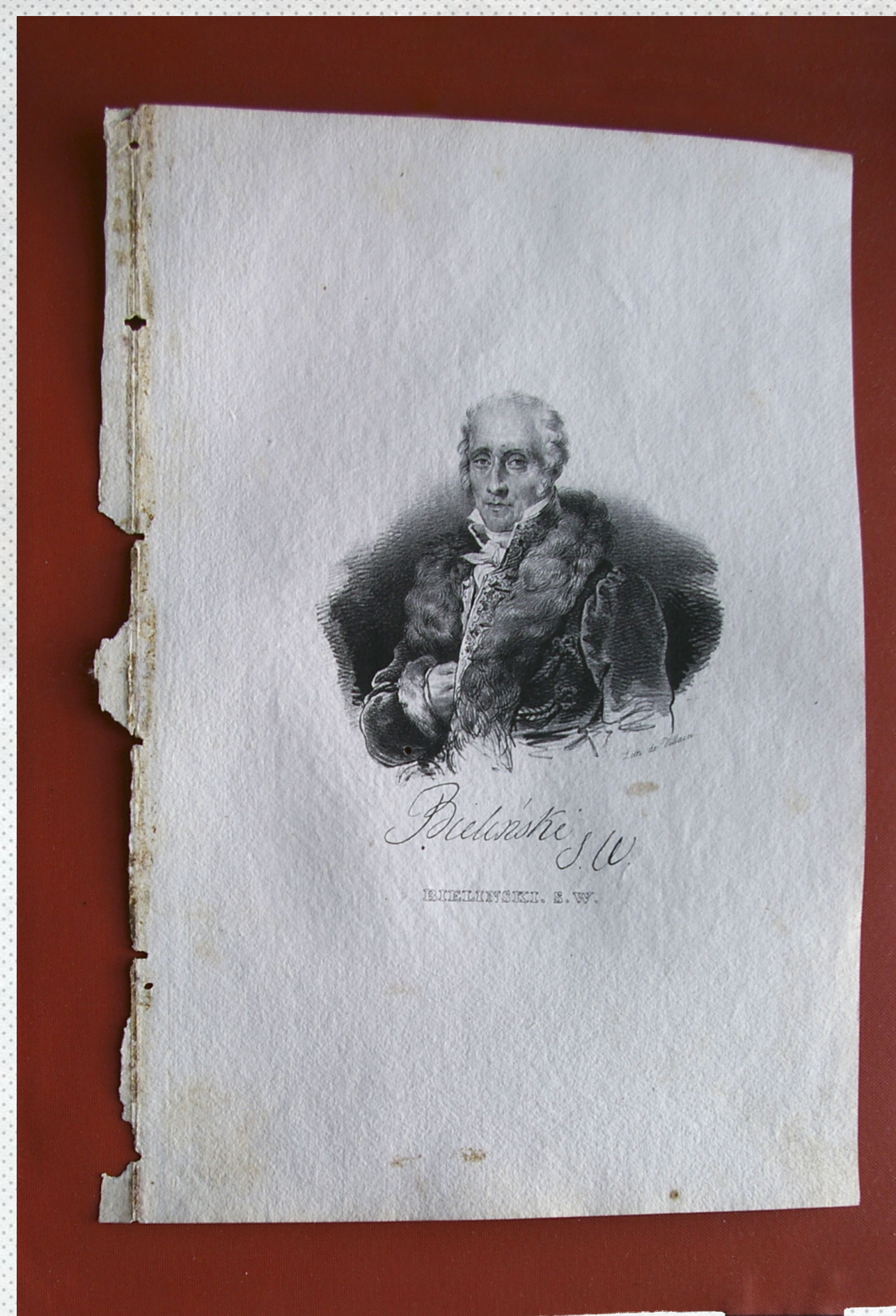
ill. 1 a. IMAT system: flexible transparent or breathable heating mat associated main control unit with a touch-screen control console and a wireless temperature sensor.



ill. 1 b. IMAT heat transfer system (left), thermography of the heater and IMAT touch screen showing event and stable heat transfer pattern.

Paper conservators tried different enzymes to remove old adhesive and to clean spots. Textile conservator used a mixture of enzymes for casein adhesive cleaning. Despite different enzyme carriers and concentrations, treatments more or less were successful. Optimum temperature for used enzymes usually is about 40 °C. Such temperature was ensured by IMAT film heater.

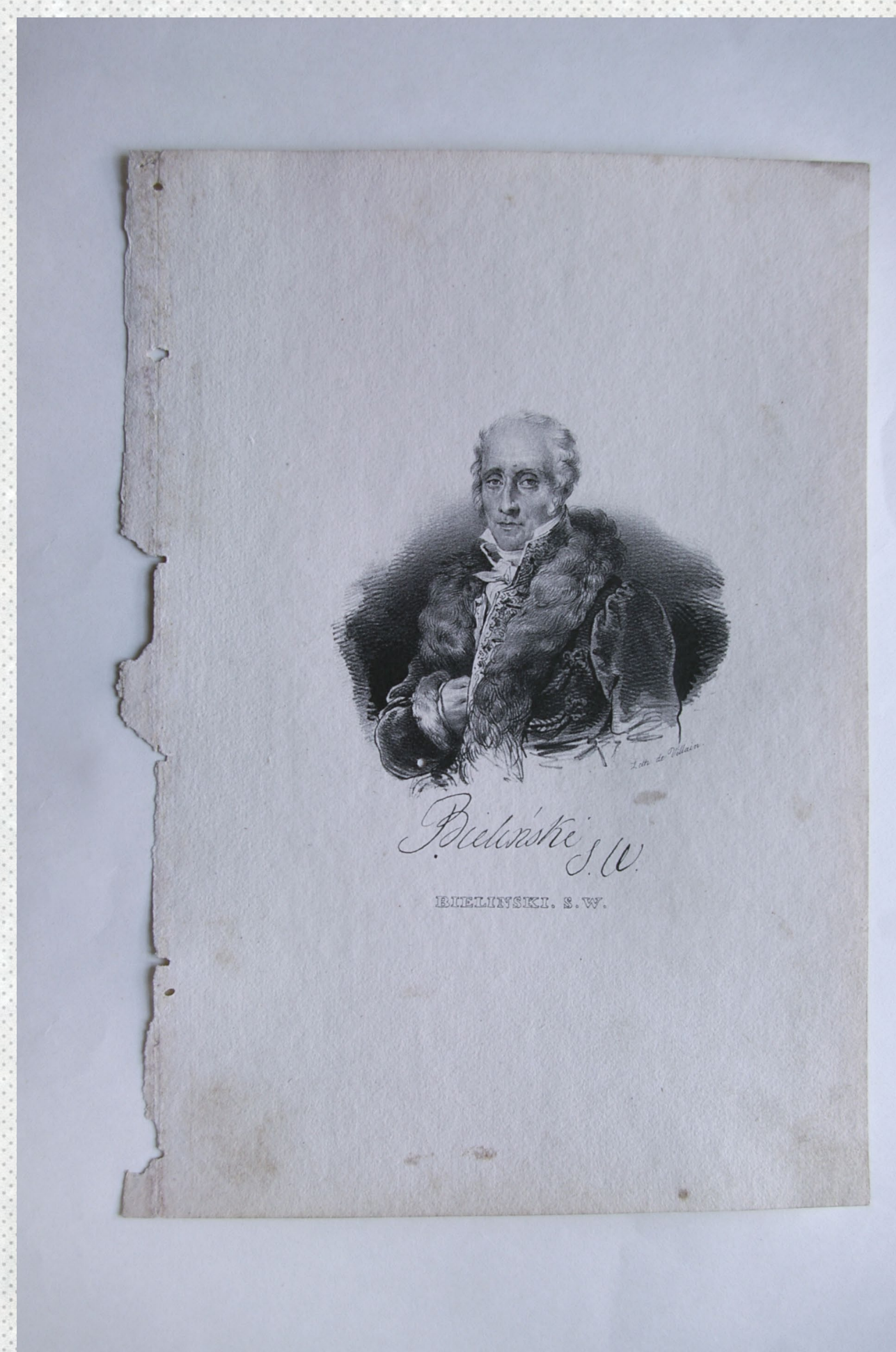
Described cases made it obvious that IMAT heating mat is essential and suitable in conservation processes with enzymes.



ill. 5 a. The lithography "Portrait of Bielinsky" before restoration. According to research results, old adhesive was protein glue and starch mixture, some spots contained protein. Conservation scientist Rūta Butkevičiūtė.



ill. 5 b. The mixture of protease *Alcalase 2.4 L FG* (Novozymes, Denmark) and amylase *Duramyl 300L* (Novozymes, Denmark) in *Klucel E*, done in borate buffer (pH7.5), was used for adhesive cleaning. The protease *Alcalase 2.4 L FG* solution in same carrier was pasted on spots through nonwoven fabric. Standard IMAT and 40 °C was used. Conservator Rytė Šimaitė.



ill. 5 c. The lithography after enzymatic cleaning.



ill. 6 a. The embroidered casket before restoration.



ill. 6 b. The moiré silk, decorated with silver lace and silk embroidery with casein adhesive was attached to the wooden box. Conservation scientist dr. Laima Grabauskaitė.



ill. 6 c. The mixture of enzymes *Everlase 16L* and *Esperase 8.0L* (Novozymes, Denmark) in *Klucel E*, done in sodium borate/potassium phosphate buffer (pH9), was applied on adhesive residues. Standard film heater and 40 °C was used. Conservator Danguolė Daugirdienė.



ill. 6 d. The moiré silk after enzymatic cleaning.



ill. 6 e. The embroidered casket after restoration.