Anatomie clastique – many parts make a whole

Rose Peel

ABSTRACT

The Macleay Museum at the University of Sydney holds two anatomical papier mâché models designed and produced by Dr Louis Thomas Jérôme Auzoux (1797–1880). Universities and schools bought such models to understand, through demonstration, human anatomy. These two life-sized human models are rare and significant historical objects not previously fully investigated.

The university had become concerned about their condition. Although light and strong enough to survive years of handling, many surface areas had lifted, cracked, flaked or delaminated, producing a disfiguring effect. The models had previously had some minor treatment but were still covered in black dirt inside and out. The brittleness of the surface with the possibility of further surface losses and the difficulty of handling these figures inspired the university to raise funds for their conservation.

The challenging task of stabilising the three-dimensional models, 'Gladys' and 'William', was undertaken in 2011 and 2013 respectively. The models were cleaned and consolidated. Analysis was undertaken but will require further investigation to add to the international conservation profile of Auzoux collections.

Keywords anatomical models, papier mâché, Dr Louis Auzoux, France 19th century, analysis, Bermocoll E 230 FQ, Beva®gel

INTRODUCTION

The Macleay Museum at the University of Sydney holds two anatomical papier mâché models designed and produced by Dr Louis Thomas Jérôme Auzoux (1797–1880). They were originally intended for professional medical training but also to educate the general public who were keen to understand human anatomy. They are now rare significant objects interpreted both scientifically and as art. Auzoux named such models 'Anatomie Clastique' from the Greek word *klao* 'to break' because they could be taken apart exposing, in this case, the structure and connection of muscles, nerves, blood vessels and inner organs.

Many of Auzoux's human, animal and botanical models survive worldwide in university and museum collections, often in poor condition. Their strange but compelling beauty has led to extensive documentation about the history of teaching anatomy and now embraces conservation investigation.

In 1995 Le Museé de l'Ecorché d'Anatomie du Neubourg was founded in France, to ensure Auzoux's legacy continues. The displays give viewers insight into the variety of models and show how they were manufactured. Nearby in his home village of Saint-Aubin-D'Ecrosville, Normandy, Auzoux had established a factory in 1828 and opened a shop in Paris in 1833. Catalogues with price lists promoted his prolific business, which produced models for over 150 years and exported them to over 30 countries including Australia.

COLLECTIONS IN AUSTRALIA

The Harry Brookes Allen Museum, University of Melbourne, has 11 detailed models of various organs – for example, an eye, larynx and heart – eight of which are clearly identified as being produced by Auzoux. Alexandra Gerner recently researched the collection, specifically the history of anatomy and the use of the papier mâché anatomical models at the university (Gerner 2010).

The Powerhouse Museum in Sydney has 81 models identified as by Auzoux – for example, botanical models of fungi, flowers, human organs and bees in honeycomb – many of which were purchased by catalogue from1883. An Auzoux silkworm, for example, formed part of a demonstration by the Museum's curator in an address to the Royal Society in the 1880s (collection database accessed 30.11.13). The Melbourne Museum, Victoria, also has a model of fungi dated 1914.

It is not known when and how the University of Sydney acquired the two models, nicknamed Gladys (Figure 1) and William (Figure 2), as no acquisition details have been found. It is assumed that the medical school at the university had connections with professors of anatomy from Britain, specifically Scotland, who would have passed on details of these lifelike models and their practicality in demonstration.

The Faculty of Medicine was established at the university in 1856. In 1883 Professor Thomas Anderson Stuart was appointed as the first Professor of Medicine and in that same year appointed Alexander MacCormick as Demonstrator in Anatomy and Physiology. By 1887 Stuart had established a Museum of Human and Morbid Anatomy that grew to 25,000 specimens. Perhaps anatomical models were a part of the collection (Young 1984).

In 1881 NSW passed 'An Act to authorize the establishment of Schools of Anatomy and to regulate the practise of Anatomy therein [5th April, 1881.]' known as the *Anatomy Act of 1881*.

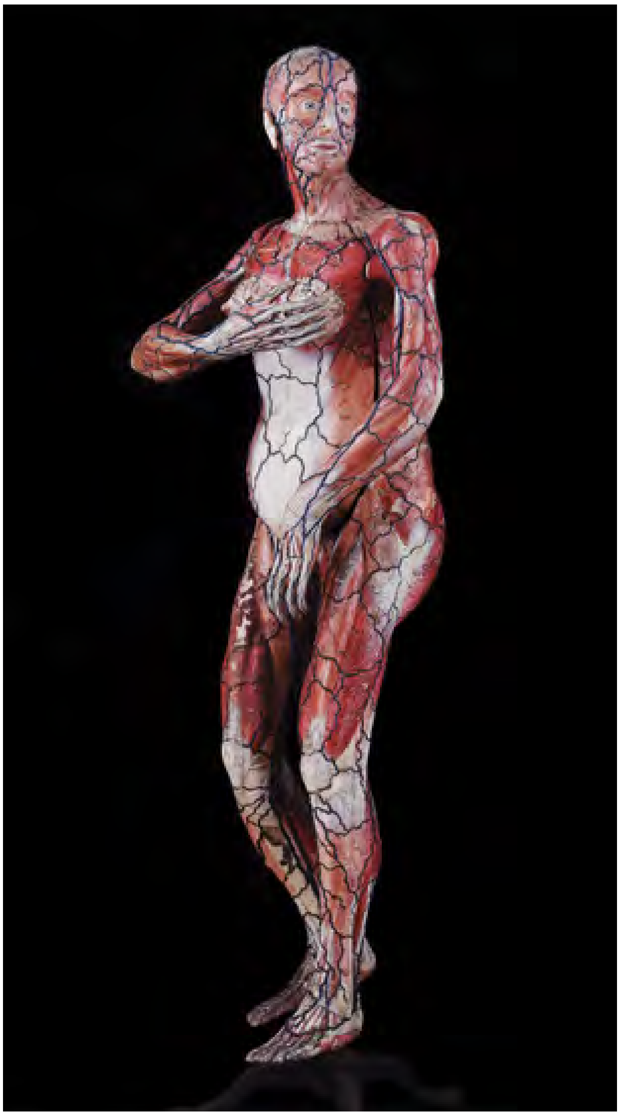

Figure 1. Anatomical model of a female 'Gladys'. Author: Dr Louis Auzoux Date: 1852 (?). Registration number: SC1998.24 University of Sydney. Dimensions: 143 x 52 cm x 36 deep. Photographed by Tim Harland

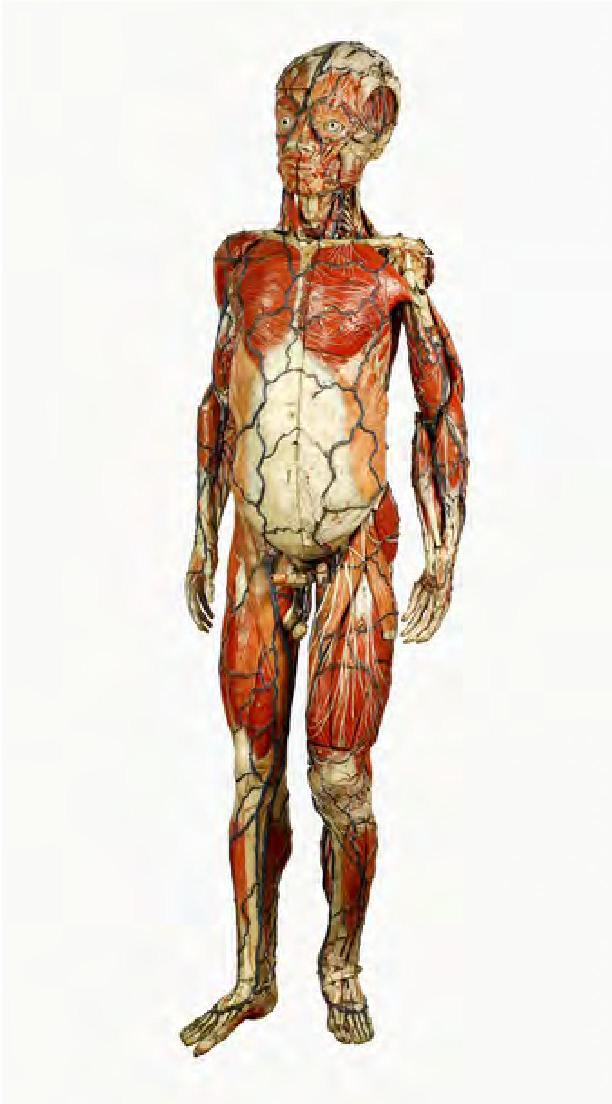

Figure 2. Anatomical model of a male 'William' Author: Dr Louis Auzoux, Date: 1861. Registration number: SC1998.23. University of Sydney. Dimensions: 123 x 38cm x 21 deep. Photographed by Tim Harland

WHY WAS THIS NECESSARY?

Historically in France and Britain cadavers, to be later dissected, were sourced from graves, from those who were hanged for murder or the unclaimed poor. After various scandals, The British Anatomy Act was passed in 1832 and it was this that influenced Britain's colonies to ensure that a supply of bodies was legal and when dissected shown respect, stating in the *Anatomy Act 1881* section 14: 'All persons who shall carry on and practise [sic] anatomy shall do so in such a way as to avoid unnecessary mutilation of any bodies that they may be examining anatomically and shall conduct such examinations in an orderly quiet and decent manner' (*Anatomy Act of 1881*).

'Practical anatomy (Dissection)' was taught in the winter months from May to October at the university, so Gladys and William were probably useful tools during the rest of the year (Sydney University Calendar 1863-4). The Inspector of Anatomy, Thomas B. Belgrave MD, wrote in his report to G. H. Reid, the Minister for Public Instruction, that in 1883, 11 bodies were sourced from: Temora, 1 of anatomical interest, Callan Park Lunatic Asylum 1, Gladesville Asylum 1, Sydney Infirmary 3 and the remainder from the George Street Asylum, Parramatta. He states that 'the latter institution could provide an adequate supply of bodies ... ample for requirements (Belgrave 1884)'. There were only four (possibly six) students at this time, but by 1893 the student cohort had swelled to 100.

HISTORY OF DR LOUIS AUZOUX'S WORKSHOP

France had a vibrant hand-made paper industry in the eighteenth and nineteenth centuries that lead to innovative technological development. For instance, the Montgolfier papermaker brothers invented the first paper lined hessian balloon that flew for the public in 1783 in Annonay. Louis-Nicolas Robert (1761–1828) envisaged a continuous paper sheet and is credited with designing the prototype of the Fourdrinier machine that was to democratise literacy.

The burgeoning papier mâché technology formed as cast pulp – papier mâché (paper strips pasted together in a mould) or papier collé (sheets pasted together and pressed between moulds) – were all used to create objects such as decorative wall panels, furniture or indeed puppets which were sold on the streets of Paris.

This strong but light material inspired Auzoux to design anatomical and botanical models, as a replacement of earlier models made of wood, ivory and coloured wax – which was expensive and not durable. Auzoux qualified as a physician in 1818 and because of his personal experience in dissecting decomposing cadavers, with intermittent access, when studying medicine, he experimented and presented his first model of a human figure to the Paris Academie Royale de Médecine in 1822. Encouraged by the response he opened a factory where he employed both men and women in paper crafts, related trades and as artists. It is extraordinary to think that this business survived through the turbulent times of the Second Republic in the 19th century, the First and Second World Wars and well into the 20th century.

CONSTRUCTION

Auzoux's creative production has been analysed through historical and conservation investigation. Barbara Dumont describes the process but first distinguishes the terms papier mâché and papier collé, as both methods were used for the models depending on the structural requirement (Dumont 2011).

The lighter non structural parts that can be disassembled were formed in two halves of a plaster mould by overlaying up to 12 starch-pasted paper strips – a method of papier collé. When dry, the two sections were sewn together with an iron wire forming a hollow section. The wires were disguised by an overlay of paper (Nijhoff Asser 2008, Dumont 2011).

The larger structural parts were formed in alloy moulds, a combination of lead, antimony and tin invented by the chemist, Jean Darcet (1725–1801). The reusable moulds were set into wood and filled with 'the specific paper pulp called carton pâte'. Auzoux named it Terre, which means 'earth' or 'clay' (Dumont 2011). Martyn Gorman writes after visiting Le Museé de l'Ecorché d'Anatomie that the moulds were 'first of all lined with several layers of glued paper and then filled with "Terre" a paste of flour glue, finely shredded paper, chopped rags, blanc de Meudon (calcium carbonate) and poudre de Liège (powdered cork)' (Gorman 2005)[1]. This confidential technique was passed on through generations of workers. The cast mixture was hammered into the moulds and it is thought a metal skeletal armature was introduced at this stage for strength.

The two halves were then aligned and forced together under pressure from a cider press until dry. The surface was then covered with paper – called rapapillotage – in preparation for painting (Dumont 2011).

The blood vessels were represented with iron wires, which were prepared separately and were bound by fibre thread. Dumont analysed these threads as ramie fibres. They were then nailed into position. Some of the wires visible in William appeared to have only a coating of a white ground and others, like Gladys, had clearly defined bound brown fibre threads, covered by a white ground.

ANALYSIS

Helen Laurendet (2013) X-rayed the male's right arm that clearly shows the complex construction (Figure 3).

XRF of the same arm was undertaken with a Bruker Tracer III-V+ handheld XRF analyser, by Alayne Alvis who identified:

Site 1 – vein standing free from musculature upper arm, taken from side – very large proportion of Zn, significantly less Fe and Pb.

Site 2 – the metal hook, securing arm to body – Fe, possibility of trace of Pb.

Site 3 – tip of thumb, roughly where nail would be; to look at lighter armature in fingers and effect of yellowish paint/surface coating – high readings Zn, significant amount Pb.

Site 4 – centre of inner face of thumb where Fe nail on vein exposed, pearly white paint around – high Zn reading, significant amount Pb (not as high a proportion as site 3), plus a very small but clear reading for Fe.

Figure 3. William: X-ray of right arm

SURFACE LAYER AND BINDER

Skilled painters applied the brush painted details of blood, nerves, veins and muscles, resulting in a lustrous finish. One detached fragment from Gladys clearly shows at least three alternate layers of a proteinaceous material and pigments to the final protective surface. Le Museé de l'Ecorché d'Anatomie records that sturgeon or another fish glue was used for this purpose.

Although FTIR analysis could not identify the exact protein it is assumed that both models' surface coating is fish glue. A sample of the surface coating from William also included particles of calcium sulfate, which was probably lying around the studio. There is no discolouration of this material as would be expected of animal gelatin exposed to light. There were undoubtedly manufacture variations over time.

FTIR found no evidence of oil or egg tempera as a binder in either model. The binder is assumed to be water based although there was not enough binder available to identify a specific gum[2].

PIGMENTS

Pigments were dispersed in water and mounted in Melt Mount (RI=1.66) and examined x 400 magnification with polarized light microscopy.

Results for William

It is a limited palette and consistent with other analysis.

- Blue - Prussian blue for the larger veins with some carbon black that makes it darker
- Blue - Prussian blue contains lead white, calcium carbonate and sulfate to vary the tone
- Red – a very fine iron oxide was used for the smaller bright blood vessels
- White - zinc and lead white created a warmer white
- White - Lead white and calcium carbonate – were visible in white ground and paint

FIBRES

William – fibres were extracted from an exposed area near a metal prong on the left brachial muscle near 'portion moyenne'. Linen/flax was identified with extreme destruction of the fibres, examined x 400 magnification – Olympus BX60 and Leica DMLP

Gladys – fibres were also taken from the verso of two detached surface areas. The fibres would have been the outer layer of the mould and sit next to the ground layer.

Microscopic features:

Herzberg stain identified linen – cross striations, single and bundled and wheat straw – ring cells were clearly visible.

Staining colour:

Bast fibres¬ –¬ stained red and raw straw yellow. Patches of blue suggest starch particles.

Phloroglucinol – all fibres stained yellow so there is no lignin.

AUTHENTICATION – SIGNATURE

Each part is numbered and identified in French on separate paper labels glued to the surface. Small printed hands point a finger to the corresponding number that shows where the piece can be detached. The hand's direction suggests where an aligned metal prong slips into a section and at the other end an L-shaped hook anchors it to the body. These would normally correspond to a pamphlet – *Tableau Synoptique* – explaining the order that each part could be disassembled and re-assembled, based on taxonomic principles. Unfortunately the pamphlets from this collection are lost.

Elizabet Nijhoff Asser researched the various signatures and found that models signed and dated 'Auzoux doct. fecit anno 18..' were used by the company before 1880, the year Auzoux died. And from1880 to at least 1914 they read 'Anatomie Clastique du doct. Auzoux 18…' (Nijhoff Asser 2008, p.288). William is clearly signed in black ink 'Auzoux doct. Fecit anno 1861', on the upper right thigh. Gladys has only a partial inscription that includes – an incomplete 'A …' and below it a 'd' and '…iT'. followed by '… a'. This could mean the missing words are 'Auzoux doct. fecit anno' which suggests before 1880 but is not conclusive. The image of this inscription was manipulated with Photoshop as it can sometimes reveal, more effectively than infrared, invisible script or images, but this proved unsuccessful as the surface coating on which the signature was written was too damaged or lost.

CONDITION

Both models were in extremely fragile condition due to cupping, flaking and loss to the surface (Figure 4). Both thoracic sections were distorted and could not properly close with the hooks and eyes due to the effect of humidity – probably because they were left disassembled on many occasions in a damp Sydney environment. For long-term care and preservation it would be better not to display them open, even though curators and the public may prefer it.

Gladys, who appears to embody Aphrodite, is missing her heart. As the goddess of love, possibly she created a passion in the heart of a medical student not wanting to succumb to her power. William is missing his left proper shoulder. The organs of both, although very dirty, were in sound condition, and their beautifully painted surfaces once revealed, are testimony to the skills of Auzoux's artists.

William is a smaller than life-sized male (cheaper to produce) and far more complex than the female model who is life-sized. William's left leg and left arm can be each disassembled into 30 separated pieces, and his head reveals a brain dissected into five sections and a dissected eye. Both models, except for gender, enclose the same organs.

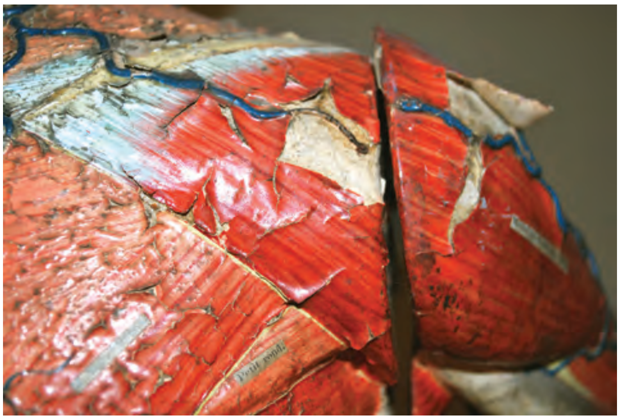

Figure 4. Gladys: Detail of flaking surface

TREATMENT

Both models had previously undergone partial treatment at the university where some surface areas were cleaned and some flakes consolidated. Paper conservator Eliza Jacobi worked with Elizabet Nijhoff Asser on the Museum Boerhaave collection in the Netherlands, and through a serendipitous conversation when she was visiting the National Gallery of Australia in 2011, the proposed treatment of Gladys was discussed.

For both Gladys and William, some areas of the outer body had to be treated first before they could be placed horizontally on the operating table. Sections were removed with a Teflon spatula, as the original tool for the procedure was long lost. Internal areas that were covered in dust were first vacuumed.

GLADYS

As expected the surface coating was very susceptible to moisture and caused immediate swelling. Following Eliza's advice the first area was cleaned with chilled water (Barden1999, Nijhoff Asser 2008). A brush was dipped into the water, brushed onto the surface and wiped onto paper to remove surface dirt. The cleaned area was then wiped with fine disposable face sponges. The protenaceous coating often had ingrained dirt on the surface or underneath that initially was removed with a fiberglass brush but was found too abrasive so some dirt remains.

When the area had hardened again it was further cleaned with saliva and a cotton bud and wiped clean with a sponge. The semi-detached area at this point was quite malleable so depending on the size and thickness either Isinglas or a warm gelatin was initially used by introducing the adhesive under the flake with a fine brush. The area was protected and burnished with a Teflon spatula or held in place with bandaged lead shot weights as previously documented by Richard Barden, Elizabet Nijhoff Asser and Barbara Dumont.

Due to the three dimensionality of the object using lead shot weights proved to be time consuming and not always successful. There were hundreds of areas to be treated and three months to complete the work before it was to go on exhibition at Melbourne Museum, Victoria.

Conservation framer, June Andersen's use of pressure sensitive fibre pore tape that she uses to position photographs temporarily when mounting was recalled. Instead of using the weights, fibre pore tape was used to hold down the area. It was burnished for a few seconds and left in place for several hours until the adhesive dried (Figure 5). This allowed work to continue more quickly as the section could be turned and consolidated. The tape was removed easily and there was no loss to the fragile surface coating.

Figure 5. Gladys: Repair with micro pore tape

The adhesive needed to adhere the flake quickly while remaining flexible without sinking into the ground or paper layers. In addition, there were areas of exposed metal wires that had corroded on the surface or under the paint it was necessary to ensure they were not contacted by further moisture. To treat the corrosion was too problematic without the possibility of affecting the paper or paint although any loose metal particles were removed mechanically. Exposed metal areas were sealed with 10% Paraloid™ B-72 with some hope that that would retard the process once in a stable environment. They were then covered, or if missing, shaped with kozo.

It was decided to use Bermocoll E 230 FQ for the smaller lighter flakes and Beva®gel for the more recalcitrant flakes. Both adhesives dried quickly and could be applied sparingly. The Beva® gel was diluted with deionised water where appropriate.

WILLIAM

The procedure changed slightly during the treatment process. Instead of using the chilled water, the surface was wiped with Bermocoll on a sponge that removed the surface dirt effectively and humidified the flake which was then adhered with Bermocoll or Beva®gel, then cleaned with saliva/cotton bud and a final wipe of Bermocoll (Figure 6).

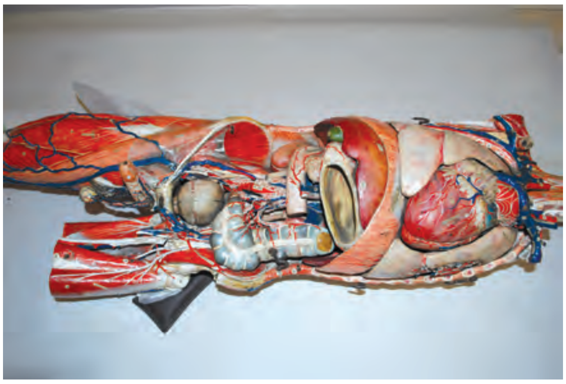

Figure 6. William: inner organs before treatment

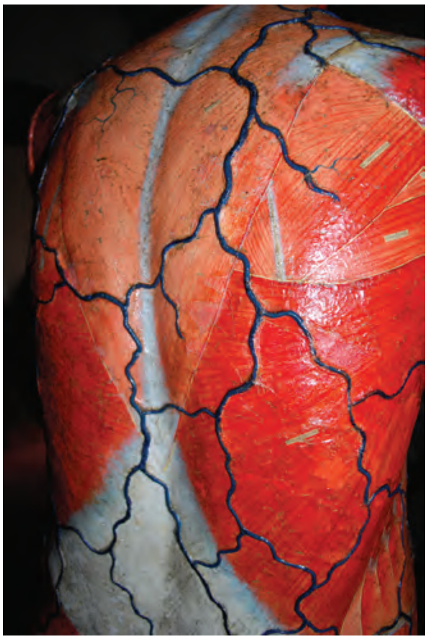

Figure 7. Gladys: Detail of consolidated flaking surface

Areas that were lost in both models were filled with kozo strips and starch paste or toned cellulose powder bound with methyl cellulose, isolated with Bermocoll or Paraloid™ B-72 and inpainted with watercolours. The colour was built up and interlayered with Paraloid™ B-72 that produced a replication of the shimmering finish. These areas are clearly visible as requested by the curators at the Macleay Museum.

Both models were surface coated with 5% Paraloid™ B-72 in ethanol to prevent further distortion through change in climatic conditions and will allow safe handling of the models. Paraloid™ B-72 was not applied to the surface of the organs as they would be protected physically and non-invasive historical information retained. They are, however, vulnerable to change if displayed individually (Figure 7).

CONCLUSION

The two models have been consolidated but not fully analysed due to pressures of time and access. It is hoped that the University of Sydney will further contribute to the ongoing investigation of Louis Auzoux's collections in Australia, thereby providing a greater understanding internationally of his remarkable achievement.

ENDNOTES

1. 1A film made in 1986 under the supervision of Bernard Barral the last director of the company who explains the process. Accessible at Le Museé de l'Ecorché d'Anatomie du Neubourg, France
2. 2 FTIR: Thermo Scientific iD5, ATR accessory with diamond window, Room temperature detector, 16 scans range 400nm¬-4000nm, Software Omnic 8.2 and Thermos Scientific iN10MX, Used in transmission modes. Sample preparation on diamond window Cooled MCT detector Collection time 0.402 sec x 2 scans Range 600nm – 4000nm, Software Omnic Picta.

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MATERIALS

Bermocoll E 230 FQ
(ethylhydroxyethyl cellulose) Akzo Nobel Functional Chemicals AB, SE 44485 Stenungsund, Sweden

BEVA® GEL
aqueous dispersion of ethylene vinyl acetate and acrylic resins in a solution of water-soluble cellulosic material. Talas 330 Morgan Ave Brooklyn, NY 11211, USA

Paraloid™ B-72
ethyl-methacrylate copolymer soluble in acetone, toluene, xylene and ethanol, The Dow Company.

AUTHOR BIOGRAPHY

Rose Peel was Senior Paper Conservator at the Art Gallery of New South Wales 1985–2008, and since 2009 on part-time contract at the National Gallery of Australia. She also works as an independent conservator in Sydney and has a BA in art history and theory, University of Sydney.

Rosepeel17@gmail.com