

## A History of Fish Glue as an Artist's Material: Applications in Paper and Parchment Artifacts

### ABSTRACT

This article presents a brief historical overview of fish glue as an artist's material applied to paper and parchment artifacts. Artists and craftsmen have appropriated this natural glue since antiquity. Artists have used this material in the preparation of binding media and adhesives, the source for which was a commonly available fish protein. Scientific publications and practical recipe books refer to the use of animal and fish glues in the making and restoring of objects, icons, paintings, illuminated parchment manuscripts, and other artifacts.

In this article the author describes only applications of fish glue compiled from the records where it was mentioned as a separate entity.

### EARLY REFERENCES TO FISH GLUE

Glue can be extracted from fish by heating the skin or bones in water. The purest form of fish glue, made from the membrane of the air bladder (swim bladder) of certain species of fish such as the sturgeon, is also called isinglass (fig. 1). Isinglass can be produced from various species of fish using diverse manufacturing processes. Depending on the manufacture, the purity of isinglass can vary. Historic sources do not always specify which part of the fish was used to make the glue.

There is no record telling us exactly when and where the first animal or fish glue adhesives were used. However, it is known that at least 3500 years ago these adhesives were used in Egypt. Even though Egyptian records do not describe in detail the adhesive preparation process, they do tell us that it was made by being melted over fire and then applied with a brush (Darrow 1930, 9).

From the first-century Roman scholar Plinius we learn that two kinds of glue were used in antiquity: animal glue

(*taurokolla* in Greek, *gluten taurinum* in Latin), made from the skins of bulls, and fish glue (*ichthyokolla*) made from some parts of fishes. In references to the glue used by ancient craftsmen, both terms *xylokolla* (in Greek) and *gluten fabrile* (in Latin) are cited; however, it is not clear to which kind of glue these terms applied (Gug 1975, 37).

In an eighth-century European manuscript from the Cathedral of Lucca, fish glue is recorded as a material for painting. A. P. Laurie translated this manuscript into English in 1926; it tells that the pigments in fresco paintings were applied to wet plaster without mixing them with a binding medium, using only water. For panel paintings wax was mixed with the pigments, and for illuminating

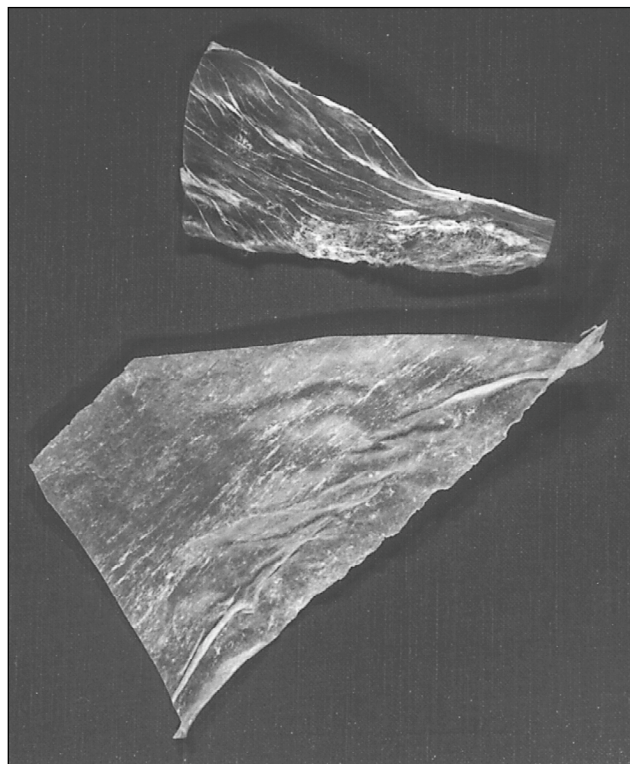


Fig. 1. Sturgeon air bladder membrane for making isinglass.

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parchment manuscripts fish skin glue was used (Laurie 1926, 107).

In the Middle Ages in a twelfth-century treatise on methods and recipes for painting and illuminating by the German Benedictine monk Theophilus, fish glue appears once again. In his *Schedula Diversarum Artium* (Ch. XXX) he gives directions for grinding gold and then mixing it with fish glue for use in gilding of illuminated manuscripts. He continues, (Ch. XXXIII):

... on every sort of glue for pictures of gold, if you have not a bladder cut up thick parchment or vellum. ... Prepare also the skin of an eel. ... Prepare thus also the bones of the head of the wolf-fish, washed and dried, carefully washed in warm water three times. To which ever of these you have prepared, add a third part of very transparent gum, simmer it a little, and you can keep it as long as you wish. (Laurie 1926, 167)

In discussing ink preparation, Theophilus also mentions fish glue among such other materials as yolk of egg, white of egg, parchment, cherry gum, plum-tree gum, and linseed oil (Laurie 1926, 170).

In around 1390 Cennino Cennini (an Italian artist trained by Agnolo Gaddi), the author of the *Craftsman's Handbook* (*Il Libro dell'Arte*), mentions earlier applications of fish glue in restoration: "This glue is made from various kinds of fish . . . it is good and excellent for mending lutes and other fine paper, wooden or bone objects" (Cennini [ca. 1390] 1960, 66–67).

#### HISTORICAL USES OF FISH GLUE

As we can see from ancient and medieval records, fish glue was both a common and important adhesive for many special applications; adapted by artists, it was used from the time of ancient Egypt to twentieth-century France, in painting media, coatings and grounds, in the gilding of illuminated manuscripts, and in pastel fixatives.

#### ILLUMINATED PARCHMENT MANUSCRIPTS: SIZING, GILDING, AND REPAIR

In medieval Europe, parchment was the main material for writing. It was usually made from sheep or calf skin, but occasionally from the skins of such other animals as goat, antelope, and gazelle. Preparation of the parchment was a time-consuming procedure requiring special skills. One of the many steps in the process was sizing of the parchment, which enhanced its strength and prevented the writing medium from penetrating too deeply, allowing the parchment to be reused. When the parchment was to be used over again, the old ink or gouache-like medium was

removed from the surface by rubbing pumice over it; the area was then softened so it could absorb new writing.

Two types of size application, coating and impregnation, were employed. The sizing solution was generally produced from scraps of parchment or trimmings of the whole skin of an animal. Small pieces were then soaked and boiled in fresh water. Fish glue was also used to size parchment. According to D. V. Thompson, this size was prepared from the sounds (air bladders) of stockfish and sturgeon in a manner similar to that used for parchment preparation (Thompson [1936] 1956, 59).

Thompson also mentions fish glue in the context of stabilization (mending) of damaged sheets of parchment, ground preparation for laying gold or pigments, and as a binding medium (fig. 2). The purpose of the binder was to hold particles of pigments together allowing for the paint to be firmly attached to the surface of the parchment. The area on which the gold leaf would be laid was coated first with a solution of fish glue. The property of fish glue to adhere well to the porous parchment support made it a useful material for illumination of manuscripts with gold leaf and painting.

#### ORIENTAL PAINTING AND CALLIGRAPHY ON PAPER: BINDING MEDIUM

In China various kinds of animal glues were implemented as binders in paint media during the T'ang dynasty



Fig. 2. Using prepared isinglass to consolidate flaking media on parchment.

(618–906 A.D.). According to records of this period, for example, one of the essential components of lampblack ink was proteinaceous glue (Sze 1956, 67–68). One of the high quality inks used at that time was made from donkey hides and then mixed with carbon pigment. It is the glossy characteristics of that particular ink that make it easily distinguishable by specialists today. The particular kinds of animal glue that were used during the manufacturing process have, over thousands of years, preserved the distinct features of this finest quality ink.

The Chinese of the T'ang Dynasty manufactured many grades of animal glue. Glues were produced from horns and hides of deer, hides of cow, and skins of fish. Chinese documents of the ninth century record the employment of hide and fish glue in paint media (Winter [1936] 1956, 117). Fish glue from Wu (Kiangsu province) was mentioned, among other paint binders, such as ox glue from Santung and a stag-horn glue from Yun (Yannan province) by the T'ang critic, Chang Yen-yuan (Siren 1936, 232). These glues bind particles of pigments together, forming a film over the ink surface as the ink dries. This coating functions as an organic barrier, which protects ink from the hazardous effects of the environment. The glue also provides an adhesion between particles of pigments and the support. Chinese traditional supports on which ink was applied were, and still are, made from porous materials such as paper and silk. These supports allow the binding medium mixed with pigment to penetrate into the fibers and create a strong bond with it that is beneficial for the stability of an ink medium.

#### GOUACHE ON PAPER AND BOARD: GLAZING AND COATING

In the nineteenth century some artists experimented with non-traditional techniques. Some of these innovations were taken seriously by other artists of the time, but they often failed. The gouache paintings by M. Pierran, for example, which were coated heavily with glue in order to obtain a special effect, were exhibited in the 1834 Salon. These gouaches with their glossy surfaces resembled oil paintings. The technique involves application of the mixture of gouache with a large amount of gum and fish glue. These paintings over time have developed delamination and cracking (Bazzi 1960, 109).

Another method of painting with watercolor on specially prepared Bristol board was developed by C. J. Robertson, for which he received the Medal of Isis from the Society for Encouragement of the Arts, London. The process, from the backing of a Bristol board to the coating, was elaborate. When the picture was completed it was "varnished" with a solution of fish glue and then with a good quality picture varnish. "The advantages of the method are that the color, which stays very brilliant and

transparent, may be worked over in a way impossible by any ordinary method. A similar method is described by Vibert" (Bazzi 1960, 108).

Artists' experiments with coating and glazing of paintings and drawings with fish glue were recorded as early as the seventeenth century. Fish glue produced by boiling of the swim bladders of sturgeons was experimentally used by Van Dyck in his tempera paintings. When fish glue was applied in many layers and in glazed coats, the film formed was easily chipped off (Doerner 1984, 224–225).

These earlier attempts demonstrate that fish glue used alone forms a brittle film. As with any other adhesive, when and where it is appropriate to apply should be considered carefully. Perhaps the brittleness of the film formed by this glue motivated artists to introduce various plasticizers that are also used in conjunction with fish glue in restoration. Molasses in England and honey in Russia have often been used as natural plasticizers. For example, isinglass glue mixed with honey had been used for the consolidation of delaminated paint in Russian icons as early as the seventeenth century (Petukhova 1993).

#### DRAWINGS: PASTEL BINDER AND FIXATIVE

The makeup of soft pastels has not been changed much since the fifteenth century when this medium came into existence. Pulverized color pigments combined usually with white chalk were rolled together into cylinders or other shapes with a small amount of binder. Gum tragacanth and methyl cellulose are probably the most favorable binders in modern manufacturing of soft pastels, although in early recipes, milk, beer, ale, or fish glue had been employed (Maheux 1988, 41).

Methods for fixing pastels have been a great concern for artists working in this medium. Various techniques, from powdering the surface of pastel with gum arabic and then fixing it with hot steam and spraying it with a mixture of water, glue and spirit, to spraying the verso of the pastel with skimmed milk, have been implemented by artists in order to protect this fragile medium from unavoidable deterioration. Milk, water, thin tempera, resin, spirit, and also glue solutions have been the main components of many recipes for pastel fixatives.

Among the artists seriously searching for a method to stabilize the pastel medium and experimenting with isinglass glue, as a component of fixatives are Latour and Degas. The following recipe described by Lorient, and perhaps also used by Latour, includes isinglass glue:

Melt about 150 grains of isinglass in about 3/4 pt. of pure water in a double saucepan over a low fire. Strain through fine linen and pour on to a plate while hot. Add 2 parts of wine spirit to 1 part of glue. (Bazzi 1960, 98)

The method of fixing pastel with this solution, as Maria Bazzi recommends, is by spraying the verso of artwork.

Besides its applications in graphic arts, fish glue material can be found in priming, binding paint medium, glazing, and coating of easel and encaustic paintings and icons. It proved to be an excellent adhesive for wooden objects since the time of ancient Egyptians, who knew the unique qualities of this material.

#### CONCLUSION

It is my belief that conservators have a responsibility to preserve not only the physical structure of an object but also the knowledge left to us by our fellow artists and restorers of an earlier age. Those materials that well served artists and restorers for centuries should not be forgotten. We might find them very useful even today if we have a fresh look at their properties and methods of application. In this article I hope to reawaken the historic knowledge of the use of fish glue, one of the earliest artist's materials, and to encourage its scientific research and its use in conservation of historic and artistic works.

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#### REFERENCES

- Bazzi, Maria. 1960. *The artist's methods and materials*. Translated by Francesca Priuli. New York, London, Toronto: Pitman Publishing Corporation.
- Cennini, Cennino D'Andrea. 1960. *The craftsman's handbook*. Translated by Daniel V. Thompson, Jr., New York: Dover Publications, Inc.
- Darrow, Floyd L. [1930]. *The story of an ancient art, from the earliest adhesives to vegetable glue*. Lansdale, PA and South Bend, IN: Perkins Glue Company.
- Dörner, Max. 1984. *The materials of the artist and their use in painting*. Translated by Eugen Neuhaus. San Diego, New York, London: A Harvest/HBJ Book Harcourt Brace Jovanovich, Publishers.
- Gug, Rémy. 1975. Medieval glues...sounded well! *The Fellowship of Makers and Restorers of Historical Instruments* 1 (Oct): 36–43.
- Laurie, A. P. 1910. *The materials of the painter's craft in Europe and Egypt from earliest times to the end of the XVII th. century, with some account on their preparation and use*. London & Edinburg: T. N. Foulis.
- Laurie, A. P. 1926. *The painter's methods & materials*. London: Seeley, Service & Co. Limited.
- Maheux, Anne F. 1988. *Degas pastels*. Ottawa: National Gallery of Canada.
- Petukhova, T., and S. D. Bonadies. 1993. Sturgeon glue for painting consolidation in Russia. *Journal of The American Institute for Conservation* 32(1):23–31.
- Petukhova, Tatyana. 1989. Potential application of isinglass adhesive for paper conservation. *The Book and Paper Group Annual* 8:58–61.
- Siren, Osvald. 1936. *The Chinese on the art of painting*. Beijing: Henri Vetch.
- Sze, Mai-Mai. 1956. *The way of Chinese painting: its ideas and techniques with selections from the seventeenth century mustard seed garden manual of painting*. New York: Vintage Books a Division of Random House.
- Thompson, D. V. [1936] 1956. *The materials and technique of medieval painting*. New York: Dover Publications.
- Winter, John. Natural adhesives in East Asian paintings. In *Adhesives and consolidants, IIC preprints of the contributions to the Paris Congress, 2–8 September*, ed. N. S. Brommelle et al. London: International Institute for Conservation of Historic and Artistic works, 117–120.

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