THE DOCUMENTATION AND TREATMENT OF A LATE 13TH CENTURY COPY OF ISIDORE OF SEVILLE'S ETYMOLOGIES

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Introduction

A major conservation project which was completed in 1990 for a private collector involved an unusually detailed physical analysis and treatment of a late 13th century copy of the *Etymologies* of Isidore of Seville. Although the manuscript had suffered considerable damage over the centuries it still retained most of its original medieval binding structure. The main goal of the conservation treatment was to stabilize the condition of the manuscript without significantly altering the existing binding in any way. Since the manuscript could not be disbound all work was to be carried out *in situ*, thus necessitating the development of a variety of special treatment techniques. Documentation of physical features of the manuscript became an integral part of the project and the compilation of technical evidence ultimately led to a more accurate localization of the text and a reconstruction of the binding history of the volume, since its origin in the late 13th century. In this paper the author will first describe the physical make-up of the *Etymologies*, with emphasis on the particular features that helped to establish a more accurate provenance for the manuscript. Since the reconstruction of the various stages of restoration and rebacking was closely tied into the conservation treatment of the manuscript, these will be described together in the second half of the paper.

Historical Background of the Manuscript

The *Etymologies* was the most important work of the great 7th century scholar, teacher and archbishop of Seville, Isidorus Hispalensis. Written just before the author's death in 636, and edited by Isidore's friend and disciple Braulion, the text is an encyclopedia of the sciences based on word origins. It is divided into twenty books or chapters which cover the seven liberal arts, medicine and law, the church and the alphabet, man and the animals, the earth and the universe, political and physical geography, architecture and surveying, agricultural and military sciences, ships and household utensils, and the practical arts in general. As a compilation of all the known scientific theory of the early middle ages the *Etymologies* was widely copied and thus found use as an important reference work, until the development of more modern forms of science starting in the 11th century.

This paper was originally presented at the 1991 A.I.C. meeting under a slightly different title: "The Documentation and Conservation of a 14th Century French Illuminated Manusript." Following submission of the abstract for the conference paper the manuscript was more accurately identified as being of Spanish origin.

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Despite the extreme popularity of the book during the middle ages just 1100 manuscript copies of the *Etymologies* are found to be in existence today. While the majority of these remaining copies are of French, German or Italian origin only a small portion, approximately 1% of the existing number, were produced in Spain - the country where the text originated. Although the late 13th century copy in the collection of Dr. John D. Stanitz had previously been attributed to a southern French workshop[1] discoveries made during the examination and treatment of the manuscript permitted assisting scholars to assign it instead to a Spanish provenance.[2] More importantly, certain textual evidence found in the manuscript provided additional clues that this particular copy of the *Etymologies* may have been produced at the Cistercian monastery of Poblet in Catalonia.

Poblet was founded in the mid-12th century, as a branch of the mother church of Clairvaux in France, and it was an important center of religion and learning throughout the middle ages.[3] The monastery had a strong connection with other christian settlements in the province of Catalonia, as well as with those on the Balearic Islands of Iviza, Majorca and Minorca off the southern coast of Spain. These islands are mentioned in the text of the *Etymologies*, within the section on Geography, and they are signaled out with a pointing hand drawn in the left margin of the page. Scholars who examined the text suggest that the scribe who copied the manuscript may have inserted this reference to the Balearic Islands as a kind of personal footnote, to indicate his association with them and with the monastery of Poblet on the mainland.[4]

Physical Make-up of the Manuscript

The Stanitz *Etymologies* is an intact folio size copy of the manuscript which, despite at least two separate stages of restoration and rebacking, was never rebound. The present binding consists of a quarter leather cover over thick quarter-sawn beech boards (Fig.1). The boards are roughly cut to the same size as the textblock and all three outer edges are beveled.[5] A remnant of a black leather strap is recessed into a channel cut in the fore-edge of

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[1]H.P. Kraus, the rare book dealer from whom Dr. Stanitz had purchased the manuscript, had assigned it to southern France and this was assumed to be the correct provenance, until other scholars were able to provide convincing evidence for its Spanish origin.

[2]This conclusion was reached by Mr. Michel Huglot, a medieval music specialist and authority on Isidore of Seville manuscripts, who was able to examine the *Etymologies* while it was undergoing conservation treatment.

[3]The history and importance of the monastery of Poblet is documented in Frederic van der Meer, *Atlas de L'Ordre Cistercien*, Paris, Editions-Sequoia, 1965.

[4]This suggestion was made by Mr. Diaz y Diaz, a reknown Spanish paleographer, who was consulted by Mr. Huglot about the reference to the Balearic Islands that was discovered in the text of the Stanitz manuscript.

[5]The boards were hand cut with an adze, which has left distinctive marks in the wood. The surface of the two boards is flat up to the beveled edges, which are very irregular in width. The spine edge of both boards has been slightly rounded on the inside.

the upper board. This strap presumably was anchored at one time to the brass catch plate in the lower board. The manuscript is sewn on four split alum-tawed thongs which are laced straight across into a series of holes and channels made in the wooden boards. The spine of the textblock is chamfered at the head and tail to accommodate the endbands. These are sewn on a narrow core of alum-tawed leather which is laced at a diagonal into the corners of the boards. Although many of these components form part of the original medieval binding, successive repairs by later binders have significantly altered the appearance of the volume. The exact nature of these alterations, which were gradually uncovered during the course of treatment of the manuscript, will be discussed below in greater detail.

The textblock consists of a total of 184 leaves which are divided up into 16 gatherings or quires. The first 15 of these quires are made up of six bifolia, while the final quire is made up of four bifolia. There are no single leaves in the entire textblock: all quires are made up of conjoint bifolia. The writing support consists of a fine quality parchment made from

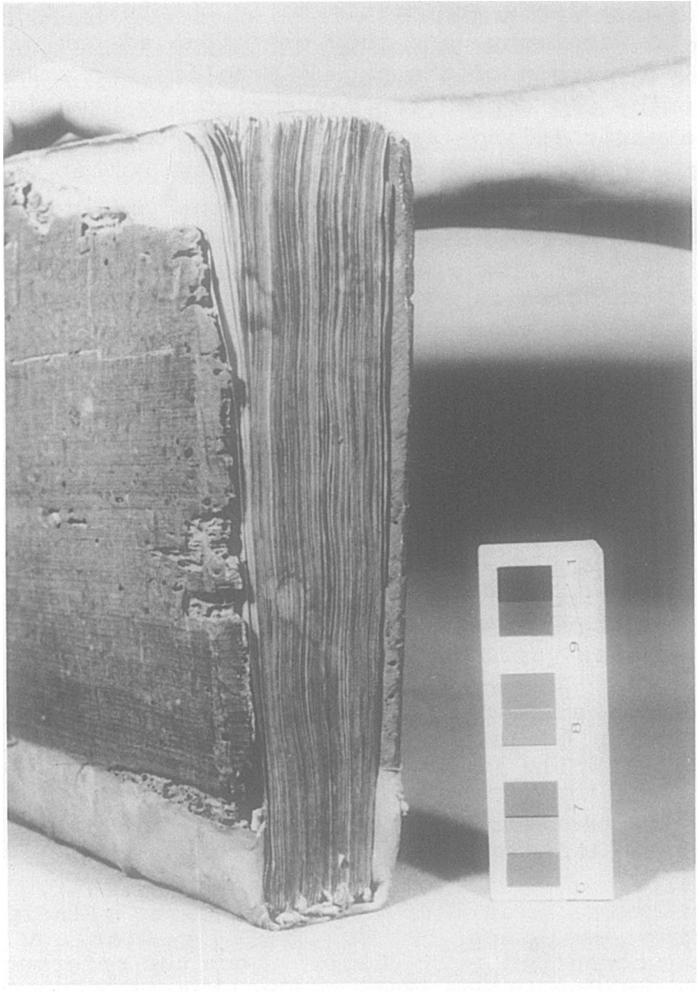

Fig.1 Manuscript before treatment showing damage to lower board at head end of book.

goatskin, that has been well selected in terms of thickness and surface appearance.[6] There is a pronounced follicle pattern on the hair side of the leaves[7] and the surface has been lightly pumiced to create a soft nap. The flesh side is much whiter in color than the hair side and it has a very smooth, almost slick surface.[8] Since calves were not as available in large numbers in the south, goat parchment was used more frequently for the production of medieval manuscripts in the mediterranean area. Thus the appearance of this type of parchment in the Stanitz *Etymologies* is consistent with the newly assigned Spanish provenance for the manuscript.

The last few quires of the manuscript have very irregular edges which reflect the outer contours of the animal skins from which they were cut. The placement of these bifolia at the end of the textblock suggest that the supply of larger skins was used up before the manuscript was completed, thus forcing the scribe to use slightly inferior skins for the final quires of text. The spine of the animal is clearly visible in the center of many leaves and, in every case, it is oriented parallel to the writing lines and perpendicular to the spine of the book. This evidence indicates that each bifolia was cut from a single skin of parchment; thus a total of 92 goatskins were used for the production of the manuscript. The typical arrangement of hair and flesh sides, known as "Gregory's Rule", has been followed in this manuscript so that at alternate openings hair side faces hair side and flesh side faces flesh side.[9] In addition, the bifolia are arranged in such a way that the flesh side faces out at the beginning of every quire.

The medieval scribe[10] of the *Etymologies* appears to have assembled the bifolia into quires and stitched them together through the spine fold before beginning his work. This temporary method of stitching or tacketing was typically done in two locations, at the head and tail of the quire, using either thread or twisted strips of parchment.[11] Based upon existing

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[6]The average thickness of the parchment leaves is 0.15-0.18 mm.

[7]Many fine animal hairs have been left in the follicles of the skin and this gives the hair side of the leaves a yellowish-brown color.

[8]The slickness of the flesh side does not appear to be the result of a coating, such as gelatin or egg white, which would have been applied to the surface of the skin. It seems more likely that parchment maker or scribe chose not to pumice the flesh side, which would raise a nap on the surface of the skin.

[9]The 19th century German scholar, Gaspar Rene Gregory, was the first to make note of the regular alternation of hair and flesh sides of parchment leaves in medieval manuscripts and hereafter this system has been known as "Gregory's Rule." See Jacques Lemaire, *Introduction a la Codicologie*, Louvain-la-Neuve, Institut d'Etudes Medievales de l'Universite Catholique de Louvain, 1989, pp.46-47.

[10]It is very possible that the Stanitz manuscript was written by more than one scribe, yet the writing has not yet been analyzed by a qualified paleographer who would be able to make this determination.

[11]Michael Gullick has extensively researched the existence of quire tackets in 12th century medieval manuscripts whose original binding structures have been well preserved. Mr. Gullick's paper," From Scribe to Binder: Quire Tackets in Twelfth Century European Manuscripts," is scheduled to be published in *The*

fragments it seems that only thread was used for quire tacketing in the Stanitz manuscript. Evidence of the quire tacketing, which was uncovered during the course of treatment, will be discussed below in greater detail.

Two pieces of evidence indicate that the edges of the textblock were trimmed immediately after the book was sewn and the boards were attached. Certain passages of marginal commentary, written by the editor or corrector of the manuscript, have been partially cut off where they appear at the outer edge of a leaf. The pricking for the horizontal writing lines is also missing from the outer margins, yet the prick marks for the vertical bounding lines are still intact at the head and tail of each leaf. These marks have a somewhat rounded contour which suggests the use of an awl rather than a knife point. The writing lines are ruled with plummet, a type of medieval pencil made from metallic lead which leaves a faint grey mark on the surface of the parchment.[12] The Latin text is written in two columns, with 42 lines to a page. Although the Gothic book hand used by the scribe is typical for the late 13th century period, the actual shape of the letter forms demonstrates a strong Spanish influence.[13] The sepia-colored writing ink is undoubtedly iron gall ink, which was used predominantly in the west throughout the history of the manuscript book.[14] A series of letters ('a' through 'f'), written in brown ink in the lower right corners of the first six leaves of each quire, are known as signature marks. These marks helped the scribe to maintain the correct sequence of leaves in each quire while copying the text from an exemplar. Catch words, written by the scribe in the lower margin of the last leaf of every quire, assisted the binder in assembling the quires in their correct order. In the Stanitz manuscript the catch words are placed vertically on the page, perpendicular to the ruling lines, and they are each surrounded by a decorative frame drawn in brown ink. The vertical orientation of catch words is more characteristic of books produced in southern mediterranean workshops and their presence in this manuscript provides further evidence of its Spanish origin.[15]

In addition to writing the signature marks and catch words the scribe of this manuscript also left instructions for the rubricator on every page. These

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Compleat Binder: Studies in Bookmaking and Conservation in Honour of Roger Powell, ed. Guy Petherbridge, (1991).

[12]Until lead point or plummet was introduced in the 11th century ruling was executed with a hard point, using a metal stylus. See Michelle P. Brown, *A Guide to Western Historical Scripts from Antiquity to 1600*, Toronto, University of Toronto Press, 1990, p.4.

[13]In their description of the manuscript the dealer, H.P. Kraus, stated that "the script resembles that of the later 13th century in southern France, or possibly Catalonia." Michael Gullick, who was consulted on the possible origin of the manuscript, felt that the script had distinctly Spanish features.

[14]For further information on medieval writing inks see Zerdoun Bat-Yehouda, *Les Encres Noires au Moyen Age (jusqu'a 1600)*, Paris, Centre Nationale de Recherche Scientifique, 1983.

[15]According to Jacques Lemaire vertical catch words are a southern phenomenon which appeared in Spain in the 13th century, in Italy around 1450 and in France another twenty years later. See Lemaire, *op.cit.*, pp. 175-76.

instructions consist of very small letters or numbers that are written in brown ink, either in the margins or within the body of text, where the rubrication was meant to appear. The roman numerals of each chapter, and the capital letters that begin each section of text, are rubricated with alternating red and blue paints. Large areas of decorative penwork, known as "pen flourishings", are executed in thinner red, blue and purple inks[16] in the margins between the two columns of writing on every page. Some of the rubrication in the manuscript was never completed and gaps can be seen in the text where the decorative capital letters were never written in.

Although several other medieval copies of the *Etymologies* contain elaborate illustrations the relatively sparse decoration of this late 13th century copy may be an indication of its Cistercian origin.[17] The only illumination in the manuscript consists of an historiated initial and several other decorated letters on the first folio (Fig. 2). Inside the initial 'D' that begins the text, Isidore of Seville is shown as a tonsured monk, seated at a desk in front of an open book and lecturing to two students who are dressed in a similar manner. The rest of the illumination, which surrounds the two columns of text, is made up of a series of semi-bestial and other fantasy figures who play a variety of wind and stringed instruments. The background of the historiated initial and other areas of the illumination are built up with raised gesso and gold leaf. Various pigments have been used by the artist and they have been tentatively identified as white lead, verdigris, ultramarine or azurite, red lead, and carbon black.[18] A unique feature of the Spanish copies of the *Etymologies* is a series of interpretive diagrams that illustrate the scientific principals of geometry and harmony described in the text. On folio 29 of the Stanitz manuscript, in between the books on Geometry and Music, a space equal in size to one and a half colomns of text was left blank by the scribe. The intention was for the illuminator to draw the interpretive diagrams in the reserved space, yet for some unknown reason the work was never carried out. Although the absence of the diagrams is not an unusual occurance, their intended inclusion in this late 13th century copy of the *Etymologies* provides convincing evidence of its Spanish origin.[19]

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[16]Generally speaking purple ink was often used for the rubrication of manuscripts produced in the southern mediterranean area, while it was rarely employed in the north. This information was provided by Dr. Lillian Randall, Curator of Manuscripts and Rare Books of the Walters Art Gallery.

[17]The aesthetics of Cisterian book illumination during the middle ages is discussed by Walter Cahn in "The Rule and the Book; Cistercian Book Illumination in Burgundy and Champagne," *Monasticism and the Arts*, ed. Timothy Gregory Verdon, Syracuse University Press, 1984.

[18]Although it was not possible to conduct any scientific analysis of the pigments in the illumination on folio 1, certain colors could be tentatively identified by simple microscopic examination.

[19]The significance of the interpretive diagrams in Spanish copies of the *Etymologies* has recently been discussed by Michel Huglot in "Le 'De musia' des Etymologies de saint Isidore de Seville d'apres le manuscrit de Silos (Paris, B.N., nouv. acq. lat. 2169)," *Revista de Musicologia*, 14, 1991.

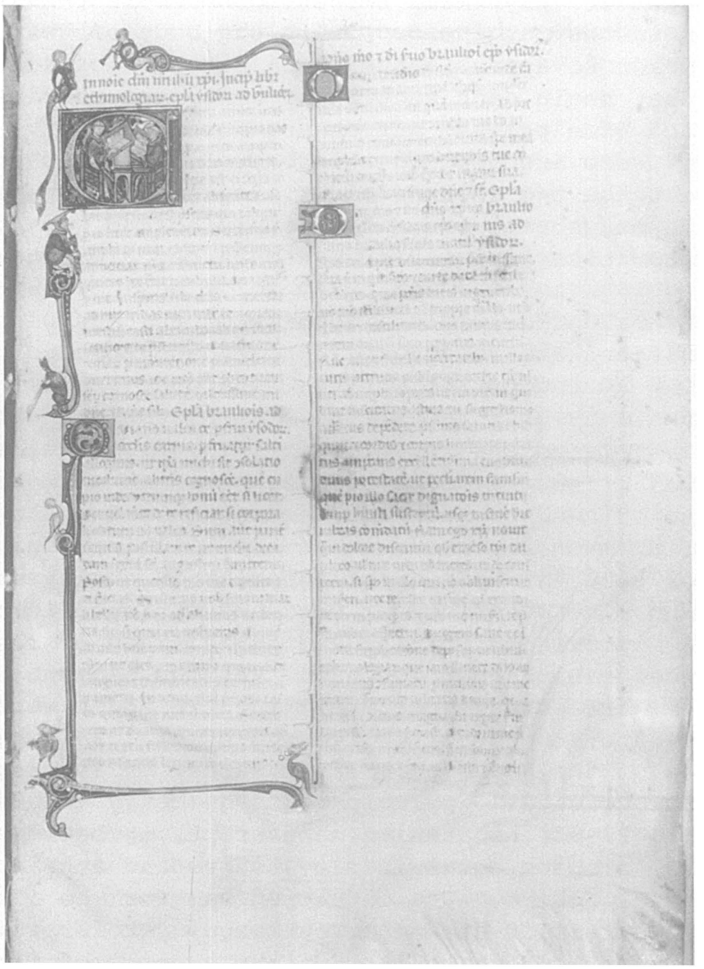

Fig.2 Folio 1 of the manuscript before treatment.

Condition of the Manuscript Prior to Conservation Treatment

The binding was, at one time, heavily infested by wood-boring insects which caused considerable damage to the two beech boards. Extensive tunneling has weakened the wood at the outer surfaces, and along the edges and corners of both boards, and many pieces have broken entirely away. The most serious damage is seen in the lower board where the upper right corner is missing and the upper left corner is only held together by virtue of the leather that covers it (Fig.1). While the upper board has remained relatively flat the lower board is severely warped to the inside.

The quarter cover consists of a piece of spongy yellow leather with a fine grain pattern which resembles that of sheepskin. The particular type of leather used for the cover indicates that it might have been applied at a relatively late date, during the 18th or 19th centuries. The surface of the leather is very abraded and stained and the edges that overlap on to the boards are quite ragged. Although the cover must have originally been pasted down to the spine of the textblock it is now only loosely adhered in a few

places. Remnants of two paper labels on the spine of the book once contained shelf marks which are now worn away. Fragments of a rectangular paper label are found adhered to the surface of the upper board, near the head edge (Fig. 10). Although spots of ink are visible on the remaining paper fragments the rest of the writing has been lost. Two other titles, written in brown ink directly on the wood surface, are located just below the paper label in the center of the upper board. The longer title begins with the word "Isidore" and is written in a very small cursive hand. The rest of the writing cannot be deciphered, yet it probably contains the complete title of the manuscript. The second title consists of only two words, "Isid Eth", and these are written in very large Gothic letters. The letter forms and handwriting style of the abbreviated title suggests a 15th or 16th century date, while the longer title seems to date from the 16th or 17th century.[20]

The brass catch plate on the lower cover is pierced with a trifoliate pattern and a piece of parchment or white leather is visible underneath the perforated area (Fig.11). One of the three brass pins that secures the catch plate to the board has been replaced with a larger iron pin. Despite this alteration the catch plate is in remarkably fine condition and its appearance suggests a date no earlier than the 15th century. A small fragment of a black leather strap is secured with three iron nails inside a channel cut in the fore-edge of the upper board. The quality of the leather, and the type of nails used for the attachment, indicate that the strap was put on the binding in the 18th or 19th century, presumably to replace a broken or missing fore-edge strap of an earlier date.

The entire binding structure has been weakened by the deterioration of the alum-tawed supports and the linen thread used for sewing the textblock and the endbands. The first and third split thongs are completely broken along the upper joint and the other two thongs are partially broken in this area. Although the sewing is still largely intact several broken threads are found in the middle of the quires.[21] Almost all of the endband threads are broken at the head and tail of the manuscript and only a few small fragments remain of the rolled alum-tawed endband core. The thread used to sew the endbands is still intact in the center of every quire[22] and additional fragments of the endband core appear to be laced into the boards, underneath the leather cover.

The single pastedown on the inside of the upper board consists of a piece of poor quality calf vellum which is relatively thick and yellow in color and has many small cuts and tears. A rectangular piece of parchment, adhered to the board underneath the pastedown, serves as an insert for a large

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[20]Approximate dates for the two handwritten titles were provided by Dr. Lillian Randall who examined the manuscript during treatment.

[21]The primary sewing thread is made up of two heavy strands of flax or hemp cord that are twisted in a 'Z' pattern. The fiber of the thread is fairly coarse in texture and dark brown in color.

[22]The thread used to sew the endbands is made up of four strands of flax or hemp, twisted in an 'S' pattern. It is more tightly twisted than the primary sewing thread and is also much lighter in color.

loss in the upper half of the leaf.[23] The pastedown is considerably narrower than the upper board and, at the fore-edge, there are two sets of holes with prominent rust stains which must have been caused by a pair of metal catch plates or clasps. Since these holes do not line up with the existing catch plate, or with any other marks in the boards, it seems likely that the pastedown was reused from another binding. A narrow flange of the pastedown extends beyond the spine fold and is crushed inside the joint area. Fragments of both the primary sewing thread and the endband thread, found inside this folded flange, indicate that the pastedown was once sewn to the textblock.

Prior to undertaking the actual treatment of the manuscript the construction of the lower pastedown was difficult to determine. It was evident that the last blank leaf of the textblock had been pasted down to the inside of the lower board, after the yellow covering leather had been turned in at the head and tail. Perhaps at the same time the upper right corner of this leaf was cut away, to match the shape of the loss in the lower board. Another piece of parchment was partially visible, underneath the pastedown, yet the recovery of this leaf did not occur until much later, after the treatment of the manuscript had begun.

In contrast to the deteriorated state of the binding the parchment leaves of the textblock are in relatively good condition, with only a few minor edge tears and insect holes near the spine folds, which increase in number towards the back of the book. The head edge of the manuscript is quite soiled and the extreme edges of the leaves are slightly gelatinized and dark brown in color. The last eight leaves of the textblock have been affected by the loss in the lower board and their outer edges are slightly torn and curled from exposure. Spills from some type of liquid has caused staining and localized cockling of a few leaves. The mechanical removal of a label or book plate from the verso of the last leaf of text has caused considerable damage to that leaf, as well as to two adjacent leaves.[24] The pattern of cockling is consistent throughout the manuscript and it is characterized by soft undulations that are oriented parallel to the writing lines of the text. In some cases the cockling is so pronounced that pleats have formed at the fore-edges of many leaves, especially where the parchment is very thin. As a result of the cockling and pleating of the leaves the fore-edge is 5/8" thicker than the spine; this gives a wedge-shaped appearance to the volume.

The first page of the textblock is in very poor condition and has suffered greatly from exposure.[25] The writing ink appears to be faded when,

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[23]The square loss in the pastedown seems to have been made intentionally with a knife, perhaps to remove an owner's inscription or similar evidence which was tied to the past history of either this manuscript, or the book from which the leaf originated.

[24]A large area of adhesive residue, below the last line of text on folio 183v, is in the shape of a shield or coat of arms. This suggests that a bookplate belonging to an early owner of the manuscript might have been attached to the leaf at one time, and was then later removed.

[25]Since the text begins on the first leaf of the initial quire it is clear that the manuscript never was intended to have blank front flyleaf; the flyleaf at the back of the book was probably coincidental and not planned. Despite the modern practice of including flyleaves at both the front and back of a book this

in fact, the damage is a combined result of both surface abrasion and active flaking of the ink. The illumination is abraded along the inner edge, where it was rubbed by the loose upper board of the binding, and there is evidence of flaking paint in several small areas. The white lead paint has been affected by pollutants and, in most cases, it has oxidized to a dull grey color. In the lower half of folio 1 a liquid dripped onto the surface of the page and caused smearing of the paints and cockling of the parchment support in a broad area (Fig.2).

The writing ink is extremely unstable throughout the manuscript. Large areas of text are very faint in color and a black debris in the gutters indicates that the ink is actively flaking off the parchment surface. Since the parchment does not show any evidence of mold damage the deterioration of the ink could not have been caused by any biological attack. The problem rather seems to stem from the initial preparation of the ink by the scribe, as well as from the preparation of the parchment surface, prior to writing. Although flaking does occur on the hair side of the leaves it is more predominant on the flesh side - due in large part to the extreme smoothness of the surface on that side of the skin.[26]

Binding History Revealed during Conservation Treatment

At the outset of the project the owner of the *Etymologies* made it clear that the goal was to stabilize only those parts of the binding and the textblock that were weak or actively deteriorating. The flaking writing ink was of primary concern, as was the looseness of the sewing and the board attachmentas obviously causing further damage to both the ink and the paint. The insect-damaged boards were to be consolidated yet the large loss in the outer corner of the lower board was not to be filled. The spine of the book was to be rebacked with new leather in a simple style, with no lettering or blind tooling, so as to reflect the medieval origin of the manuscript. Ultimately the goal of the project, from the owner's standpoint, was to have a book that did not "look new or worked on."[27]

The first step in the treatment process was to stabilize any flaking paint in the illumination before further damage occurred. A 1% solution of edible leaf gelatin[28] in distilled water was used to consolidate the flaking paint and this was applied with a fine camel's hair brush, while working under a binocular microscope. A preliminary brush application of ethanol to the area helped to reduce the surface tension of the consolidant and allowed it to

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was not at all common during the middle ages.

[26]The identical flaking ink phenomenon is seen in many medieval Italian manuscripts that are also written on a goat parchment which has a softly napped hair side and a very slick flesh side.

[27]Personal correspondence with the owner, Dr. John Stanitz of Cleveland, Ohio.

[28]Small pieces of Silver Label leaf gelatin were initially dissolved in warm distilled water and the resulting solution was kept in a double boiler so that it would remain liquid during use.

penetrate underneath the flakes of paint.[29] Since the flaking of the writing ink was so extensive it would have been impossible to consolidate every letter under the microscope and still get the project completed in a timely fashion. The alternative was to apply the consolidant as a fine spray over the entire surface of each page, while the book was held open in a type of cradle. Since this operation might put considerable stress on the severely weakened medieval binding, the consolidation of the flaking ink could not be attempted until the entire binding structure had been adequately stabilized.

So that the condition of the original sewing structure could be accurately assessed, the present quarter leather cover was removed from the binding. The leather was carefully slit along the front joint, and at the head and tail edges of the two boards. This enabled the cover to be peeled away from the board surface and from the spine of the textblock. The upper pastedown was partially lifted from the inner edge of the board, so that the two leather turn-ins could be mechanically removed. Removal of the turn-ins at the back of the book proved to be somewhat more difficult since they were located underneath the last conjoint leaf of the textblock, which had been adhered to the lower board by the most recent binder. The owner of the manuscript was curious to know what lay underneath this pastedown so the decision was made to detach it from the lower board. Moisture could not be used for fear of disturbing the finely napped surface of the parchment leaf. Fortunately it was easily removed by mechanical means, along with the two leather turn-ins, and once this was accomplished a second pastedown was revealed on the inner board surface. This pastedown consisted of a piece of poor quality parchment which was about 3/4" narrower than the board and slightly irregular in shape. A narrow flange of parchment, which extended beyond the inner fold of the pastedown, was wrapped around the spine edge to the outside of the lower board. A length of thin thread inside the folded flange was anchored to the sewing supports at each station. Since the thread did not match the primary sewing thread in either thickness or type of twist,[30] it was clear that the parchment leaf had been sewn to the textblock at a later date and then pasted down to the board.

Removal of the quarter leather cover from the binding permitted the spine of the textblock to be examined in greater detail (Fig.3). The sewing supports consisted of relatively narrow strips of alum-tawed leather that had been twisted inside out to give a more rounded shape to the thongs. The mechanical failure of the first and third sewing supports along the upper joint probably occurred at an early date, since they were found to be reinforced with narrow strips of alum-tawed leather. These repair strips were sewn to the primary supports with linen thread, using a type of whip stitch, and the ends of the thongs were then laced into the empty holes and channels in the upper board. Some time after these repairs were completed, continual stress on the binding ultimately caused the two new thongs to break along the front joint. Although the same two original supports must have been intact

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[29]Although the ethanol can be added directly to the gelatin, a separate application of a tiny amount of the solvent is often more effective in helping the consolidant to wick in under the flakes of paint.

[30]The sewing thread found inside the hook of the lower pastedown consists of two very thin strands of flax or hemp twisted in an 'S' pattern.

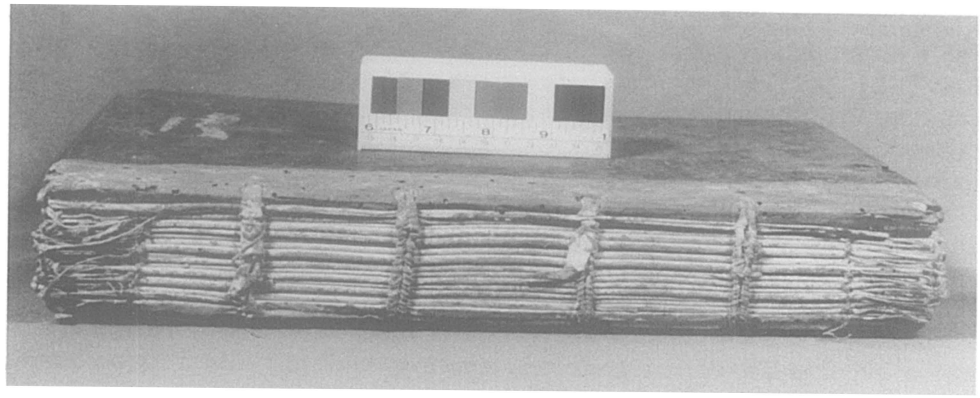

Fig.3 Spine of book after removal of quarter leather cover.

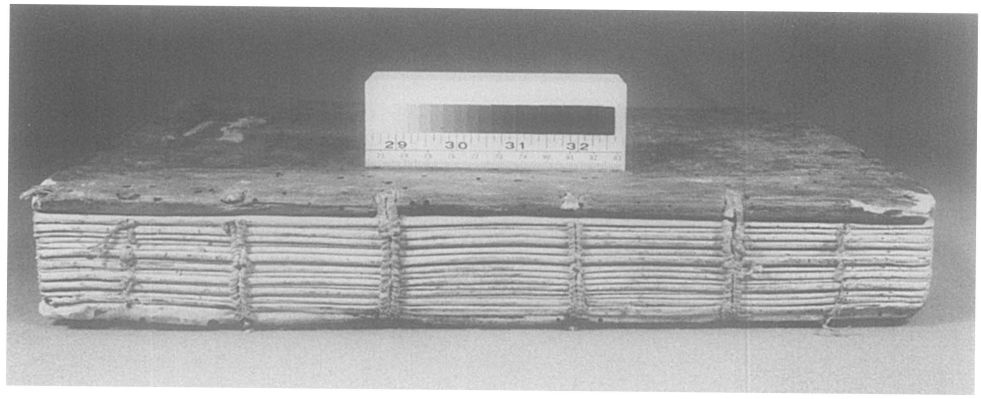

Fig.4 Spine after removal of old repairs and endband fragments.

along the lower joint, at the time that the repair work was done, the thongs eventually broke in this area as well. The second and fourth sewing supports were still intact along the lower joint and only partially broken at the upper joint.

Although almost all the endband threads were broken at the head and tail edges of the book, they were still intact on the spine and on the inside of every quire (Fig.3). A few small fragments of the rolled alum-tawed core were found at the head and tail of the textblock, loosely caught up in the sewing thread. Larger endband core fragments still remained laced into the holes and channels of the two boards. The loose endband fragments and thong repairs were no longer providing any support to the binding, and an attempt to preserve them *in situ* was likely to compromise the conservation work that was to be carried out on the manuscript. Therefore, after documenting their exact location and method of attachment to the textblock, the loose endband fragments and the repair thongs were removed and set aside for safekeeping. The fragments of the laced-in endband cores were still firmly attached to the boards and were therefore left in place. Residual adhesive on the spine of the textblock was lightly cleaned away with saliva-dampened swabs so that the spine folds could be more easily examined. Once this was done it became clear that the present endbands, which had been tied down just above the kettle stitches, were a later addition to the binding. Evidence of an earlier endband sewing was seen in a line of holes located halfway between the kettle stations and the head and tail of the book (Fig.4).

Removal of the repair thongs made it possible to see the degree of damage to the sewing supports along the joints and across the width of the spine. Although many of the sewing threads were either broken or badly frayed, the use of a herringbone stitch by the original binder has helped to keep the textblock relatively intact. A thorough examination of the spine folds revealed no other sewing stations so it was therefore assumed that the present sewing was original. Several smaller holes, made for the quire tackets, were found grouped in pairs, usually between the kettle stitch and the outer two sewing stations of the individual gatherings. In some cases the thread used to sew the quire tackets[31] was found protruding from the holes on the outside of the spine; some of these holes and protruding threads can be seen in Figure 4. Several more tackets were found intact on the inner spine folds, underneath the primary sewing thread.

On the outside of the two boards the area that had been covered with leather was substantially lighter in color than the rest of the wood (Figs.10 & 11). Closer examination of the boards revealed that the band of lighter-colored wood extended about 1/4" beyond the edge of the quarter leather cover that had just been removed. A series of small nail holes were found at regular intervals, along the entire length of both boards and just inside the line of discoloration. In addition, several very thin fragments of white leather were caught in shallow recesses, near the spine edge of the upper board. This combined evidence suggests that the binding once had a slightly

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[31]The thread used for the quire tackets is quite thin and has a soft finish. The thread is made up of two strands of flax or hemp, twisted in an 'S' pattern.

larger quarter leather cover, possibly made from an alum-tawed skin.[32] The nails were probably added at a later date, to secure the edges of the leather cover to the boards. Further evidence of this earlier cover was somewhat visible underneath the partially lifted spine edge of the upper pastedown. After consulting with the owner on this new discovery, the decision was made to temporarily remove the pastedown from the upper board so that the binding history of the volume could be more accurately reconstructed.

The fragments of thread that had been found earlier, inside the folded flange at the spine edge of the pastedown, were removed for safekeeping. The somewhat greasy quality of the parchment used for the upper pastedown made it possible to apply moisture directly, without disturbing the surface of the skin. The pastedown was brushed with a 70/30 solution of ethanol and distilled water and, as the adhesive softened, the blank leaf was gradually peeled away from the board. There was no reason to remove the rectangular patch of parchment near the head of the board, so it was left in place. Once removed the pastedown was sandwiched between felts and pressing boards to dry; the damp inner surface of the board was also dried under pressure to prevent warping. Examination of the now exposed wooden board revealed a large piece of alum-tawed leather, adhered to the inner corner at the head edge (Fig.5). This was clearly a turn-in fragment from an earlier quarter leather cover - evidence of which had just been seen on the outside of the upper board. A

Fig.5 Head end of upper board after removal of pastedown.

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[32]An example of this type of quarter leather cover can be seen in an early 14th century Italian student binding in the Beinecke Rare Book & Manuscript Library of Yale University. For a further description of this and other medieval bindings see Barbara A. Shailor, *The Medieval Book*, New Haven, Yale University Library, 1988, p.65.

knife cut in the board, at the outer edge of the turn-in, indicated the point at which the leather had been trimmed to match the width of the cover on the outside.

At this point the pastedown that had earlier been uncovered on the inside of the lower board was examined. Although the pastedown was blank on the outside writing was visible on the verso, along a partially detached edge. The owner was curious to know what the leaf might contain and was hopeful that, by uncovering more of the writing, we might reveal important evidence that would help document the origin of the manuscript and its medieval binding. Here again, the greasy quality of the parchment allowed a mixture of ethanol and water to be directly applied to the surface, without causing any damage to the skin. As the adhesive softened the pastedown was gradually peeled away, up to the spine edge, where it still remained hooked around to the outside of the lower board. Although much of the writing ink was left behind on the board surface, there was enough evidence to prove that the pastedown was a fragment of a much larger medieval document that was heavily creased from folding in several directions (Fig.6). The document was written in Latin, in a very cramped cursive hand, and with many abbreviations or contractions to the words. Although the text has not yet been deciphered it is likely to be a legal document of some kind, perhaps a land grant or a charter, which was written by a notary. A small design, drawn in the same brown writing ink in the lower left corner of the leaf, is perhaps a notarial sign used to identify the scribe who wrote the text.[33] Given the suggested 14th century date for the manuscript fragment, in addition to other evidence, it seems likely that the lower pastedown was originally sewn with the textblock and thus formed part of the original medieval binding structure.[34]

Once the pastedown was lifted, two turn-in fragments from yet another leather cover were found on the inside of the lower board (Fig.7). The smaller fragment, located near inner corner at the tail edge, became detached almost immediately while the larger fragment remained in place at the head edge of the board. Examination of these two fragments showed that they were quite distinct from the piece of alum-tawed leather that had just been found on the inside of the upper board. Although the new turn-in fragments were also an alum-tawed leather, tentatively identified as goatskin, the grain surface had been stained green. An organic dye was probably used as the coloring matter since there were no pigment particles on the surface of the leather to indicate the presence of a green paint.[35] Several thin slivers of

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[33]Dr. Lillian Randall examined this manuscript fragment after it was uncovered and it was she who suggested that the design at the bottom of the document might be a notarial sign.

[34]Based upon the appearance of the script Dr. Randall suggested a 14th century southern French provenance for the document. However, a more complete identification of the text and analysis of the medieval cursive script is necessary before the manuscript fragment can be accurately dated and localized.

[35]Although several different organic dyestuffs could have been used to stain the leather a likely possibility is sap green - a resinous extract of ripe buckthorn berries which was used in the middle ages for panel painting and manuscript illumination. See Daniel V. Thompson, *The Materials of Medieval Painting*, New Haven, Yale University Press, 1936, pp.169-171.

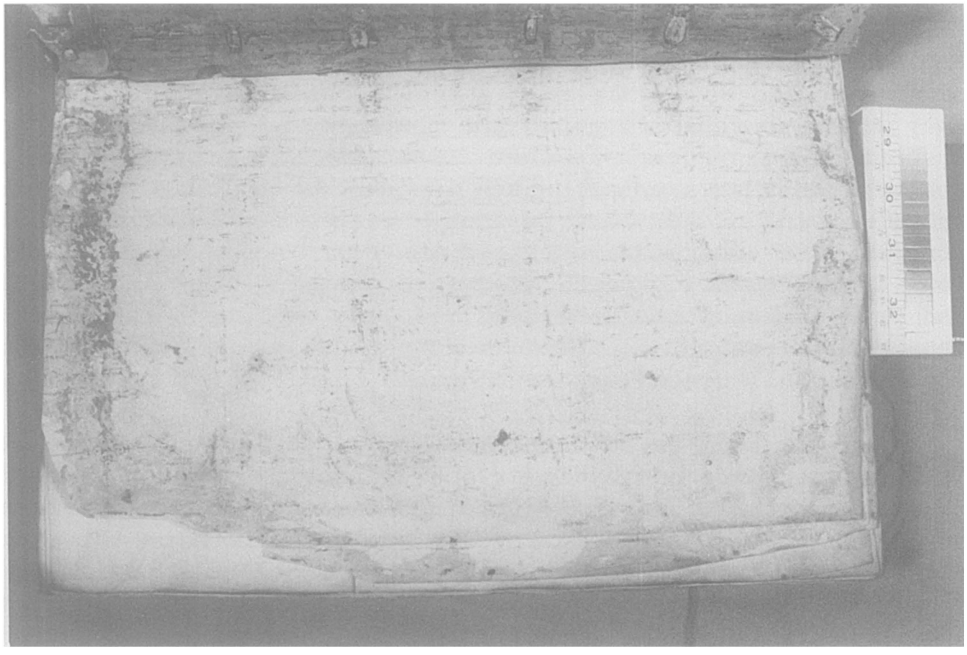

Fig.6 Manuscript fragment used as lower pastedown.

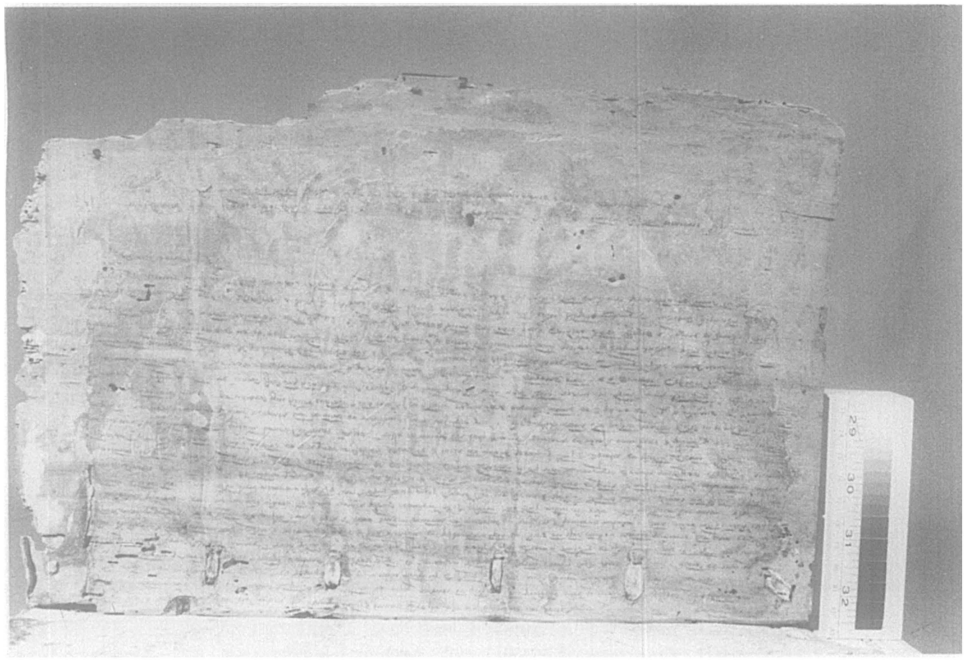

Fig.7 Offset ink from pastedown on lower board.

white leather, found beside the large turn-in fragment at the head edge of the lower board, might also be remnants from the same cover that had been peeled off the book by a later binder.

A heavy adhesive residue, along the inner head and tail edges of the pastedown, contained many green leather fibers that must have offset from the turn-ins. Since these same areas on the inside of the lower board did not contain any offset ink or adhesive residue, it is possible to deduce that the leather turn-ins were adhered directly to the board and were then covered with the pastedown in the normal manner. The fact that the adhesive residue along the head and tail edges of the pastedown, and the corresponding blank areas on the lower board, extends out to the fore-edge clearly indicates that the binding once had a full green leather cover.[36]

A total of four alum-tawed thongs, found laced into the holes and channels at the outer ends of the lower board, provide further evidence of the two sets of endbands that the binding had received during its lifetime. At the tail edge both thongs are laced through the board, one on top of the other, and are secured with a wooden peg in the second hole, as seen on the right in Figure 7. At the head edge the first endband core is laced into the board and through the second hole to the outside, where it is secured with a wooden peg (Fig.8). The second endband core pierces the lower thong in the

Fig.8 Endband fragments laced into head end of lower board.

[36]The absence of adhesive residue or leather fibers at the fore-edge of the pastedown is explained by the small size of the manuscript fragment, which probably prevented it from covering the turn-in inside the front edge of the lower board.

first hole and then, as seen on the left in Figure 7, the second core exits out through the turn-in fragment on the inside of the lower board. Given this evidence it is possible to reconstruct the two stages of endband sewing for the manuscript. The first, and presumably original set of endbands were laced into the boards and were subsequently hidden by the turn-ins from the green full leather cover. These endbands gradually became worn and most of the thread and core fragments were removed from the head and tail of the book by a later binder. A second set of endbands was then sewn on a rolled alum-tawed leather core and tied down just above the kettle stitch. Since the single holes in the upper board were empty the new endband thongs could be easily laced at the corner. On the lower board the fragments from the previous endbands and the green leather cover had been left in place, so the new endbands were laced in on top of them.

Consolidation and Repair of Wooden Boards

At the time that the manuscript was received for treatment the packing materials were covered with a fine wood dust that had obviously come from the insect-damaged boards. The dust continued to sift out of the boards during the subsequent examination of the binding, so it was clear that some type of consolidation treatment was necessary. Several objects and furniture conservators were consulted on the right choice of consolidant for the job and a material called Butvar B-98 was recommended.[37] The Butvar was initially prepared as a 10% solution in ethanol and it was fed into the insect holes using a syringe. As the consolidant was absorbed into the inner recesses of the boards the viscosity of the solution was increased to roughly 20-25% solids. Gradually the insect holes became plugged up with the thicker solution of consolidant which, in turn, provided support for the upper layers of wood that were collapsing inward. During the consolidation treatment it became obvious that the Butvar was causing the lighter areas of insect-damaged wood to become more saturated in color. However, since the final color of these consolidated areas was no different than that of the undamaged wood surface, the color change was considered to be acceptable.[38] In addition, the Butvar seemed to be quickly absorbed by the wood upon application and it did not leave a shiny film on the surface which other types of consolidants might have done more readily.

Although the application of the Butvar halted the release of wood dust from the boards, other areas of insect damage along the spine edge needed a more substantial material that would act as a filler as well as a consolidant. Research into possible fillers led to the discovery of phenolic microballoons - a material that looks like a fine white powder eventhough it is actually made up of microscopic hollow glass balls.[39] Phenolic microballoons are

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[37]Butvar B-98 is a polyvinyl buterol, made by the Monsanto Corporation, that is sold in the form of a white granular powder.

[38]The color change was beneficial in some way, in that it made the insect holes blend in with the rest of the wood and thus they became less noticeable.

[39]Phenolic microballoons are manufactured by Union Carbide Corporation. Although the two terms are often used interchangeably microballoons are distinguished from microspheres, which are solid glass balls. Both can be used in fill materials with equal success. See Pamela Hatchfield, "Note on a Fill

often used for the gap filling of wooden objects, when the bulk of a resin needs to be increased without significantly altering its weight. For the treatment of the more perforated areas of the boards, phenolic microballoons were gradually added to a 30% solution of Butvar B-98 in ethanol until the resin reached an appropriate viscosity. This mixture was either dripped into the previously consolidated insect holes, or was applied with a microspatula depending on its thickness. Although the very white Butvar/microballoon mixture could have been tinted with acrylic paints, to make the fill blend in with the surrounding wood, this was not necessary since the mixture was only used in areas that would later be hidden by the new leather cover. Some of these white filled areas are seen in Figure 4, at the head and tail edges of the upper board.

The upper right corner of the lower board was extensively damaged by insects, which had tunneled through the entire thickness of the wood (Fig.8). (This is the same corner at which the larger turn-in fragment from the green leather cover had been found, along with the two laced-in endband cores.) The wood in this area was extremely weak and many small pieces were missing at the outer edge. Any attempts to consolidate or fill the perforated wood was likely to damage or disfigure the leather cover and endband fragments in some way. Therefore, since these fragments were considered to be important pieces of binding evidence, the decision was made to remove them as a single unit from the corner of the lower board.

Once this was accomplished the deteriorated condition of the upper corner of the board became even more obvious and it was clear that a large area of missing wood would have to be replaced, in order to provide support to the outer corner.[40] One alternative was to shape a new piece of wood to the contour of the loss and attach it to the damaged edge of the board. This idea was rejected, however, because of the difficulty that was anticipated in accurately fitting a new piece of wood to the irregular shape of the corner. Another solution was to fill the area with a synthetic resin/microballoon mixture, which would mold itself very easily around the remaining wood and also fill the loss at the corner. Butvar B-98, and other resins such as Acryloid B-72, were considered to be too soft or not sufficiently bulky to serve as a fill for such a large area of missing wood. A final alternative was to use a mixture of epoxy resin and microballoons. Although the applicability of this technique is somewhat disputed among objects conservators, because of the irreversibility of epoxy resin, it has several

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Material for Water Sensitive Objects," *Journal of the American Institute for Conservation*, Vol.25, No.2, Fall 1986, pp.93-96 and "Letter to the Editor," *JAIC*, Vol. 26, No.1, Spring 1987, p.64.

[40]Replacement of the missing corner at the spine edge of the lower board was needed in order for the binding to function properly, once it was rebacked in new leather. The opposite corner at the fore-edge of the lower board did not have the same mechanical function so it was not necessary to fill the loss in that area. In addition, the owner had specifically requested that the outer corner be left in its present condition, so that the binding would not look "restored."

advantages that have recently been described in a published article.[41] After much discussion with fellow collegues the epoxy/microballoon mixture was ultimately selected as the fill material for the loss. However the Araldite epoxy that had been recommended by the Canadian authors was substituted with Ablebond 342-1, which was chosen for its superior chemical stability and for its longer working time.[42]

It was essential that all areas of original wood be completely sealed from the epoxy resin mixture, so that the fill could be removed in the future if necessary. The entire corner of the lower board was thus coated with the 30% Butvar/microballoon mixture and allowed to dry. The surrounding wood surfaces on both sides of the board were then painted with a 10% solution of Acryloid B-72 in acetone. This would act as a barrier between the wood and any epoxy that might overflow the area being filled. The Ablebond epoxy resin was liquified by heating in warm water and it was then combined with the catalyst, using the suggested ratio of 100 parts epoxy to 32 parts hardener. Phenolic microballoons were added as a bulking agent to the mixture, with the approximate weight-to-weight ratio of 2/3 epoxy resin to 1/3 microballoons. A small amount of burnt sienna Liquitex acrylic paint was added as a colorant to the fill material, so that it would blend in better with the wood. A dam to retain the cast epoxy was made out of matboard and lined with silicon coated Mylar, and this was then fitted around the corner of the board. The viscous epoxy/microballoon mixture was applied to the area of the loss using a microspatula. After 24 hours the fill had completely hardened and the matboard dam was removed. The fill was then shaped to the contour of the board using a scalpel and various sanding sticks. The hardened film of Acryloid B-72, that had been used to protect the surrounding areas of wood, was removed with acetone and cotton swabs. The completed fill of epoxy resin and microballoons is seen at the upper right corner of the lower board in Figure 11. The whiter material surrounding the fill is the Butvar/ microballoon mixture that had been used for filling small gaps and losses in the boards.

A relatively large loss of wood, just inside the tail edge of the upper board, coincided with the place where a single endband core fragment was still laced into the board. It was clear that, because of this loss, the turn-in from the new leather cover would not adhere well to the board surface. Therefore the decision was made to fill the loss with a material that would not damage the endband core and that could be easily removed in the future, if necessary. The Butvar/microballoon mixture tended to remain somewhat soft, even after drying, so it was not considered to be suitable for filling such a large area. The harder and more permanent epoxy resin/microballoon mixture, on the other hand, would have been difficult to isolate from the endband fragment that was to be left in place, in the upper board. Ultimately a mixture of thick rice starch paste and alpha cellulose powder was chosen as

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[41]R.Barclay and C.Mathias, "An Epoxy/Microballoon Mixture for Gap Filling in Wooden Objects," *Journal of the American Institute for Conservation*, Vol.28, No.1, Spring 1989.

[42]The author is indebted to fellow objects conservators, Meg Lowe Craft and Claudia Deschu, for their assistance in selecting an appropriate fill material for the job and for their guidance in the practical application of epoxy resin/microballoon mixtures in wood conservation.

the fill material for the loss. Using a microspatula the mixture was applied to the loss around the endband fragment, which was gradually covered over. The loss was overfilled in order to counteract the normal shrinkage that would occur upon drying. Once dry the surface of the fill was quite hard and it was easily leveled off using a sanding bit and a flexible shaft drill.

Reinforcement of the Textblock

Since the manuscript was not to be disbound the deteriorated sewing structure would have to be reinforced in situ. The degree of breakage of the original sewing supports at the joints and across the spine made it necessary to apply a new material on top of the existing thongs for adequate reinforcement. This material would then provide a means of reattaching the textblock to the wooden boards. Lengths of 10 cord flax twine[43] were frayed out to form wide bands of cord. These were then wrapped in a thin layer around each of the four alum-tawed thongs and secured with rice starch paste. Broken sewing threads were found scattered throughout the textblock, rather than in concentrated areas, and almost all of the kettle stitches at the head and tail were either broken or badly frayed. It was therefore necessary to reinforce the entire textblock by sewing though all the quires, rather than only those with broken threads. Prior to this step, however, certain changes were made on the inside of the textblock which would aid in the mechanical operation of the binding and provide greater support at the joint areas.

The owner of the manuscript had requested that a new parchment flyleaf be inserted in front of the first page of text, in order to provide protection to the illumination and the writing ink. Since the original front pastedown was eventually to be reattached to the board it was not necessary to provide an additional conjoint leaf, which would be used for that purpose. Therefore a single parchment flyleaf[44] was cut to the size of the textblock, with a 3 inch flange or hook guard along its spine edge. Once the manuscript was rebacked this guard would be adhered to the front board underneath the original pastedown, thus providing additional strength to the inner joint. At the back of the manuscript the original pastedown had been lifted from the lower board, but was it was still sewn to the textblock and attached to the board by means of the hook guard wrapped around the spine edge. The owner had requested that this pastedown be retained as a loose flyleaf, so that the writing on the verso would be visible for future examination and study. Although feasible to do, it meant that the lower joint would be exposed on the inside and susceptible to future damage. For this reason a relatively narrow folded piece of parchment[45] was inserted between the detached pastedown and the lower board. This loose guard would be sewn to the textblock inside the

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[43]Clarkson Best Quality Linen Cord, available from Colophon Hand Bookbindery, Seattle, WA.

[44]Made from a piece of undyed calf slunk from William Cowley Parchment Works, England.

[45]This loose guard was made from a piece of Cowleys calf slunk that had been stained a light brown color to blend in with the color of the lower pastedown. The leather dye used was Baygenal Brown CGB, made by the Bayer Chemical Company. For a description of dyeing parchment see Anthony Cains, "Repair Treatments for Vellum Manuscripts," *The Paper Conservator*, Vol.7, 1982/83, p.22.

hooked guard of the original pastedown. After rebacking the binding the outer half of the loose guard would be pasted down, across the inner joint and on to the lower board, and would thus provide the necessary support to a potentially weak area.

Once the inserted flyleaf and loose guard were in place the entire textblock was then resewn through the center of every quire, following the path of the existing sewing. A relatively lightweight 25/3 linen thread[46] was used in order to avoid adding extra thickness inside the quires and to reduce the bulk on the outside of the reinforced sewing supports.[47] Since the thread at the original kettle stitches was so deteriorated the new kettle stitches were anchored around a single length of 25/3 thread, which was laid across the spine at the head and tail of the textblock (Fig.9). New primary endbands were resewn with the same thread onto supports of 8 cord flax twine[48], which were cut to the width of the textblock and placed along the chamfered spine edges at the head and tail. The endbands were sewn with a

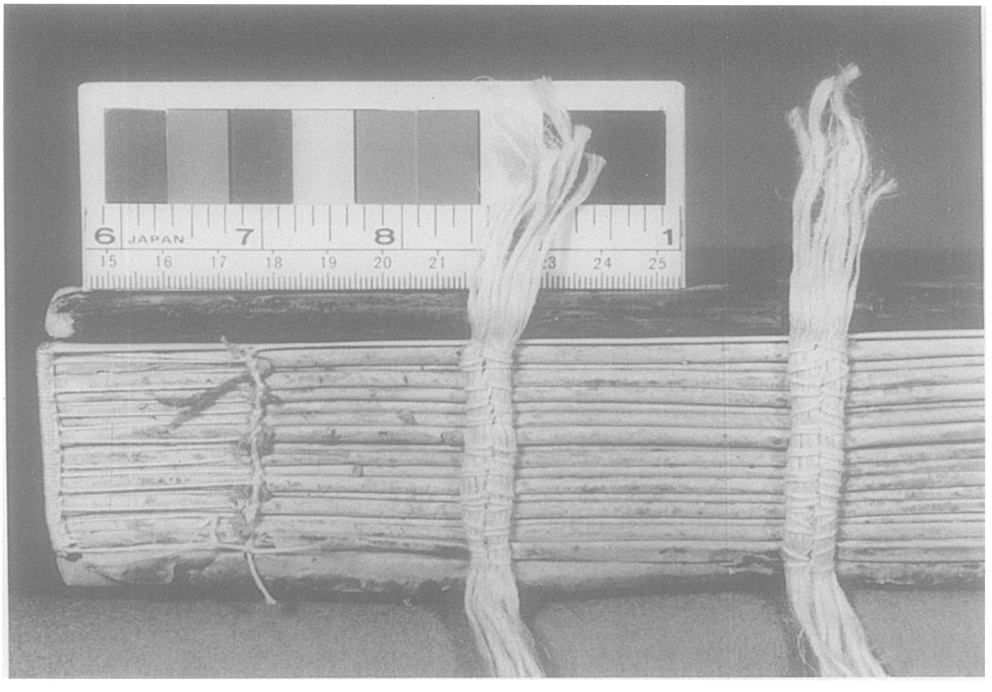

Fig.9 Head end of the manuscript after reinforcing textblock and sewing new endbands.

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[46]The thread is a soft finish unbleached linen thread with a regular 'S' twist, made by Crawford Threads Limited and supplied by Barbour Threads in Northern Ireland.

[47]This technique is difficult to use if the original sewing supports or thread are very dessicated and brittle. The pressure created by the new thread and the needle used for sewing can cause the older materials to break and come away from the spine of the book.

[48]Flax seaming twine made by Barbour Threads, N. Ireland.

back bead, through the center of every quire, and were tied down at the kettle stitches where the second set of endbands had previously been anchored. This left the original endband holes undisturbed and, at the same time, added more strength to the newly reinforced textblock.

All remaining fragments of both the original alum-tawed sewing supports, and those used for later repair, were left *in situ*, laced into the holes and channels in the two boards. This meant that the ends of the new frayed cord supports had to be brought over the joints and worked into the gaps around the fragments that lay in the channels on the outside of the boards. Rice starch paste was used to adhere the frayed cord to the existing thongs and once the new supports were secured in the first set of holes they were plugged from the outside with bits of frayed cord mixed with paste (Figs.10 & 11).

Fig.10 Front cover of manuscript after lacing in frayed cord over existing thong fragments.

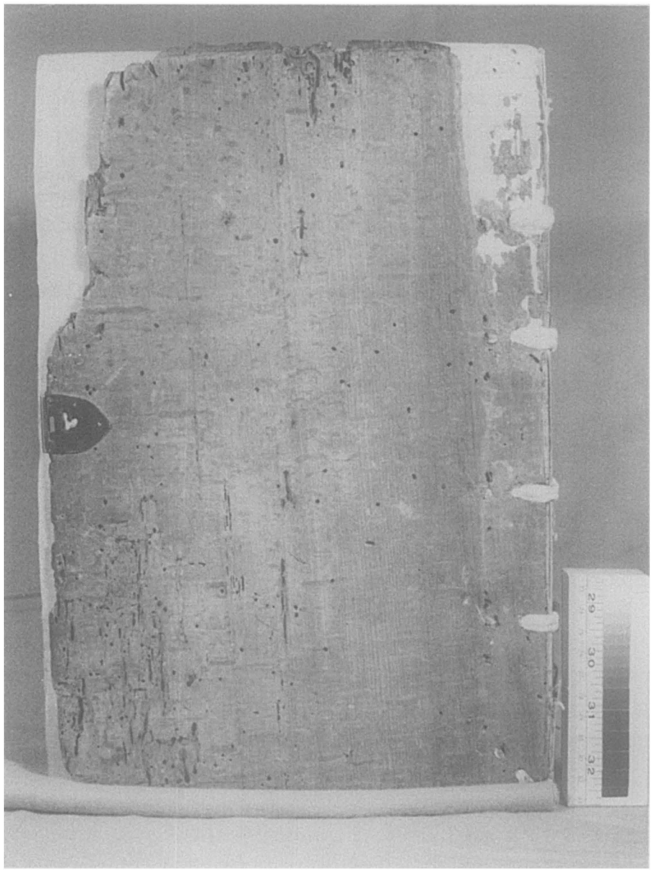

Fig.11 Back cover of manuscript after lacing in frayed cord over existing thong fragments.

Consolidation of Flaking Ink

Once the wooden boards and the textblock had been stabilized consolidation of the flaking writing ink could be safely undertaken, without causing further damage to the binding. Considering the extremely poor condition of the ink throughout the entire book the consolidation would have to be done on relatively large scale, and in such a way as to prevent any cockling or surface alteration of the parchment leaves of the textblock. Previous experience with the overall consolidation of flaking ink in a disbound parchment manuscript proved to be successful and, in that case, a suction table was employed to hold the leaves in place during treatment and to facilitate the rapid absorption of the consolidant into the ink and the surface of the skin.[49]

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[49]For a description of this treatment see Abigail B. Quandt, "The Conservation of a 12th Century Illuminated Manuscript on Vellum," *A.I.C. Preprints of Papers Presented at the Fourteenth Annual Meeting, Chicago, Illinois, 21-25 May, 1986*, pp.97-113.

A prototype of a suction table system had already been developed for the treatment of pages inside bound books, yet it had never been put to use by a practicing conservator.[50] This system seemed the ideal solution for consolidation of the flaking ink in the *Etymologies* and, after some alterations were made to the original design, a suction table and wooden jig were built to a size that would accommodate the relatively large dimensions of the manuscript. The suction table was constructed with an inner core of plastic light diffuser panel that had been cut with shallow channels across both surfaces, to allow for better air flow.[51] One long edge of the panel was beveled so that the table could be placed more easily inside the gutter of the open book. The panel was then sandwiched between a piece of 50 mesh stainless steel screening on the top, and a sheet of 24 gauge aluminum on the bottom. The aluminum sheet, which was cut slightly larger along three sides, was scored and then wrapped around to the top of the table, leaving one long edge uncovered. A narrow opening was cut along one side of a 1 1/4" square Plexiglas tube and the edge of the table that had not been covered over was inserted into the tube and secured with screws and bolts. The end of the tube that was flush with the edge of the table was sealed, while the opposite end, which extended beyond the table by about four inches, was left open for attachment to the suction pump (Fig.12).

The wooden jig, which would hold the book open during treatment, was constructed according to the original design, with a few minor changes. Additional support was provided for the upright portion of the book by a triangular wooden wedge, which was temporarily secured to the upper surface of the jig with a pair of clamps. The cover and pages of the book not being treated were held in place against the wooden support using a large piece of matboard and a wide strap of 5 mil Mylar, which was secured with clips to the left and right edges of the wedge.[52] The suction table was attached by its Plexiglas air channel to a wooden bar on the jig, which allowed the table to be lifted in an arc, away from the book, as the pages were turned. Suction was provided by a commercial wet/dry vacuum which was attached by a long hose to the open end of the Plexiglas tube. The surface of the suction table was covered with a piece of nonwoven polyester web and the area around the leaf to be treated was masked off in the usual way, using strips of polyethylene sheeting. Figure 13 shows a sample book set up in the wooden jig, with the suction table in place underneath an open page.

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[50]Stefan Michalski, a conservation scientist at the Canadian Conservation Institute, developed a design in 1988 for a suction table system to be used for the treatment of bound books. The author is indebted to Dr. Michalski for his advice on the fabrication of a working model of his system which would be used for the treatment of the Stantitz manuscript.

[51]Although Dr. Michalski's suction table had been built with an inner core of aluminum waffle there was some concern about residual machine oil, which according to some people, can be difficult to remove entirely. The plastic light diffuser panel or "egg crate", although thicker than the aluminum waffle, was readily available and did not present the same kind of problems, so it was used instead for the inner core of the table.

[52]Although this set-up was somewhat primitive it provided the necessary support for the manuscript during treatment. Further improvements will be made in the system when time permits.

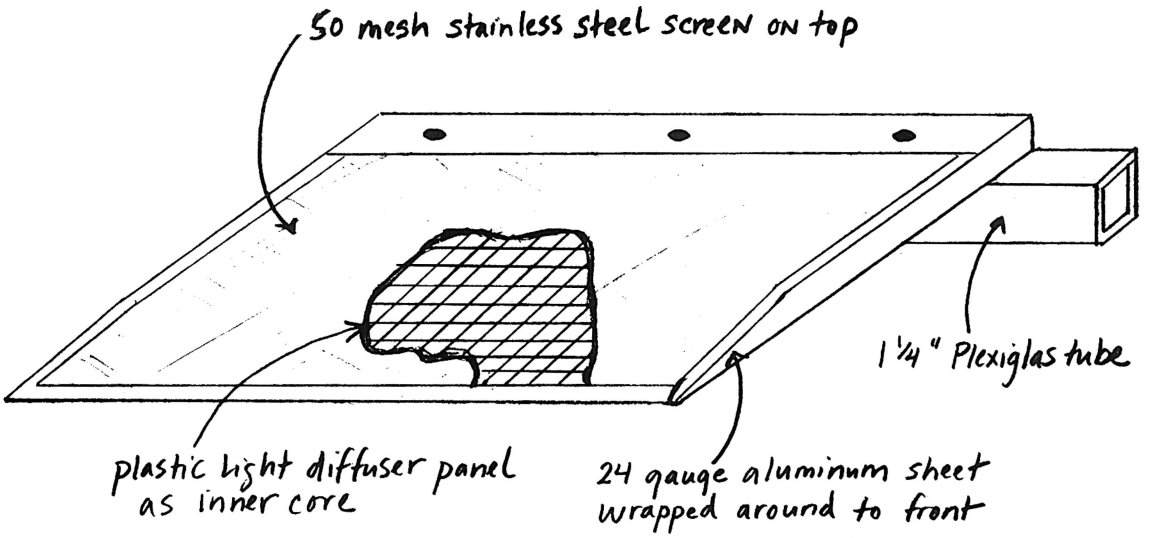

Fig.12 Diagram of suction table.

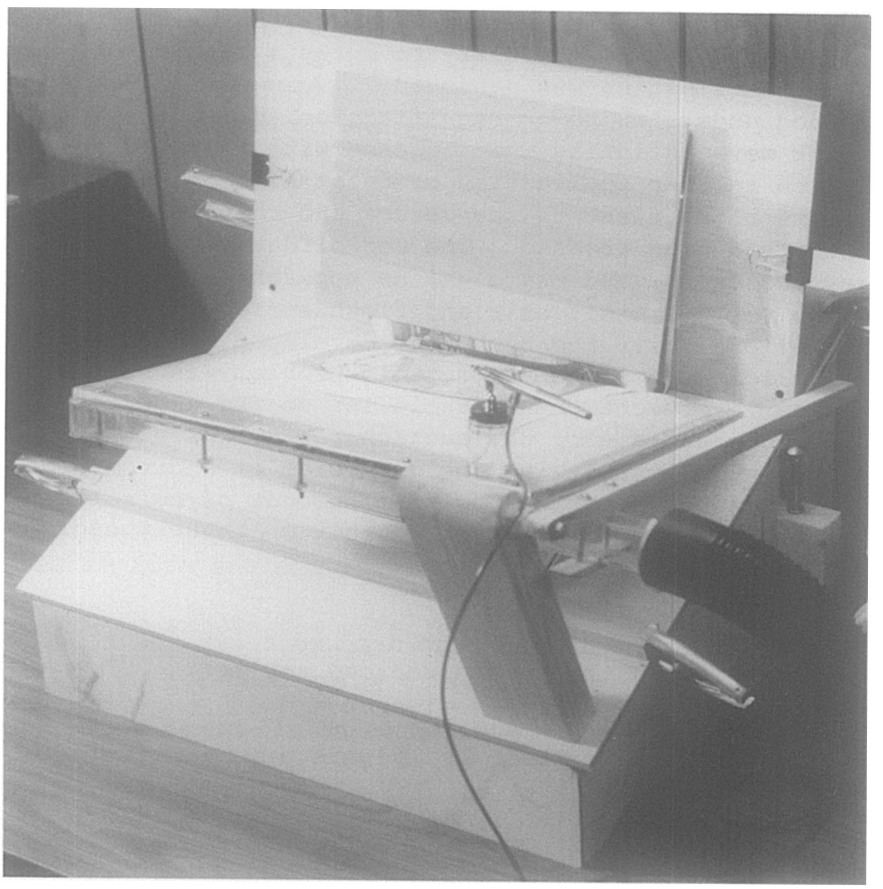

Fig.13 Sample book in wooden jig with suction table in p.

The consolidant was to be applied as a fine mist using an air brush. This technique would ensure that broad areas of flaking ink would be treated across an entire page, yet it also meant that the consolidant would be absorbed into the blank areas of parchment at the same time. In consideration of this fact the obvious choice of consolidant was either parchment size or edible leaf gelatin. Both of these materials are largely made up of collagen and would therefore be compatible with both the ink and its binder and the parchment support of the textblock. Since edible leaf gelatin was readily available in the workshop, and more easily prepared than parchment size, it was selected as the consolidant for the job.[53]

A 1-2% solution of edible leaf gelatin in distilled water was prepared and then diluted by half with ethanol before use.[54] The purpose of the ethanol was to reduce the surface tension of the gelatin so that it would quickly be absorbed by the ink and the blank areas of parchment, without leaving a film of adhesive on the surface. A blotter was used to protect the upright portion of the book in the jig, while an individual leaf was being treated on the suction table. The air brush was directed in a sweeping motion across each leaf, starting at the fore-edge and working in towards the gutter of the book. Although the leaf was held firmly on the table while the suction was on, it would begin to move and cockle at the edges if the rate of application exceeded the rate at which the gelatin was absorbed into the parchment surface. It was therefore critical to apply the consolidant in a gradual manner, waiting thirty seconds to one minute before the air brush was passed over the leaf for a second or third time. Since the writing ink was in such poor condition it was usually necessary to spray a single leaf several times before adequate consolidation was achieved.[55] Areas of flaking ink were regularly examined under low power magnification, using an Optivisor, and if the flakes of ink moved slightly when touched with a soft brush the treatment was continued with another application of gelatin. Consolidation proceeded through the entire book, first on the versos and then on the rectos, until almost every leaf had been treated. The consolidation treatment was ultimately very successful and there was no apparent darkening of the ink or alteration to the very distinct hair and flesh surfaces of the parchment leaves. One complication in the technique developed at the beginning of the project, yet with some experimentation, this problem was ultimately solved. The difficulty was to prevent the unstable ink on the underside of a page from off-setting on to the surface of the suction table, while the upper side was being treated. By quickly spraying the underside of a given page, before it was placed over the suction table; the small amount of consolidant that was applied seemed to lightly hold the ink together so that it would not flake off

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[53]Silver Label leaf gelatin was also used to treat the flaking ink and was prepared in the same manner that was described earlier.

[54]Since the gelatin was to be applied in an air brush the ethanol was added directly to the solution, rather than in a separate step as previously described.

[55]The multiple application of gelatin to the affected leaves made the consolidation treatment a very lengthy procedure. Since it was difficult to keep the gelatin solution warm, and therefore liquid, the air brush needed to be flushed with pure water on a regular basis to prevent the nozzle from getting clogged.

on the surface of the table.[56]

Rebacking the Binding and Construction of Rare Book Box

The final aspect of the treatment was to replace the quarter leather cover that had been removed from the spine and sides of the binding at the outset of the project. The present owner of the *Etymologies* preferred a medium tone for the new cover, so that it would blend in with the exposed wooden boards of the binding. A piece of Hewits alum-tawed goatskin was chosen for its long-term stability and the grain surface was stained with Levaderm dye to a light brown color.[57] In preparation for rebacking the spine of the textblock was lined in between the bands with strips of Sekishu, a medium weight Japanese paper, and rice starch paste. The purpose of this lining was to act as a separation layer between the parchment textblock and the new leather cover, which was to be adhered overall to the spine.[58]

After pasting out the leather with rice starch paste it was then positioned over the spine, molded over the raised bands and adhered to the sides of the book.[59] The leather was turned in at the head and tail and simple caps were formed over the new endbands. The book was then tied up with heavy cord in order to solidify the attachment of the leather and to ensure a clean definition to the raised cords and other features on the spine. The book was then left to dry for 24 hours in this position. After the spine had set the book was opened up and the parchment joint, which extended from the new front flyleaf, was adhered with rice starch paste to the inside of the upper board. The cuts and tears in the original front pastedown had been previously repaired with transparent fish skin and parchment size[60] and much of the heavy adhesive residue on the verso was removed, so as to reduce the

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[56]This problem had not been encountered before, when a similar technique was used to consolidate flaking ink and moldy parchment in a 12th century English manuscript. In that case the disbound leaves were humidified in a chamber prior to, as well as during the application of the consolidant. The introduction of moisture must have kept the ink flexible enough so that it stayed intact as a cohesive film and did not flake off on to the surface of the table.

[57]Levaderm leather dyes are manufactured by the Mobay Chemical Corporation. They come in liquid form and are diluted with both water and ethanol for use.

[58]The decision to adhere the covering leather to the spine of the book was based upon the still fragile nature of the sewing structure, which needed the extra support that an attached spine could provide. In an attempt to keep the spine as flexible as possible, however, only a lightweight lining of Japanese paper was applied to the back bone of the book, prior to covering.

[59]The new leather was cut so that it would be equal in width to the earlier alum-tawed quarter leather cover and would extend up to the line of discoloration on the two boards.

[60]Transparent fish skin, an equivalent to traditional goldbeaters' skin, is manufactured by Joseph Long Inc. of Belleville, New Jersey. The adhesive was made from parchment clippings, presoaked and cooked in water in a double boiler.

tension in the parchment leaf.[61] Although the narrow flange that extended beyond the spine edge of the pastedown had been unfolded and flattened it was obvious that, once the leaf was reattached, this area was likely to get crushed again, inside the joint, as the book was opened and closed. Since the sewing supports could not be put under any further strain the narrow flange was removed from the pastedown and preserved separately, along with the thread fragments that had been recovered earlier. The pastedown was then readhered with rice starch paste to its original position, inside the upper board.

At the back of the book the portion of the loose parchment guard that was adjacent to the lower board was pasted down in the same manner, across the joint and on to the board, while the other half was left as a narrow stub, behind the original pastedown. This pastedown was not readhered to the board, but instead was left as a loose flyleaf so that the writing from the medieval parchment document could be seen on both the verso of the leaf and the inside of the lower board (Fig.14). Although the new parchment joint now covered a small portion of the offset ink near the spine edge of the board, this was a small concession to make to ensure adequate support for the binding in a potentially vulnerable area. Since the owner of the manuscript wanted to retain the relatively simple appearance of the binding after rebacking the cover was left plain, without any gold or blind tooling on the spine (Fig.15).

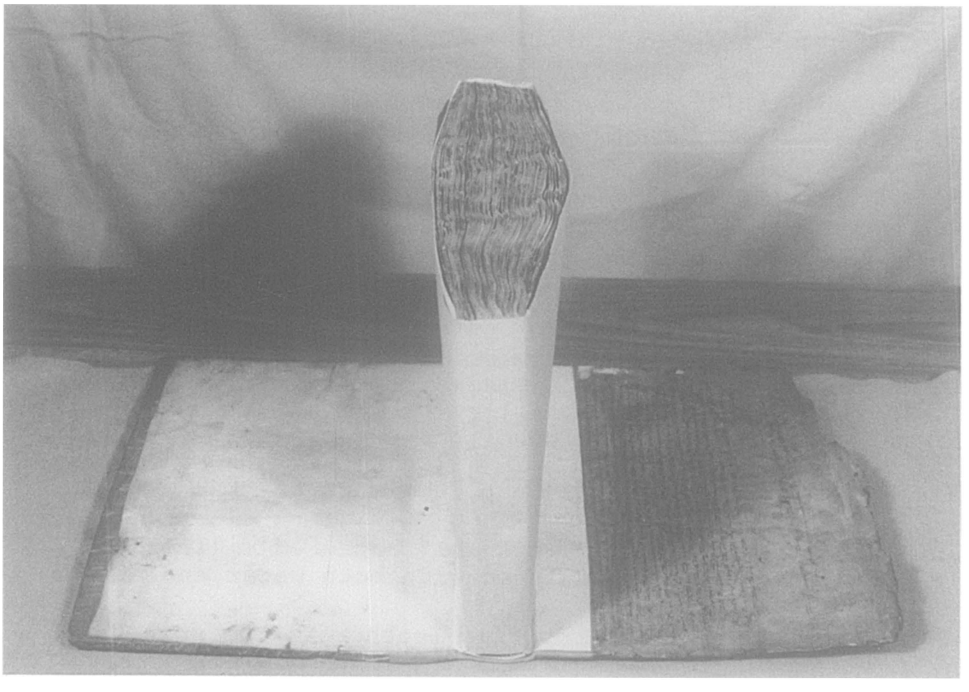

Fig.14 After rebacking and attachment of new parchment joints and original front pastedown.

[61]There seemed to be at least two distinct layers of adhesive on the inside of the upper pastedown which would indicate that it had been pasted more than once to the surface of the board. Most of this adhesive was removed with saliva-dampened swabs and the parchment leaf was then clipped and pinned to dry.

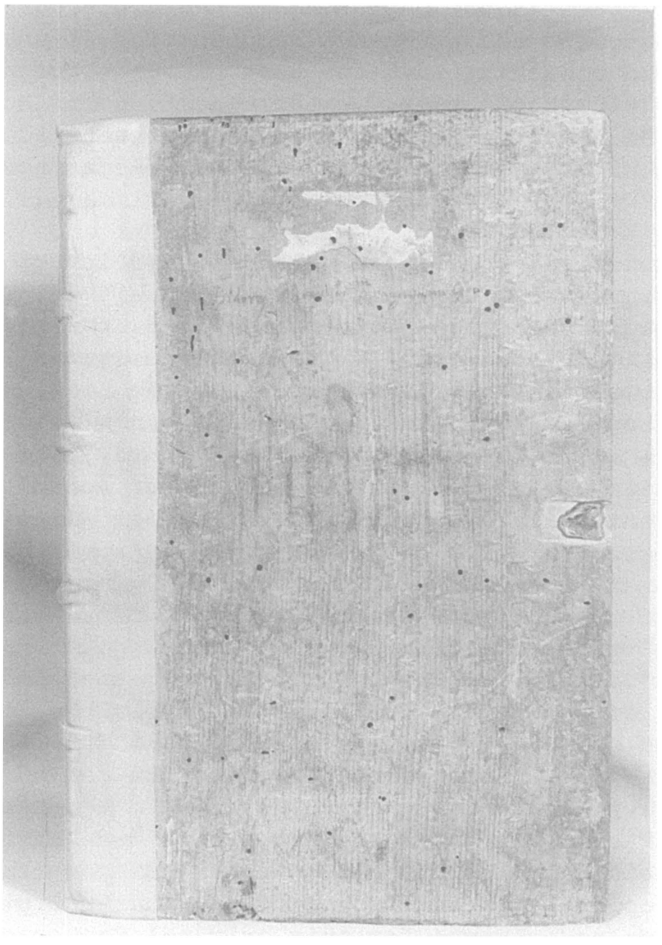

Fig.15 Manuscript after treatment with new quarter leather cover.

Once all of the conservation work was completed a clamshell box was made for the manuscript. A drop fore-edge wall allowed for easy retrieval of the large book and an inner lid, which covered the manuscript in the lower tray, would help to keep the volume under pressure while in storage. To provide a custom fit for the manuscript the interior of the box was lined with contoured pads made from polyester batting and unbleached Irish airplane linen. Van Heek book cloths were used to cover the trays and the case of the box and a gold stamped leather label, containing the author's name, the title and date of the manuscript, was applied to the spine of the box. Instead of storing them in a pull-out tray inside the box, all of the binding fragments recovered during the course of treatment were preserved in a separate notebook, along with the written and photographic documentation for the project. The notebook had its own slipcase so that it could be stored on the owner's bookshelf, alongside the boxed manuscript.

Conclusion

Although much of the necessary repair and consolidation work on the manuscript was anticipated at the beginning of the project the recovery of the many binding fragments, and the extensive documenation of the various stages of binding, repair and rebacking that the book had undergone in the past, had not been foreseen by either the owner or the conservator. However, the careful analysis of existing evidence proved to be essential in reconstructing the complete binding history of the manuscript, which can now be briefly summarized.

The basic structure of the binding has remained intact since the middle ages and this consists of an all-along sewing, with a herringbone stitch, on to four split alum-tawed thongs which were laced and then pegged into wooden boards. The original endbands were also sewn on alum-tawed thongs and were tied down halfway between the kettle stitches and the head and tail of the book. Although most of these original endbands are now missing, two fragments of the tawed core are still laced into the lower board. The binding was then covered completely with a piece of alum-tawed leather (possibly goatskin) that had been stained green on its outer surface. Although medieval green leather bindings are quite rare they have been documented in some European collections[62], so the reconstruction of the original cover, based upon existing evidence, is appropriate for the late 13th century date of the manuscript. The two pastedowns for the binding were both fragments that had previously been used for other purposes. The blank upper pastedown was reused from another binding of a slightly smaller size, while the lower pastedown was a fragment of a large medieval document, written on one side of a piece of inferior quality parchment. Both of these leaves had a folded flange or hook along the spine edge which enabled them to be sewn to the textblock at the same time that the sixteen quires of the manuscript were assembled and sewn. A fastening for the binding might have been provided by a leather strap which was attached to the upper board and hooked on to a central pin in the lower board. The only existing evidence for this original fastening is the deep channel in the fore-edge of the upper board and a rusty nail hole in the center of the lower board which aligns with the channel made for the strap.

Both the extensive insect damage to the binding, and the breakdown of the sewing structure, brought about the removal of the full green leather cover. Two of the broken sewing supports were then repaired with strips of alum-tawed leather and the endbands were resewn on to rolled alum-tawed cores and tied down at the kettle stitches. The binding was rebacked using an alum-tawed skin in a quarter leather style. At the same time a brass catch plate was added at the fore-edge of the lower board and this was used to secure either a leather strap or a metal clasp, set into a channel in the upper board. An abbreviated title, "Isid Eth," was written in large gothic letters on the surface of the upper board. A rectangular paper label, containing the

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[62]Although red and blue medieval bindings are documented in some European and a few American collections, green colored bindings are much more rare. However, the bindings of two 13th century Spanish manuscripts in the Bibliotheque Nationale in Paris, have been described as "reliure ancienne parchemin vert." (Although what is described as parchment is probably an alum-tawed leather.) See Francois Avril, et.al., *Manuscrits Enlumines de la Peninsule Iberique*, Paris, Bibliotheque Nationale, 1982, nos. 93 & 98.

title of the manuscript, might have also been adhered to the upper board at approximately the same time. The exact date of the initial repair and rebacking of the manuscript is uncertain; however existing evidence suggests a 15th century date for the work.

The last stage of repair to the manuscript occured some time in the 18th or 19th century. Although the earlier quarter leather alum-tawed cover was removed from the spine and sides of the book, no attempt was made to replace or reinforce the broken sewing supports or to resew new endbands on the binding. Instead the entire sewing structure was left untouched in its present condition. One alteration to the inside of the manuscript involved the pasting down of the last blank flyleaf to the lower board. The purpose of this was presumably to hide the turn-ins from the new quarter leather cover and/or to provide extra reinforcement across the weak inner joint at the back of the book. Once adhered the former flyleaf, and the original pastedown, were trimmed together at the outer corner to match the shape of the loss in the lower board. A black leather strap was added at the fore-edge of the upper board, presumably to replace a broken or missing strap or clasp. The full title of the manuscirpt, written in small letters on the surface of the upper board, might have been added somewhat earlier than the second rebacking although this is difficult to determine.

Although the outward appearance of the *Etymologies* did not change significantly during the project the physical condition of the manuscript was grreatly improved by the conservation treatment. The consolidation of the flaking ink and the stabilization of the sewing structure and the wooden boards have made it possible for the book to be handled safely, without causing further damage. Although the uncovering and removal of the various binding fragments seemed at times to be too invasive a procedure, the actual binding structure was not harmed in any way and the information gained from the recovered evidence proved to be extremely useful in reconstructing the past history of this important medieval manuscript.