Textual History of the Bible

VOL. 3: A Companion to Textual Criticism

PREVIEW

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Volume 3, *A Companion to Textual Criticism*, Volume Editors Russel E. Fuller and Armin Lange, consists of the following subvolumes:

**Volume 3A**
*History of Research* edited by Armin Lange and Russell E. Fuller surveys the history of research on the textual criticism and textual history of the Hebrew Bible and its versions in both Judaism and Christianity from its ancient beginnings until today for all of its important versions.

**Volume 3B**
*Modern Editions of the Text of the Bible in Hebrew and the Ancient Versions (Fifteenth Century to the Present)* edited by Richard D. Weis provides a comprehensive discussion of the printed editions of the Jewish Scriptures in all of the languages covered in THB 1 and 2 starting from the advent of the printing press in the West.

**Volume 3C**
*Theory and Practice of Textual Criticism* edited by Mika S. Pajunen will address in one place technical terminology, genres and media transmitting biblical texts, the practice of textual criticism, translation theory and translation technique, and theories of textual transmission.

**Volume 3D**
*Science and Technology* edited by Marilyn J. Lundberg will bring together information on the science and technologies that increasingly impact and influence not only the decipherment, study and conservation of ancient manuscripts of all types but also the textual criticism of biblical texts itself. Issues of manuscript conservation, analytical tools, and (virtual) manuscript enhancement are thus as much discussed as electronic databases of biblical texts or digital online repositories of biblical manuscripts.

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Textual History of the Bible

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Introduction

The Textual History of the Bible is the first comprehensive reference work for the textual history and textual criticism of the Hebrew Bible. Volumes one and two provide information on the textual history of the Hebrew Bible as well as its deuterocanonical scriptures in general and for each of its books in particular. The articles engage with the Hebrew, Greek, Aramaic, Syriac, Latin, Arabic, Coptic, Ethiopic, Armenian, Georgian, Old Church Slavonic, Christian Palestinian Aramaic, and Gothic versions as well as biblical quotations and questions of canonical history. As a Companion to Textual Criticism, volume three addresses the history of research and editorial history for textcritical and texthistorical study of the Hebrew Bible and its deuterocanonical scriptures and addresses the theoretical and practical as well as scientific aspects connected with it.

As a whole THB responds to the paradigm shift in the textcritical and texthistorical study of the Hebrew Bible away from an exclusive focus for the earliest attainable biblical text towards a study of the biblical versions as texts and religio-cultural objects in their own right. This has led not only to an unprecedented recognition of the importance of secondary biblical translations but also to a systematic consideration of issues of canonical history.

The paradigm shift in textual criticism and textual history also requires an extended metatheoretical reflection on many levels. This includes an examination of hermeneutics, philosophy and translation technique, that builds on the purely philological theoretical frame of previous generations. In addition, the sciences have impacted the textcritical and texthistorical study of the Hebrew Bible and its deuterocanonical scriptures on many levels in an unprecedented way. Next to traditional questions of history of research and editorial history, papyrology, codicology, and paleography, the third volume of THB will therefore engage extensively with the sciences, hermeneutics, philosophy and translation technique.

To achieve this ambitious goal, THB 3 (A Companion to Textual Criticism, editors Russell E. Fuller and Armin Lange) will consist of four parts that will each be published as standalone subvolumes,
allowing readers to purchase whichever part of THB they require most for their own research. These four subvolumes will cover a range of matters that pertain to modern textual criticism. The student of text criticism might ask: When was the idea of an Urtext first suggested? What is a homoioarkton and why does it occur? When was a certain codex written, and what exactly does it contain? Which scribal materials and tools were used at a given time? How can the date of a manuscript be determined? THB 3 attempts to address these and related questions. Its entries will span the history of research of textual criticism from antiquity until today. It will include entries on modern Bible editions, on textual criticism and textual transmission, and on issues of science and technology in the textual criticism of the Hebrew Bible. THB 3 addresses the history of research and the editorial histories of the Hebrew Bible, as well as other aspects of text-critical research and its auxiliary fields, or Hilfswissenschaften, such as papyrology and codicology.

THB 3A (The History of Research; subvolume editors Armin Lange and Russell E. Fuller) will survey the history of research on the textual criticism and textual history of the Hebrew Bible and its versions in both Judaism and Christianity. It will include comprehensive overview articles of the history of the textual study of the Hebrew Bible and ancient versions by both Jewish and Christian scholars. The surveys will commence in antiquity and will cover all textcritical and texthistorical research until the present day. While with such a vast narrative, comprehensiveness remains an unattainable goal, THB 3A will be the first survey covering the whole history of research of the textcritical and texthistorical study of the Bible from its ancient beginnings until today for all of its important versions.

THB 3B (Modern Editions of the Text of the Bible in Hebrew and the Ancient Versions (Fifteenth Century to the Present), subvolume editor Richard D. Weis): It is often difficult to find information about the earlier and even about the more recent editions of the Hebrew Bible or its versions. Little information is available as to what motivated them or sometimes even on which manuscripts they were based. Surprisingly, no comprehensive editorial history of the Hebrew Bible and its deuterocanonical scriptures has been published to date; only isolated studies exist. THB 3B will therefore provide a comprehensive discussion of the printed editions of the Jewish Scriptures and their deuterocanonical texts in all of the languages covered in THB 1 and 2 starting from the advent of the printing press in the West.

THB 3C (Theory and Practice of Textual Criticism; subvolume editor Mika Pajunen): There are few systematic discussions of the theory and practice of the textual criticism of the Hebrew Bible and its deuterocanonical scriptures. Particularly few such discussions engage with the (ancient) versions beyond the Hebrew and Greek texts. THB 3C will for the first time address in one place technical terminology, genres and media transmitting biblical texts, the practice of textual criticism, translation theory and translation technique, and theories of textual transmission. It will focus both on the theoretical and practical aspects of the textual criticism and textual history of the Hebrew Bible and its deuterocanonical scriptures.

THB 3D (Science and Technology; subvolume editor Marilyn Lundberg) will for the first time bring together information on the science and technologies that increasingly impact and influence not only the decipherment, study and conservation of ancient manuscripts of all types but also the textual criticism of biblical texts itself. Issues of manuscript conservation, analytical tools, and (virtual) manuscript enhancement are thus as much discussed as electronic databases of biblical texts or digital online repositories of biblical manuscripts and much, much more.

Armin Lange and Russell E. Fuller (October 2020)
The history of the research about the Biblical text in the west is the history of several Latin versions and editions and how they conform what will be called the Vulgate. However, in this history, the Hebrew and the Greek texts played an important role in the development and study of the Latin text (→ 1.2.2). The study and transmission of Jerome's translation (→ I.1.3.5) and its predecessor, the old Latin translation called Vetus Latina (→ I.1.4.1), depended on how the scribes, editors, and scholars understood them and linked them with their Vorlage. This tension between the two translations was caused by their different approaches towards their original and the different nature of those originals. The Veritas Hebraica that Jerome introduced in the Christian Latin world had an impact on how the Biblical text was transmitted and studied. The Hebrew text would have a role in the Vulgate after its translation in the same way that a Greek text had a role in the Old Latin translation. However, for the most part, the Hebrew (→ I.1.2.2; → I.1.5) and Greek texts (→ I.1.3.1.1) played an indirect role in the Western tradition of the Bible during the Middle Ages. In very few cases, Christian scholars turned to the Hebrew text for the reconstruction of Jerome's translation. Even less so they turned to the Greek text, which was almost not used in the West as an authority regarding the Latin text, even for the New Testament.

The use of a Hebrew text was almost as exceptional as the use of a Greek one in Western Christian scholarship. When it happened, Christian scholars mainly employed Hebrew sources to underline Jerome's authority but not to correct Jerome's translation. One of the most notable examples of direct use of the Hebrew text in the west took place from late eighth to the ninth century C.E., i.e. during the Carolingian Renaissance. Under the patronage of Charlemagne and his successors, in this period an extreme interest in the Latin language and in the Bible developed. Alcuin of York (735–809 C.E.) was commissioned by Charlemagne to prepare a revised edition of the Vulgate whose textual tradition had suffered from contamination by the Vetus Latina. The recension of Alcuin is most famous of all the Carolingian recensions. It constitutes the basis of the thirteenth century Paris Bible (→ II.1.1.5.4; → II.1.1.4.6.7), which provided the foundation for the early printed editions.

Besides Alcuin, there were other scholars working on the biblical text. Among them, the Visigoth Théodulf of Orleans is the most important. As bishop of Orleans, he undertook a revision of the biblical text with the aim of rediscovering the hebraica veritas which he identified with the original text of Jerome. His Bible pandects are characterized by the accumulation of readings and variants. One therefore cannot speak about a “Thedoulfian” recension, but a work “in progress,” since the manuscripts differ from each other and every one preserves different marginal readings. Three of these

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1 For a more detailed treatment, see → 1.1.2.2.3.
4 The manuscripts were dated by Fisher in this order from the earliest to the more recent ones: Stuttgart Württembergische Landesbibliothek HB II, 16 (Constance); London, British Library Add. 24142 (St. Hubert); Le Puy Chapter Library; Paris, Bibliothèque nationale de France lat. 9980 (Orleans); Paris Bibliothèque nationale de France lat 1937 (Saint Germain); Copenhagen, Kongelige Bibliotek, Ny Kgl Samling 1 (Carcasonne). See B. Fischer, “Bibelausgaben des frühen Mittelalters,” in La Bibbia nell’alto Medioevo (eds. G. Cremasoli and C. Leonardi; Spoletto:
manuscripts preserve marginal readings based on a Hebrew manuscript much like the MT, which was produced around the eighth century C.E. For instance, in the Saint Germain Bible, ca. 2000 annotations can be found for the books of Genesis–Joshua, Samuel, Kings, Job, and the Psalms. The variants tend toward literality regarding the Hebrew, presenting sometimes new translations that mimic the Hebrew more closely. Thus, in the Saint-Germain Bible, when Jerome translates the Hebrew תיב with Latin equivalents of the English words “house,” “temple,” or “palace,” the annotations always point out: h. habet domus “H(ebrew) has house.” This means, that there is a clear Hebrewizing tendency in the annotations.5

The impact of the Theodulf Bibles was limited. Theodulfian material seems to surface in texts such as Eadwine’s Psalter (manuscript Cambridge, Trinity College R.17.1) dated in 1150. There was, however, a Christian interest in the Hebrew text of the Bible through the Middle ages which is documented in the works of several authors. Examples include Etienne Harding, the Victorines, Robert Grosseteste, Roger Bacon, and Nicholas of Lyra. This interest in the Hebrew text is linked with the shift in the exegetical paradigm. Possibly under the influence of Jewish exegesis, a gradual change toward a literal approach and away from figurative interpretation can be observed.6 The Victorines are an example for such a shift towards literal interpretation and for a new interest in the Bible. Hugh of Saint Victor (ca 1090–1141) and Andrew of Saint Victor (d. 1175) often quoted the Hebrew text in their commentaries on the Pentateuch and the Former Prophets. They did this either in the form of a literal translation that differed from the lemma of the commentary or in the form of a Latin transcription of the Hebrew which was accompanied by a Latin translation side by side with the Vulgate text they used. The extent of the Victorines’ knowledge of Hebrew remains uncertain, but it seems quite likely that Andrew of Saint Victor had a certain command of the language. However, much of their knowledge of Hebrew readings and interpretation came from contact with the Jewish scholarship of Northern France, mainly with the works of Rashi (1040–1105), R. Joseph Kara (ca. 1055–1130), Rashbam (1080–1160), and R. Joseph ben Isaac Beckhor Shor (mid to late twelfth century). Direct contact with these authors is not likely. The Victorines will have learnt the textual variants and interpretations they included in their works from conversations with contemporary Jewish Scholars in France.7 On the other hand, it must be taken into account that in some cases Andrew’s in hebreo translation seem to show dependence on Theodulfian manuscripts.

The Hebrew text reflected in Hugh and Andrew’s work was akin to that used by Jewish exegetes of the period and supported their literal interpretation; they used the Hebrew variants to discuss and clarify the Vulgate text (→ I.1.3.5).8 Thus, the MT (→ I.1.5) was the indirect basis (via Jewish cooperators) of their in hebreo readings; this Hebrew text could have variants as in Exod 14:13 where the text he labels as in hebreo, ut nunc videtis “like you see now” is a variant extant in some Hebrew manuscripts, a fragmentary text from the Cairo Genizah, the Samaritan Pentateuch (→ I.1.2.3), Targumin (→ I.1.3.3), LXX (→ I.1.3.1.1), the Peshitta (→ I.1.3.4), and the Vetus Latina (→ I.1.4.1).10

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Centro studi alto Medioevo, 1963), 519–600 (594).

5 For more examples for annotations in 1 Samuel–2 Kings in the same manuscripts, see Candiard and Chevalier-Royet, “Critique,” 26–28.


9 Andrew, Exod., ll. 762–63.

10 *BHS, cf. apparatus to the verse.
The *ut* “like” reflects כָּכָא, “like” instead of the Masoretic כֵּא “for whom.” Not all the notes marked in *hebreo* are taken from a Hebrew text; some of them are vestiges of the Vetus Latina and others reflect Latin variants of the Vulgate."

Other authors of the twelfth century attest to the use of the Hebrew text as well. Stephen Harding (d. 1134), abbot of Cîteaux, provides evidence of employment of the Hebrew text in his revision of the Vulgate. Harding replaces many Latin renderings in 1 Samuel–2 Kings by others closer to the Hebrew text. As in the case of the Victorines, he acknowledges that these corrections were made with the help of Jewish Scholars who translated the original text into French. Nicolas Maniacoria (d. towards 1145), used the Hebrew text in works such as *Suffraganeus bibliothecae* and *Libellus de corruptione et correptione psalmorum et aliarum scripturarum*. He corrected the Latin text with readings and transcriptions from the Hebrew, using also the help of Jewish collaborators, as he himself noted. Herbert of Bosham (d. ca 1194), who wrote in the second half of the twelfth century, employed the Hebrew text in his works, showing better knowledge of the language than previous authors.

Several Latin writers in the twelfth and thirteenth centuries, such as the already mentioned Stephen Harding and Nicolas Maniacoria, as well as thirteenth-century authors of *correctoria* employed the word *Hebreus* in the singular to refer to a fixed and established Hebrew text and the plural *Hebrei* to refer to “Hebrew manuscripts.”

The authors of the *correctoria* distinguished between *antiqui hebrei* “old Hebrew manuscripts” and *novi hebrei* “recent Hebrew manuscripts.” It is not clear, however, if these designations indicated Hebrew variants in comparison to the MT. Thus, the access to and use of the Hebrew texts are well attested in the twelfth and the thirteenth centuries. Christian scholars gained access to Hebrew texts either through the help of Jewish scholars (most of the time) or independently (less frequent). In the same way, the “bilingual” Hebrew–Latin manuscripts made in England between the twelfth and thirteenth centuries confirm Christian access to Hebrew texts and attest a working knowledge of Hebrew among Christian scholars. Among these bilingual manuscripts are several Latin–Hebrew Psalters, with the Hebrew text and a Latin translation (Vulgate, Gallicana, Psalter *iuxta hebraeos*) written in parallel columns. Most of them have an interlinear Latin translation as well (*superscriptio*).

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11 On this example and others, see M. Leyra, “The Victorine Exegesis on the Pentateuch and the Former Prophets: The Sources of the In *hebreo* Interpretations in the Light of Its Parallels with the Peshit School of Northern France and Other Jewish Sources” (PhD diss., Hebrew University, 2001), 196–203.


text and only the *superscriptio*. In this way, Hebrew readings and the Hebrew text were taken back and influenced the Latin text at least in an indirect way.\(^\text{21}\)

Such influence of the Hebrew text on Christian scholars can also be seen in the important fourteenth-century commentary of Nicholas de Lyra, the *Postilla literalis super totam Bibliam*, written ca. 1320. This commentary was characterized by its literal approach to the text and by an undoubted Jewish influence that such a literal approach revealed. Many of these Jewish interpretations in the work of Nicholas of Lyra go back to Rashi’s works, which were read and known by Nicholas. In fact, Nicholas of Lyra constitutes the pinnacle of the Christian recourse to Jewish sources for the study of the Bible, precisely in a period characterized by a strong antisemitic bias in Christian society. Nicholas of Lyra shared that bias but was, at the same time, aware of the importance of Jewish exegetical and textual traditions.\(^\text{22}\)

When commenting on a text, he used the Jewish explanation, employing the Hebrew text if necessary, and noting the meaning of Hebrew words. Examples include his commentaries on Lev 27:29 and Num 11:18. He took into consideration the problems posed by Hebrew grammar and vocalization. His commentary had a great influence in a period when there was a waning of Christian interest in Jewish writings and in the Hebrew text of the Bible itself.

Nicholas of Lyra anticipated the importance of Hebrew and the Hebrew interpretation in the study of the Biblical text of the fifteenth century. By the end of the fifteenth and the beginning of the sixteenth century, Hebrew language positions were established in Leuven, Paris, and Alcalá, bringing about a return to the Hebrew text of the Bible and an interest in the Jewish understanding of it. This return *ad fontes* would result in the publication of the first Renaissance Polyglot, the Polyblot Bible of Alcalá in 1517.\(^\text{23}\) The interest in the Hebrew language and the Hebrew text was caused by a new emphasis on the “grammatical-historical,” i.e. literal interpretation of the biblical text, moving away from the medieval allegorical interpretation. Much of this interest in Hebrew language and culture was the work of the Florentine circle that gave origin to Christian Kabbalah and, as a byproduct, to Christian Hebraism.\(^\text{24}\)

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\(^{23}\) *Complutensian Polyglot.*


Christian David Ginsburg (1831–1914) was one of the most important biblical and Masoretic scholars of the late nineteenth and early twentieth centuries. In 1894, Ginsburg prepared an edition of the Hebrew Bible for the Trinitarian Bible Society (= Trin) in two volumes, one containing the Pentateuch and the Former Prophets and the other the Latter Prophets and Hagiographa. The Hebrew title was

“יפלעבטיהםיקיודمشׁדקהירפסעבראוםירשׂע
ןמתוהגהוםיפולחםעםינושׁארםיסופדיפלעוהרוסמה
םינשׁיםימוגרתוםיקיתעדייבתכ”

“The Twenty-four Books of the Hebrew Bible Carefully Revised According to the Masorah and According to Early Printed Editions with Emendations from Early Manuscripts and Ancient Translations,” and the English title was "The Massoretico-Critical Text of the Hebrew Bible." The first edition was reprinted in 1896, in one volume in 1906, and most recently also in one volume in 1998.

In his extensive *Introduction to this edition, published separately in 1896, Ginsburg stated that the text he used for this edition was based on the Second Rabbinic Bible of Jacob ben Ḥayyim, and that none of the variations mentioned in the apparatus were introduced into the text itself. However, neither of these assertions is accurate. In the first place, notwithstanding his assertion of fidelity to ben Ḥayyim, Ginsburg’s text differed from ben Ḥayyim’s text in a number of ways. Unlike ben Ḥayyim, who simply used the letters פ and ס to indicate the open (petuhot) and closed (setumot) sections, Ginsburg laid out his text in accordance with the Masoretic rules for these sectional divisions. Ginsburg also indicated the *sedarim divisions in the margins and indicated the *Ketiv and *Qere differently from ben Ḥayyim. Whereas ben Ḥayyim printed the *Ketiv with vocalizations and accents but left the *Qere unpointed in the margin, Ginsburg printed the *Ketiv unpointed in the text but pointed the *Qere in the margin. The layout of the books of Psalms, Proverbs, and Job also differed in the two editions since Ginsburg printed these books in poetic stichography whereas ben Ḥayyim had printed them as continuous text. A further difference between the two editions was in Ginsburg’s writing a *rafe sign over *begedkefet letters to indicate the aspirate sound of these consonants, and also over the letters *alef and *he when they were not consonants, a practice he dispensed with in his later Bible edition. As for his assertion that none of the variations mentioned in the apparatus was introduced into the text, there are scores of cases where Ginsburg did exactly that. Here are some examples:

*addition of a letter: at Esth 8:11, ben Ḥayyim reads גדר “to kill” whereas Trin reads גדרל “to kill”;
*different preposition: at Esth 9:2, ben Ḥayyim reads מֵהֶנֶפְבּ “in front of them,” whereas Trin reads מֵהֶנֶפִל “before them”;
*different plene or defective forms: at Judg 17:9, ben Ḥayyim reads כְֵלוֹה whereas Trin reads כְֵלֹה (both meaning “going”); at Judg 7:5, ben Ḥayyim reads וֹתֹא whereas Trin reads וֹתוֹא (both meaning “him”); at Jer 27:7, ben Ḥayyim reads זִילְדּ whereas Trin reads זִילֹדּ (both meaning “great”).

In his *Introduction Ginsburg described in detail the sixty manuscripts and nineteen printed editions that he used for this edition. All the manuscripts, apart from two, British Library Or. 4445, a ninth century C.E. Torah, and the St. Petersburg Latter Prophets (916), were relatively late, and nearly all were from the British Museum and are now housed in the British Library. However, in the apparatus of this edition, Ginsburg does not actually identify the source(s) of a reading as any of specific manuscripts. He refers only in general terms to מפרים אחר חריש “another manuscript” or מפרים אחר חריש “other manuscripts.” Curiously, the manuscripts that Ginsburg does refer to by name in his apparatus are those lost manuscripts mentioned by the Masorah, namely, Codex Yerushalmi, Codex Hilleli, Codex Mugah, and Codex Zambuki.

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Ginsburg’s text was accompanied by an apparatus which presented the variant readings from the collated manuscripts and editions, including variations in text divisions, orthography, vocalization, and accents, variations between the readings of Eastern and Western Schools, and variations between the schools of Ben-Asher and Ben-Naphtali. He also included variant readings from the Samaritan, Septuagint, Vulgate, Peshitta, and the Targums although he never indicated which particular versional text he used for these witnesses. He simply listed them in the preface to his edition abbreviated as שַׁמָּר (Hummash Shomroni = the Samaritan Pentateuch); אָしっかり (Targum Onkelos), יז (Targum Jonathan), פ (Targum Suri = Peshitta), א (Targum Shivim = Septuagint); and ו (Targum Romi = Vulgate).

Ginsburg’s Trin edition provided the basis for his major four-volume edition for the British and Foreign Bible Society (= BFBS). This BFBS edition was intended to mark the centenary of the society in 1934, but the first volume was not issued till four years later. It took eighteen years until the fourth and last volume appeared. The Pentateuch appeared in 1908, the Former and Latter Prophets in 1911, and the Psalms in 1913. Ginsburg died in 1914 and in 1926 his assistants A.S. Geden and H.E. Holmes, using Ginsburg’s notes, oversaw the printing of the entire Writings. The BFBS edition was reprinted in 1970 in four separate volumes by Makor (Jerusalem) under the title Torah, Nevi'im, Ketuvim. The BFBS edition was reprinted in 1970 in four separate volumes by Makor (Jerusalem) under the title תורא יבש מיי ותורא תורא תורא תורא Kash Shomroni = the Samaritan Pentateuch); א (Targum Onkelos), יז (Targum Jonathan), פ (Targum Suri = Peshitta), א (Targum Shivim = Septuagint); and ו (Targum Romi = Vulgate).

As with the Trin edition Ginsburg made the text of ben Hayyim the basis of his edition and recorded in the apparatus “all the important variations in words, orthography, vowel points, accents and sectional divisions, as he found them in the many manuscripts that he had examined.”4 Just as in the Trin edition there was to be no alteration in the text except in the very few instances in which ben Hayyim “was recognized to be at variance with an important Massorah.”5 The text is therefore described by Kilgour in the preface to the Former Prophets as “substantially” that of ben Ḥayyim.6

The publication of volume four of his Massorah in 1905 (see → 2.1.2.1.3) over a decade after the publication of his Trin edition in 1894 enabled Ginsburg to recommend changes on the basis of Massorah notes for the new BFBS edition that was yet to be published. Some of the changes were put into effect in the new edition, e.g., רָאָע (plene) of 1 Sam 21:8 was changed to דֹּאָעַישֶך (defective, both meaning “Doeg”), and הָכְּרָבָּר (defective) of Ps 118:12 was changed to כַּרְבָּרִים (plene; both meaning “like bees”). But others were not, e.g., בַּיְשֶך (defective) of Judg 21:12 was not changed to בַּיְשֶךְ (plene; both meaning “Jabesh”) nor was גַּרְשֵׁם (defective) of 1 Chr 15:7 changed to גַּרְשֵׁם (plene; both meaning “Ger-shom”) as he had recommended. The relationship between the fourth volume of Ginsburg’s Massorah and Ginsburg’s editions is seen not only in the many references in the fourth volume to readings in his Trin edition, referred to as “my printed edition” or “my edition of the Hebrew Bible,” but also in references back to this volume in his apparatus in the later BFBS edition. Thus, regarding the form בֵּית הָאָשֶׁר at 2 Chr 8:2, which in volume four he recommended changing to אוֹבָּשׁ (both meaning “them”),7 in the apparatus in BFBS he refers back to this very section of his Massorah giving the exact citation (Masorah, vol. 4, letter א, §1442). Likewise, on the form אָשֶׁר at 2 Chr 32:27, which he had recommended in vol. 4 to be changed to אוֹבָּשׁ (defective first; both meaning “and treasuries”),8 he refers back to this section of the apparatus (Masorah, vol. 4, letter א, §201) even though the recommended change was not introduced in the text.

A major difference between the Trin edition and the BFBS edition is the enormous expansion of the apparatus notes. Whereas in the apparatus of the


6 Kilgour, “To the Reader,” v.


Trin edition Ginsburg did not identify the manuscripts from which each reading came, in the apparatus of the BFBS edition he does identify them, listing those manuscripts supporting his selected reading as well as those not supporting his reading. Unfortunately, there are so many notations in his apparatus that every page has just a few lines of Hebrew text, while the lower part of the page is full of detailed notes. This presentation has challenged the most dedicated of readers, and indeed one critic wondered in a review how any reader could be expected to work through this mass of information.9

Ginsburg has often been criticized for his choice of relatively late manuscripts mostly from the British Museum, and for not selecting other manuscripts, particularly from other libraries in Europe, which would have been available to him.10 He has also been taken to task for only occasionally citing the collections of Kennicott11 and de Rossi (→ I.1.2.1.3.2; → 2.1.2.1.1),12 and for completely ignoring the textual results of his seventeenth century predecessors Menahem di Lonzano (Or Torah) and Yedidia Norzi (Minchat Shai) (→ I.1.2.1.3.1; → 2.1.3.3.1).13 Nevertheless, despite these criticisms, Ginsburg’s text readings have been utilized in the critical apparatuses of the editions of Biblia Hebraica (i.e., *BH and *BHS). They have also been used in the third apparatus (medieval bible manuscripts) of the Hebrew University Bible Project edition of Isaiah,14 but neither in Jeremiah15 nor in Ezekiel.16 They also are not used in the apparatus of *BHQ on analogy to that edition’s decision to exclude readings from Kennicott and de Rossi in the apparatus.

Ginsburg’s four-volume BFBS edition, without the extensive apparatus, was used as the starting point for an edition published in one volume by the Magnes Press in 1953. This edition, known as the Jerusalem Bible, was attributed posthumously to Moses David Cassuto. It was titled "Hebrew Bible: Jerusalem Edition: Corrected according to the Masorah of Ben Asher on the basis of a manuscript prepared by the late Moshe David Cassuto, and corrected by Eliyahu Shemuel Hartom."17 The publishers note in their preface that before his untimely death Cassuto was preparing an edition of the Bible based on Ben Asher manuscripts including the Aleppo Codex. The original idea was to print the edition in a newly designed Hebrew type but, when that idea did not materialize, it was decided simply to insert Cassuto’s notes into an existing Bible edition, and Ginsburg’s BFBS edition was selected for this purpose. According to the publishers, Cassuto’s corrections were inserted into the Ginsburg text “with invisible alterations by skilled craftsmen,” and then photographed to avoid typesetting.18 However, nowhere in the edition do the publishers acknowledge their debt to Ginsburg, and it received very bad reviews, one reviewer even suggesting that it “be withdrawn from the market.”19

In sum, in spite of the unfortunate use of Ginsburg’s text in the edition attributed to Cassuto, the two Bible editions by Ginsburg, especially the second, are important milestones in the development of printed editions of the Hebrew Bible.20 The first was a major attempt at a critical edition of the Masoretic Text based on manuscripts offering a corrected version of ben Ḥayyim’s text and a critical apparatus. The second was a critical edition of a type not seen since the beginning of the nineteenth century in the work of J. Jahn (see → 2.1.3.5). Moreover, it is also a rough contemporary of the simi-

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11 Kennicott, 1776–1780.
12 De Rossi, 1784–1788.
14 Goshen-Gottstein, *HUB, Isaiah.*
17 Cassuto, Torah nebi’im usketubim.
19 See Orlinsky, “Prolegomenon,” xiv.
20 For a discussion of Ginsburg’s editions in the context of Bible editions published by nineteenth century Bible and evangelistic society editions see → 2.1.3.6.
lar editions of R. Kittel (see → 2.1.3.8.2) although Ginsburg and Kittel constructed their editions on somewhat different principles. Even though it was not continued in a series of subsequent editions such as Kittel's first editions received, Ginsburg's second edition deserves as much place as Kittel's in setting the standard for critical editions of the Hebrew Bible until the discovery of the Dead Sea Scrolls.

David Marcus

Editions Discussed

M.D. Cassuto, מי היה עם ביעז הלוי והעניב את הפרסון ונוסחיו (תל אביב: מגד prueba, 1953).


Other Works Cited


4.1.1.7 Virtual Unwrapping: A Computational Approach for Reading Damaged Manuscripts

The task of textual criticism is quite often thwarted by manuscript damage. Burned scrolls, waterlogged texts, and wrinkled pages have long tantalized—and frustrated—biblical scholars. What hidden marginal notes might correct prior readings? What new differences, errors, or conjectural emendations are locked away behind damage? What critical link between translations and versions are obscured by the ravages of time?

Past attempts to ferret out such secrets have often failed, because the only options for opening or restoring texts were intrusive physical processes. Such restoration simply is not possible for many manuscripts, however, so severe is the damage; for others that do hold promise, these attempts often cause additional injury without contributing new knowledge. The seeming result has been a backlash against any physical interaction at all with materials. Instead, artifacts are “safely” locked away, with their potentially valuable contents left trapped and unknown.

Thankfully, for certain kinds of materials, that no longer has to be the case.

In 2015, our computer science research team at the University of Kentucky successfully restored the writing on a burned scroll excavated in 1970 from En-Gedi (fig. 1; → I.2.2.1.11.5), an ancient Jewish community dating from the eighth century B.C.E. The digitally rescued words were from Leviticus, making the damaged manuscript the oldest extant copy of a Pentateuchal book after the Dead Sea Scrolls and the only one ever found in a holy ark.

The entire restoration process was performed digitally and noninvasively. More importantly, our results represent the first time that unseen writing inside a hopelessly damaged and extremely friable manuscript has been imaged and rendered at such high quality that scholarly study of the text can occur. This technological and textual breakthrough, called “virtual unwrapping,” forges a new pathway for defeating manuscript damage and exposing textual discoveries buried within the confines of marred material.

4.1.1.7.1 Virtual Unwrapping

Virtual unwrapping is a computational process for digitally restoring the writing within an object without physically opening or altering it in any way. It is a computational pipeline – a series of computer algorithms that coalesce to create a pathway to textual restoration. The steps in the overall process include noninvasively digitizing an object, segmenting its layers, texturing those layers, flattening the resulting images, and merging all of the flattened pieces into a single "master view" that enables complete textual analysis.

Virtual unwrapping can be applied to a wide range of damaged, text-based materials, such as that of codices, scrolls, and amulets. This systematic and noninvasive restoration of text from within damaged objects provides the textual critic with new information that is not obtainable with other known methods. While the process itself is technically interesting, the overall goal is to provide a restoration of high enough quality that a complete textual criticism of the document can occur.

4.1.1.7.2 Digitization

Virtual unwrapping begins with the acquisition of a 3D digital representation of the selected artifact. This volumetric image provides a point-by-point model of the object’s internal structure. Several methods exist for performing noninvasive, penetrative, volumetric scanning, and any of them can be used in our pipeline. This flexibility allows us

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1 Ashley-Smith, “Losing the Edge.”

2 Shutthanandan et al., “Pixe Analysis on an Ancient Scroll Sample”; Redo-Sanchez et al., “Terahertz Time-gated Spectral
to take advantage of improvements in technology as they occur so that we get the best images possible.

For most of our work, we have relied on micro-computerized tomography (micro-CT) scanning. In principle, this method is the same one used in hospital CT (or “CAT”) scans, but on a small scale with massively increased resolution. Such x-ray-based tomographic scanning captures in three dimensions every wrap, layer, and turn within the interior of an object.

The material and physical properties of the damaged object dictate the scan settings or protocol for each particular project. For example, the elemental composition of the ink and the writing surface affect how the scan will reveal (or not reveal) its secrets. Another fundamental concern is resolution – it must be high enough so that one can see the layers on which there is writing. At low resolution, one risks missing evidence from within an object – especially writing that might be on both sides of a page or written in a very small hand.

In the case of the scroll from En-Gedi, the contents were initially a complete mystery. Determining how best to scan the scroll so that the writing would be revealed required educated guesses and several attempts to optimize the scan settings. After all, how does one determine the correct settings before knowing the ink composition, how it will appear in the scan, or even if ink actually appears in the document? With the help of calibration scans, the protocol and spatial resolution were optimized in order to capture enough detail through the thickness of each material layer to reveal ink if present and detectable.3

3 Seales et al., “From Damage to Discovery via Virtual Unwrapping.”
In a real sense, digitization frees an object from its physical form. The replicated digital model can be worked on in parallel by scholars all over the world without physical constraints or risk to the original object. Digitization as part of virtual unwrapping is just the first step, however. The acquired data is then passed through our software pipeline, a sequence of algorithms designed to create a restoration of the text that exists within an object. The scroll from En-Gedi provides a perfect example for demonstrating the need for restoration stages following the initial digitization step.

After scanning the object, the focus turns to accurately identifying and modeling the individual layers of the document, a process we call segmentation. The layers represent the wraps of the scroll or, in the case of a book, the pages. The digital depiction of the internal structure of an object may show numerous and varied layers, and one might assume that each layer represents a distinct wrap or page. However, over time, damage deforms the shape of writing surfaces. Layers may be fused together due to fire, water, or simply the passage of time. In the case of parchment, one layer may be separated into two (perhaps as a result of bubbling in the fat of the animal skin), giving a false impression of two distinct writing surfaces. Finally, the laminated fibers that make up papyrus may be buckled or broken down. These deformations result in unpredictable variations in the appearance of the surface material in the digitized tomographic volume, making the estimation of the true substrate on which there may be writing quite difficult (fig. 2).

Segmentation denotes our process for addressing this wide range of potential problems. It is the conversion of all the evidence within the scan of surfaces on which there may be writing – layers of material – into a geometric, computer model. We achieve this by treating the scan as a volume of 3D samples from the interior of the object, and to these samples we apply a variety of image processing and computer vision techniques.4

The volumetric scan defines a world coordinate frame for the modeling. The goal is to track, as closely as possible, the 3D shape of the layers as represented in the digitized volume. This creates a 3D surface that will be used by the texturing process to search for evidence of writing.

Since the layers of a document may be quite varied in shape, an expert user makes adjustments as the segmentation runs to ensure an accurate surface representation. Once complete, the segmented computer model of the surface shape readily supports many powerful computational manipulations that are necessary to restore the writing: ray intersection, shape dynamics, texturing, and rendering (fig. 3).

### Texturing

Modelling the shape of layers is crucial to the task of restoring written text. Only after a writing surface is segmented and modeled does it become possible to recover indications of letters and words.

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4 Seales et al, “Reading the Invisible Library.”
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In the micro-CT scan volume that are situated on that recovered layer. This process, called texturing, works by using the exact shape of the segmented layer as a guide within the larger volume to restrict where the search for evidence of writing occurs. Each point on the reconstructed writing surface is assigned a brightness (intensity) value as it appears in the 3D volume. In the case of micro-CT, these intensities are related to density: brighter values indicate regions of denser material, while darker values suggest a less dense component. Comparing these intensity variations reveals the presence of ink. For example, since iron is a dense material, a coating of ink made from iron gall would appear brighter in micro-CT than the surrounding, less dense papyrus on which it sits.\(^5\)

In an ideal case, each surface point could be mapped directly to its 3D volume position, generating the best possible replication of text.\(^6\) In practice, however, errors in the segmentation process combine with artifacts in the scan to create the need for a filtering approach that can overcome these sources of noise. For example, miscalculations can occur when localizing and estimating the shape of the layers as well as when estimating density. A proper texturing process can mitigate these miscues to some degree and produce a better representation of the evidence in the scan for what is written on the segmented layer.

To produce readable text from the scroll from En-Gedi, we implemented a filtering framework that tested a number of texturing approaches.\(^7\)

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\(^5\) Seales, “Reading the Invisible Library.”

\(^6\) Seales et al., “From Damage to Discovery.”

\(^7\) Seales et al., “From Damage to Discovery.”
Since each restoration project is unique, it is important to have a framework that supports some experimentation. The textured, segmented layer that results from this step in the pipeline can be readily evaluated for visual quality, using such determinants as the brightness and contrast of the ink and the sharpness of the edges of the letter forms.

4.1.1.7.5 Flattening

The restoration of the text must address the contours of each layer. Unrestored, damaged objects contain layers that are wrapped, wrinkled, and anything but flat. This stage in the virtual unwrapping pipeline is designed to restore the shape of such layers to planar images, just as if the artifact itself had been ironed flat. In the end, the restoration mimics how a conservator might physically open and smooth a document, yielding a page that is suitable for photography. It is remarkable that such a result can be achieved by this computational pipeline without ever disturbing the damaged disposition of the original layers.

We explored a number of methods for mapping a 3D surface onto a plane. As with other stages in the virtual unwrapping pipeline, it is important to have a framework and a set of alternative techniques that can deal with the many deformations that are present in damaged material. One approach is an extension of physics-based flattening methods for wrinkled manuscripts. For the scroll, we used material simulation, mimicking the cloth modeling from the rendering community.

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8 Brown and Seales, “Image Restoration of Arbitrarily Warped Documents.”
In this approach, the model of the layer is represented as a mass-spring mesh, where each vertex in the mesh is assigned a mass and the connections between vertices are treated as springs with associated stiffness coefficients. The mesh is relaxed to a plane through a balanced selection of appropriate forces and parameters. The software simulates the unravelling process by stretching the corners out to calculate target positions. Pulling the corners is a first approximation to a cloth-like unwrapping operation. The software then pushes the surface onto a collision plane so that any wrinkles are smoothed. These simulations are performed with an open-source physics engine most commonly used to produce visual effects in video games and movies. This process mimics the material properties of isometric deformation, which is analogous to the physical act of unwrapping.

The result of flattening is a 2D rendering of the original 3D layer, which is segmented and textured from the digitized volume (fig. 4). In the best cases, this rendered image appears in quality to be as clear and accurate as a photograph. In practice, however, the deformed layer may need encouragement to be flattened. This adjustment can introduce some character distortion, such as alteration in size and shape of letter forms. There are several different flattening approaches from which to choose, and each one distributes the distortion error differently across the shape. We measure the distortion needed to flatten out a layer by each approach and can reveal the degree of distortion introduced by each one as a heat map. The distortion information visible in the heat map is useful for determining where the error in flattening is most pronounced and if it affects the quality of the visible text. The distortion map can help an expert determine the best flattening technique for a particular object, and it can be used by scholars as a cue for how the accuracy of the rendered textual images has been affected by flattening.

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9 Seales et al., “From Damage to Discovery”; Seales et al., “Reading the Invisible Library.”

10 Terzopoulos et al., “Elastically Deformable Models.”
4.1.1.7.6 Merging

The highly irregular geometry of most damaged manuscripts necessitates the piecewise application of our virtual unwrapping framework. The approach is not unlike a physical restoration process, where small fragments are accurately situated and then assembled painstakingly into a complete whole. This piecewise merge has tremendous advantages as a digital process as well. First, the fragments derive from known and accurately catalogued locations in the digitized volume, making assembly straightforward. The merge itself can be performed smoothly, so that the result is seamless. And because the process is digital, there is no damage to the original object.

The scroll from En-Gedi, which in its physical form is rolled and crushed, required this sort of processing with small sections being pushed through the computational pipeline one at a time. The final step, after a number of small parts were segmented, textured, and flattened, was to create a completely merged image of the various pieces. This final composite rendering is called the “master view” and serves as the basis for any scholarly study of the restored text (fig. 5).

This merging process presents its own challenges. Workflow must be attended to very carefully, in terms of keeping track of where all the pieces should be placed. Errors can also occur when lining up all of the pieced edges. However, the final merging and visualization step also serves as an important check of the correctness of the work thus far. As discussed, each of the prior steps in our pipeline involves a series of algorithmic decisions and approximations. Since textual identification is the primary goal, we tolerate some mathematical and geometric error along the way to ensure that we extract the best possible images of text. The final merge step allows us to confirm the continuity of the text across sections, thereby confirming the veracity of the segmentation and texturing.

4.1.1.7.7 Engendering Trust in Textual Results

Once merging is complete, the end-to-end pipeline that maps the voxels of the volumetric scan to the pixels of the master view image is preserved as a data chain of exact transformations and algorithms. This data chain can support interesting visualizations of how the scanning captured the writing. More importantly, it also provides a complete provenance chain, which is a crucial component of this computational process.

The full set of transformations used to generate a final master view image can be referenced so that every pixel in a final, virtually-unwrapped master view can be mapped back to the voxel or set of voxels within the volume that contributed to its intensity value. This referencing ability is important for two reasons. First, a quantitative analysis can be performed that measures image quality in terms of sharpness, contrast, and flattening-induced distortions. Second, it enables the verification of any extracted text, because it allows an outside, independent auditor to confirm exactly how the original scan data is being assembled to produce the texture claim. If the “original” data can be shown to be original, and the process can be inspected, the result has a higher level of confidence associated with it.

The goal of the textual critic, after all, is to engender trust in any claim of restored text from a damaged object. The restored text becomes the basis of a new reading of a collated manuscript, and as such it is crucial that the digital rendering of a previously unread and still invisible text be validated and confirmed as legitimate. It is centrally important for the computational pipeline to enable confirmation that claims of restored letter forms, words, and markings are well founded.

Figure 6 demonstrates the ability to select a region and point of interest in the texture image and invert the transformation chain to recover original 3D positions within the volume. This ensures that the process of text identification is not simply a judgement call by an expert looking to find letters

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11 Seales et al., “From Damage to Discovery.”
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and words. Rather, it is a chain of transformations that can be inspected and critiqued. While an expert judgement is usually atomic, unassailable, and not open for debate, the data transformation chain offers a more objective basis for textual discovery and restoration.

4.1.1.7.8 Textual Analysis

Perhaps the greatest achievement resulting from the virtual unwrapping of the scroll from En-Gedi was a type of interdisciplinary collaboration that had never before been possible. Our software revealed the hidden, unseen writing on five complete wraps of the scroll from En-Gedi (→ I.2.2.1.11.5). Armed with this high quality restoration (which at an effective resolution of 1500 dots per inch is comparable to archival quality images in digital libraries), Hebrew and biblical scholars performed a complete textual analysis of the internal, unobservable contents of the scroll. The level of detailed examination they were able to conduct on a text that does not tangibly exist is truly extraordinary. In addition to identifying the writing as parts of the first two chapters of the book of Leviticus, scholars noted several physical, textual, and paleographic details that distinguish the scroll from En-Gedi as one of the most important biblical discoveries of the twenty-first century. What follows is a summary of their findings.12

4.1.1.7.9 Physicality

The five virtually unwrapped revolutions of the animal skin in the scroll from En-Gedi reveal two columns of Hebrew text in amazing clarity and detail. The resulting scholarly assessment13 revealed that there are no intervals between verses, and likely the two columns would have originally consisted of thirty-five lines each. Only eighteen lines have been digitally restored. These restored lines contain thirty-three to thirty-four letters and spaces between letters. Some spacing between words can be seen, but it is minimal at times. The text appears on one continuous sheet of parchment. No visual evidence of connecting stitches appears in any part of the image. Scholars made these assessments purely from the digital master image.

Scholars also noted that a large blank space appears before the beginning of the text, which, in their assessment, confirms that the preserved and restored writing comes from the beginning of the scroll.14 In addition, because of the location of the reconstructed wraps in the scan data, scholars can determine that the text of Leviticus 1 and 2 appears on the two outermost segments, with Leviticus 1 wrapped inside Leviticus 2. The innermost segment contains the large blank area. These conclusions can be drawn thanks to the digital provenance chain discussed earlier, which links the

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12 This discussion summarizes the conclusions of Segal, Tov, and Yardeni. For the complete analysis, see Segal et al., “An Early Leviticus Scroll from En-Gedi.”

13 Segal et al., “An Early Leviticus Scroll from En-Gedi.”

14 Segal et al., “An Early Leviticus Scroll from En-Gedi.”
rendered text in the master image back to its location in the scan volume.

Other physical details noted by scholars include traces of horizontal and vertical rule lines, some of which appear as cracks. These lines are believed to be the indentations that scribes would have scored into the parchment using a sharp instrument. Scholars posited that the heat from the fire caused fissures to open up along the grooves. Finally, because of the concentration of data in the center of the scroll, which can be seen in Figure 7, scholars suggested that the end of the scroll may have been attached to a wooden rod.

4.1.7.10 Textual Criticism

Because of the photographic clarity of the script, scholars were able to read and transcribe the entire text of the scroll (→ I.2.2.1.11.5). They identified column one as Leviticus 1:1–9 and column two as Leviticus 2:1–11. While thinking initially that the artifact might be a complete Torah scroll, scholars determined after their analysis that the document is either a dedicated Leviticus scroll or a scroll that contains the book of Leviticus as well as two or three additional Pentateuchal books.\(^{15}\)

The readability of the verses allowed a thorough comparison with other extant witnesses to Leviticus; and while the scroll does not contribute any new readings of the book, it does provide significant evidence regarding the Bible’s textual history. Scholars found that the entire two columns of writing exactly match the consonantal text of the medieval MT of Leviticus, using MT\(_L\) as their point of comparison. They did note a few orthographic, linguistic, and content variations from extant textual

\(^{15}\) Segal et al., “An Early Leviticus Scroll from En-Gedi.”
witnesses in general, allowing them to claim the scroll’s closer affiliation with MT than with other Masoretic manuscripts.

Their analysis concludes that the scroll from En-Gedi is strictly proto-Masoretic. In doing so, the scholars were able to confirm a prevailing notion regarding the occurrence of a monolithic text following the destruction of the Herodian Temple and of the Qumran settlement (→ I.1.2.2.4.3). Carbon 14 dating of the En-Gedi scroll firmly places it in the third or fourth century C.E., or less likely, in the second century C.E. All known Hebrew biblical manuscripts that are dated after 70 C.E. reflect the proto-MT text (→ I.1.2.2.2.2; → I.1.2.2.4.3), and the En-Gedi scroll confirms that exclusive dominance, making it a significant biblical text.

In addition, scholars found that the scroll from En-Gedi punctuates an almost 800-year gap in archeological evidence of the biblical text. Again, carbon dating situates the scroll between the second and fourth centuries C.E., shortly after the Dead Sea Scrolls and before the medieval bible fragments found in the Cairo Genizah, which date from the ninth century C.E. onwards. Direct evidence for the text of the Hebrew bible in this interim period is practically non-existent, making the reconstructed scroll a valuable witness (Fig. 8).

As noted above, carbon dating strongly suggests that the scroll was penned shortly after the Dead Sea Scrolls. However, our digital rendering of the Hebrew script is good enough to allow direct comparison to letter shapes seen in other Judean Desert Scrolls, and the resulting palaeographical analysis by Dr. Ada Yardeni posits an earlier date of the second half of the first century C.E. or the beginning of the second century C.E.

Using the digital image generated by our software, Yardeni carefully traced the structure of each letter and compared them to two fragments from other manuscripts dating from the first to second century C.E. She closely examined the handwritten characters to determine how the various physical characteristics and patterns in the way they are drawn compare across the documents. For example, she observed whether the primary direction of letter strokes is to the right or left; how the strokes bend and curve up and down; and whether the strokes are connected or drawn separately.

In all, Yardeni analyzed and compared twenty-two distinct letter shapes, which she was able to determine were created with a reed-pen, the nib of which was cut almost straight. Summing up her comparative analysis, she found that the script of the Leviticus scroll from En-Gedi demonstrates many similarities, as well as a few slight differences, to that appearing in the above mentioned fragments. For example, in all of the fragments, she observed that the left diagonal stroke of the medial mem slants down moderately to the left without reaching the imaginary base line, leaving a large gap between its end and the relatively short base-stroke, and that the final mem was long and narrow. However, in the scroll from En-Gedi, she noticed a gap between the “roof” and the left down-stroke of the final mem, a variation that does not occur in the Judean Scroll fragments. According to Yardeni, these types of infrequent differences may indicate the En-Gedi scroll’s somewhat later phase of development, but the En-Gedi script definitely belongs to the style of the “Jewish” book-hand seen in the scrolls of the Judean Desert. She therefore claims that this scroll can be safely dated to about the second half of the first century C.E. or, at the latest, the beginning of the second century C.E.

16 Segal et al., “An Early Leviticus Scroll from En-Gedi.”

17 Segal et al., “An Early Leviticus Scroll from En-Gedi.”

18 Segal et al., “An Early Leviticus Scroll from En-Gedi.”
4.1.1.7.12 A Conservation Coup

The ability of Yardeni and her colleagues to thoroughly analyze a text never before seen – and perhaps never to be seen – in its material context represents amazing progress for manuscript recovery and restoration, especially considering that the scroll suffered absolutely no additional damage. The greatest risk involving research and study of friable materials has now, therefore, shifted. No longer is the primary concern the potential destruction of these prized artifacts. Using our software, interactive research can be performed using the lightest touch and posing the least risk to materials ever possible.

Instead, today’s threats actually come in the form of lost potential and stymied discovery. Conservators and others responsible for the safekeeping of these valuable items have often been slow to recognize the twin benefits of safety and discovery that technology offers. For example, the use of digital scanning methods is obviously key to the conservation success of our software pipeline. Yet gaining permission to scan materials is often the largest hurdle to overcome. It is true that any sort of analysis requires some transport and handling of artifacts, and so care must be taken even when noninvasive methods are used. But with volumetric digitization, the disturbance to the artifact is minimal and can usually be accomplished in a matter of hours. Once acquired, the scan data serves as the basis for all other work, allowing the friable object to be returned to the safety of its protective archive.¹⁹

The continued evolution of digitization technology will reduce even further the need to transport and handle damaged objects. New scanner designs, which allow an object to be placed in its natural orientation rather than in a pre-oriented pose that might not be best given its condition, are emerging. Some scanners can be moved to the archives, obviating the need for transport of materials to a far-away location. Technology has made and continues to make its contribution; now it is time for the conservation community to do the same.

4.1.1.7.13 Natural Partners

In the end, the computer scientist working to virtually restore and unwrap an ancient scroll has set himself to the same task as that of the textual critic. Translations of and annotations to a written work are not damage per se, but they are alterations that have occurred over time to an original text. While the textual critic sorts through these variants to establish a “critical text” best representing the original, the computer scientist works to reverse and unwind damage so that a text is restored to its original state. Both efforts are attempts to ferret out the way a text originally appeared compared to how it has changed over the years.

As we build vibrant and trusting partnerships between the computer scientist and the textual critic, discovery of lost meaning will progress at an unprecedented rate. The scroll from En-Gedi, therefore, represents the first of many ancient texts whose potential for scholarly impact and interest will be redeemed thanks to innovative interdisciplinary collaboration.

Christy Chapman
C. Seth Parker
Brent Seales


W.B. Seales, “Reading the Invisible Library: A Retrospective,” in *Modern Alchemy: New Technology for Mu-

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¹⁹ Seales et al., “From Damage to Discovery.”
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