

## THE VOCALIC PHONEMES OF TIBERIAN HEBREW\*

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**Abstract:** *Much has been written on the synchronic phonological analysis of Tiberian Hebrew. Most of the literature dealing with this problem, however, is based on outdated ideas about Tiberian Hebrew phonetics. This paper provides a new phonological analysis of the Tiberian Hebrew vowels based on the pronunciation of Tiberian Hebrew as reconstructed by Geoffrey Khan. This results in the identification of three phonemically short vowels, /ě ă ǫ/; five vowels that are underspecified for length, /i ɛ a ɔ u/; and five that are phonemically long, /ī ē ō ū/. I conclude that the Tiberian vocalization is largely phonemic, since every vocalic phoneme is always spelled with one and the same vowel sign. Moreover, the occurrence of five underspecified and five phonemically long vowels matches the description of the Hebrew vowels given by Joseph and David Qimhi, suggesting that they, too, aimed to capture the phonemic level of Hebrew phonology.*

### 1. INTRODUCTION

Tiberian Hebrew, the language of the Hebrew Bible according to the reading tradition recorded by the Tiberian Masoretes, has often been subjected to phonological analysis. It was studied from a transformational–generative point of view in the Ph.D. dissertations of Alan Prince and John McCarthy,<sup>1</sup> both of whom would go on to become highly influential phonologists, and evidence from Tiberian Hebrew has been adduced in the debates between proponents and opponents of Optimality Theory.<sup>2</sup> The standard work on Tiberian Hebrew phonology, that by Joseph Malone,<sup>3</sup> is a classic application of generative phonology in the style of *The Sound*

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1. A. S. Prince, “The Phonology and Morphology of Tiberian Hebrew” (Ph.D. thesis, Massachusetts Institute of Technology, 1975); J. J. McCarthy, “Formal Problems in Semitic Phonology and Morphology” (Ph.D. thesis, Massachusetts Institute of Technology, 1979).

2. A. D. Green, “Opacity in Tiberian Hebrew: Morphology, Not Phonology,” *ZAS Papers in Linguistics* 37 (2004).

3. J. L. Malone, *Tiberian Hebrew Phonology* (Winona Lake: Eisenbrauns, 1993). Although only published in 1993, this work was largely written in the 1970s.

*Pattern of English*,<sup>4</sup> and more recent works on the synchronic phonology of Tiberian Hebrew largely follow the same paradigm.<sup>5</sup> Clearly, the phonology of Tiberian Hebrew is not just of interest to Hebraists or Semitists; rather, it plays an important role in the broader field of general linguistics.

Like any phonological enterprise, the description of Tiberian Hebrew crucially relies on accurate phonetic data. Since the Tiberian reading tradition is no longer in use and has not been for the past millennium or so, acquiring these data is a bit more complex than in the case of living languages.<sup>6</sup> Luckily, many details of the Tiberian pronunciation can be retrieved from the vocalization. In the history of scholarship, several different phonetic interpretations of the Tiberian vocalization, specifically of the vowel signs, have predominated; we will briefly discuss them in the following sections. Note that the phonetic forms, given between square brackets and written in the International Phonetic Alphabet, follow the interpretation of the Tiberian vocalization discussed in the section at hand; in many cases, they contradict our most recent understanding of Tiberian phonetics.<sup>7</sup>

### 1.1. The Five-Quality Interpretation

The traditional view, still maintained in early twentieth-century grammars like the 28th edition of Gesenius, is that the Tiberian vowel signs represent ten vowels, with five different qualities and a length distinction; see table 1.<sup>8</sup> This means that several vowel signs are ambiguous: ◌ֶ is always short [e], ◌ֵ is always short [a], ◌ֹ is always long [e:] and ◌ֻ is always long [o:], but ◌ִ is either short [i] or long [i:]; ◌ֻ and ◌ֹ are either short [u] or long [u:]; and ◌ֶ is either short [o] or long [a:]. In each case, an ambiguous vowel sign normally has its short value in closed, unstressed syllables and its long value elsewhere, for example, יִכְתֹּב [jiχ'tʰo:v] ‘he will write’ with short [i] versus יִשְׁנוּ [ji:ʃə'nu:] ‘they (m.) will sleep’ and יִבִּין [ja:'vi:n] ‘he will understand’ with long [i:]; חִכְמָה [ħoχ'ma:] ‘wisdom’

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4. N. Chomsky and M. Halle, *The Sound Pattern of English* (New York: Harper & Row, 1968).

5. For example, D. Volgger, *Notizen zur Phonologie des Bibelhebräischen* (Arbeiten zu Text und Sprache im Alten Testament 36; St. Ottilien: Eos Verlag, 1992); A. W. Coetzee, *Tiberian Hebrew Phonology: Focussing on Consonant Clusters* (SSN 38; Assen: Van Gorcum, 1999).

6. G. Khan, *A Short Introduction to the Tiberian Masoretic Bible and Its Reading Tradition* (2nd ed.; Piscataway: Gorgias; 2013), p. 4.

7. As presented, for instance, in G. Khan, “The Tiberian Pronunciation Tradition of Biblical Hebrew,” *ZAH* 9 (1996).

8. W. Gesenius, *Hebräische Grammatik* (28th ed.; ed. E. Kautzsch; Leipzig: Vogel, 1909).

with short [o] versus כָּתְבוּ [k<sup>h</sup>a:θə'vu:] ‘they wrote’ and זָקֵן [za:'qa:n] ‘beard’ with long [a:]; and שֻׁלְחָן [ʃul'ħa:n] ‘table’ with short [u] versus יָבִילוּ [ju:χə'lu:] ‘they (m.) will be able’ and יָקוּם [ja:'qu:m] ‘he will stand up’ with long [u:].

Table 1: The five-quality interpretation

sign	◌ִ	◌ֵ	◌ֶ	◌ֹ	◌ֻ	◌ֺ	וּ, ◌ֻ
pronunciation	[i(:)]	[e:]	[e]	[a]	[a:], [o]	[o:]	[u(:)]

Ultimately, this interpretation goes back to the twelfth-century grammatical treatises of Joseph and David Qimhi; given their situation in Spain and the South of France, it has been suggested that they based their description of Hebrew on Latin, which also has five long and five short vowels.<sup>9</sup> Besides its long pedigree, the five-quality interpretation has the advantage that it allows many morphological and phonological processes to be described as the simple lengthening or shortening of a vowel, for example, the alternation of a short vowel in the construct state with a long vowel in the absolute state seen in pairs such as דְּבַר [dəvar] ‘word’ (construct) versus דְּבָר [da:'va:r] ‘word’ (absolute), בֶּן [ben] ‘son’ (construct) versus בֵּן [ 'be:n] ‘son’ (absolute), and קָטָן [qət'on] ‘small’ (m. sg., construct) versus קָטֹן [qa:'t'o:n] ‘small’ (m. sg., absolute). In the course of the twentieth century, however, it became clear that the five-quality interpretation did not correspond to the pronunciation used by the Tiberian Masoretes. Rather, each vowel sign represented a different vowel quality. This insight gave rise to the seven-quality interpretation.

## 1.2. The Seven-Quality Interpretation

In the interpretation followed by influential grammars like those by Bergsträsser and Bauer & Leander, the different vowel signs indicated differences in vowel quality, but not quantity.<sup>10</sup> ◌ִ and ◌ֶ were recognized as representing the open-mid vowels [ɛ] and [ɔ], respectively. Besides explaining why there are seven Tiberian vowel signs, rather than five, this allows us to understand some cases where \*a has been rounded to [ɔ] due

9. J. Qimhi, ספר זכרון (Book of remembrance; ed. W. Bacher; Berlin: M'kize Nirdamim, 1888); W. Chomsky, *David Kimhi's Hebrew Grammar (Mikhlol)* (New York: Bloch, 1952).

10. G. Bergsträsser, *Hebräische Grammatik* (vol. 1: Einleitung, Schrift- und Lautlehre; Leipzig: Vogel, 1918); H. Bauer and P. Leander, *Historische Grammatik der hebräischen Sprache* (Halle: Niemeyer, 1922).

to assimilation to a bilabial consonant, as in *\*máwet* > מוֹת [ˈmɔvɛθ] ‘death’ (cf. בַּיִת [ˈbajitθ] ‘house’ for the original *\*a* vowel), or where *\*e* has been lowered to [ɛ] due to assimilation to a following [ɔ], as in *\*ʕlélkō* > עָלֶיךָ [ʕɔːˈleːχɔː] ‘on you’ (m. sg.) (the original quality of the stressed vowel is preserved in forms like עָלֵינוּ [ʕɔːˈleːnuː] ‘on us’).

As these examples show, most vowel signs could represent either long or short vowels in the seven-quality interpretation. The identification of each vowel as long or short was based on historical reconstructions and morphological arguments. A key observation was that practically all instances of ֶ in open or stressed syllables were historically long, while all cases of ֵ were historically short. This length or shortness was then also postulated for Tiberian Hebrew and analogically extended to other, more ambiguous cases. Based on the short ֵ in the second syllable of fientive *qal* perfect forms like שָׁמַר [ʃɔːˈmar] ‘he kept’, the parallel vowels in stative *qal* perfect forms were also held to be short, for example, כָּבֵד [kʰɔːˈveð] ‘he is heavy’ and קָטַן [qɔːˈtʰon] ‘he is small’; based on the ֶ in adjectives like הַדָּשׁ [ħɔːˈðɔːʃ] ‘new’ (m. sg.), a long vowel was posited in graphically indistinguishable forms like כָּבֵד [kʰɔːˈveːð] ‘heavy’ (m. sg.) and קָטַן [qɔːˈtʰɔːn] ‘small’ (m. sg.). The vowels in segolates like כָּלָב [ˈkʰɛlɛv] ‘dog’, סֵפֶר [ˈsefɛr] ‘document’, and חֹדֶשׁ [ˈħoðɛʃ] ‘month’ were read as short for historical reasons. Long ֶ was identified in forms like יִבְנֶה [jivˈneː] ‘he will build’ by analogy with the long final vowel in forms like בָּנָה [bɔːˈnɔː] ‘he built’ and based on their reconstructed forms. Thus, long and short versions were identified for every vowel sign but ֵ, as shown in Table 2.

Table 2: The seven-quality interpretation

sign	ֶ	ֵ	ִ	ֹ	ֻ	ֺ	וּ, ֹ
pronunciation	[i(:)]	[e(:)]	[ɛ(:)]	[a]	[ɔ(:)]	[o(:)]	[u(:)]

While the seven-quality interpretation matches the Tiberian vocalization better than the five-quality interpretation, it is not directly based on phonetic information from Tiberian sources. Such data do feature in Geoffrey Khan’s studies of treatises and transcriptions that are closer to the Tiberian tradition, which have led to an improved understanding of Tiberian Hebrew phonetics; I will refer to the resulting interpretation of the Tiberian vowel signs as Khan’s interpretation.

### 1.3. Khan's Interpretation

Khan's interpretation, presented in a number of publications, is based on masoretic treatises by authors from or close to the Tiberian tradition, as well as Karaite manuscripts containing Hebrew text, with Tiberian vocalization, but written with the Arabic consonantal script.<sup>11</sup> Since the plene spelling of long vowels is obligatory in Arabic, this provides us with direct information on vowel length. In many cases, the vowel length as attested in these manuscripts contradicts that posited by the seven-vowel interpretation. For example, מֶלֶךְ 'king' is written with the Arabic consonants *mʕlḥ*, indicating a pronunciation as ['mɛ:lɛχ], while the seven-quality interpretation would read this with a short vowel, as ['mɛlɛχ].

Khan notes that vowel length is largely conditioned by syllable structure. All seven full vowel signs represent long vowels if they are stressed or occur in open syllables. In closed, unstressed syllables, ִ and ֵ are always long ([e:], [o:]); ֶ and ֹ are always short ([ɛ], [a]); and both long and short instances of the other three vowels occur. Incidentally, this distribution in closed, unstressed syllables matches that inferred by Bendavid based on the Tiberian cantillation signs.<sup>12</sup>

Table 3: Khan's interpretation

Sign	ִ	ֵ	ֶ	ֹ	ֺ	ֻ	ּ, ׁ
Pronunciation in open or stressed syllables	[i:]	[e:]	[ɛ:]	[a:]	[ɔ:]	[o:]	[u:]
Pronunciation in closed, unstressed syllables	[i(:)]	[e:]	[ɛ]	[a]	[ɔ(:)]	[o:]	[u(:)]

Khan's interpretation aligns more closely with the explicit remarks on vowel phonetics made by sources close to the Tiberian tradition and the behavior of the cantillation signs than either of the previous two interpretations. It remains the most plausible interpretation of the Tiberian vowel signs proposed to date.

11. Most importantly, G. Khan, "Vowel Length and Syllable Structure in the Tiberian Tradition of Biblical Hebrew," *JSS* 31.1 (1987).

12. A. Bendavid, "מנין החלוקה לתנועות גדולות וקטנות?" (Whence the division into large and small vowels?), *Leš* 22 (1957).

#### 1.4. Purpose of This Paper

While it is true that much work has been done on the synchronic phonology of Tiberian Hebrew, it predominantly uses outdated interpretations of Tiberian phonetics. Prince and McCarthy both follow the five-vowel interpretation, while Malone and others use the seven-vowel interpretation.<sup>13</sup> Some recent grammars of Biblical Hebrew do take Khan's findings into account, but the partial conditioning of vowel length leads them to conclude that length was not phonemic anywhere, which makes it hard to explain the occurrence of long and short vowels in closed, unstressed syllables.<sup>14</sup> Khan himself also originally argued that length was conditioned purely by syllable structure and stress,<sup>15</sup> but his more recent work on Tiberian phonology does include a phonemic length contrast;<sup>16</sup> he posits the existence of eleven or twelve phonemes, /i e ε a o u ī ē ̄ ̄ ū/ and possibly /ɔ/.<sup>17</sup> While this accurately accounts for the attested phonetic surface forms, it may be possible to arrive at a more economical analysis by considering the complementary distribution of allophones. Moreover, Khan's analysis is presented in different publications, each with a separate focus, making it hard to get an overall view of his argument; understandably, these different accounts also contain some mutual inconsistencies. It may therefore be beneficial to present the phonological facts in a more systematic manner.

The purpose of this paper, then, is to present a new analysis of Tiberian Hebrew phonology, focusing on the vowels. Before starting on the analysis itself, section 2 will discuss the nature of Tiberian Hebrew as a reading tradition, rather than a natural language, and the implications thereof for its phonology. The analysis presented in section 3 will then lead us to identify three short vowels, five vowels that are underspecified for length,

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13. A. S. Prince, *The Phonology and Morphology*; J. J. McCarthy, "Formal Problems;" J. L. Malone, *Tiberian Hebrew Phonology*.

14. For example, P. Joüon and T. Muraoka, *A Grammar of Biblical Hebrew* (2nd reprint of 2nd ed.; Rome: Gregorian & Biblical Press, 2009); J. Blau, *Phonology and Morphology of Biblical Hebrew* (Linguistic Studies in Ancient West Semitic 2; Winona Lake: Eisenbrauns, 2010).

15. G. Khan, "Vowel Length and Syllable Structure."

16. G. Khan, *A Short Introduction*; G. Khan, "Syllable Structure: Biblical Hebrew," in *Encyclopedia of Hebrew Language and Linguistics* (ed. G. Khan; Leiden: Brill, 2013); G. Khan, "Vowel Length: Biblical Hebrew," in *Encyclopedia of Hebrew Language and Linguistics*.

17. Khan uses a macron to indicate phonemic length. The same convention will be adopted in this paper in order to show that the length is an inherent property of the phonemically long vowels, rather than a separate segment.

and five vowels that are phonemically long. Surprisingly, this looks remarkably like the system described by Joseph and David Qimhi, suggesting that the vowel systems they describe were meant to capture underlying contrasts rather than phonetic surface forms.

## 2. THE NATURE OF TIBERIAN HEBREW

As is well known, the Hebrew Bible as it has come down to us, in the Masoretic Text, is a hybrid. The texts of the Hebrew Bible were composed throughout the first millennium BCE, but the largely consonantal Hebrew script left many aspects of the pronunciation unexpressed. After the death of Hebrew as a spoken language in the second century CE, the correct pronunciation was passed on as an oral tradition until the Tiberian vocalization was fixed around the tenth century CE. While the consonantal text remained quite stable during this period, the divergence of different Hebrew reading traditions and comparison with Greek and Latin transcriptions from antiquity indicate that this pronunciation did not remain unchanged for all that time. Thus, the Tiberian vocalization imposes an early medieval pronunciation of Biblical Hebrew on a first-millennium BCE consonantal skeleton. This pronunciation as it was fixed in the Tiberian vocalization is the object of study in this paper.

The large time gap between the composition of the biblical texts and the Tiberian pronunciation recorded in the vocalization has some interesting consequences for the linguistic status of Tiberian Hebrew. Perhaps oversimplifying a bit, we may state that in a living language, a speaker's morphosyntax produces a string of phonemes that matches an utterance's intended meaning, after which this string of phonemes is converted into a phonetic surface form by the speaker's phonology. In the case of a reading tradition like Tiberian Hebrew, the first step is left out. A reader who wanted to start reading Genesis out loud would not use his mental grammar of Biblical Hebrew to construct a sentence matching the intended meaning "In the beginning God created the heavens and the earth." Rather, he would retrieve the mental representation of the verse as he had learned it from his teacher and heard it countless times since. This mental representation, presumably stored as a string of phonemes, would then still be sent to phonology in order to produce a phonetic surface form. Accordingly, Tiberian Hebrew cannot be said to have any productive syntax or morphology, since no new sentences or words are ever generated—

but it does have a productive phonology, which creates new phonetic realizations of the previously existing sentences and words.

This independence from morphosyntax leads to unusual behavior in the phonology. In living languages, all instances of a given morph normally have the same underlying representation, that is, they consist of the same phonemes. A phonemic difference between two forms must therefore have some conditioning at the level of lexicon, syntax, or morphology, as in the difference between English *hat* /'hæt/ and *cat* /'kæt/ (lexically conditioned; different lexemes), the different person endings in Italian *am-o* /'am-o/ 'I love' and *am-i* /'am-i/ 'you (sg.) love' (syntactically conditioned; different morphemes) or the different plural endings in German *Tag-e* /'ta:g-ə/ 'day-s' and *Forschung-en* /'fɔʁʃʊŋ-ən/ 'investigation-s' (morphologically conditioned; different allomorphs). But since Tiberian Hebrew lacks all of these linguistic subsystems, what historically are different instances of one and the same morph are free to grow apart; strings of phonemes do not have to correspond to other strings of phonemes that are identical at a deeper linguistic level, because there *are* no deeper linguistic levels any more. We may find phonemic contrasts—consistent differences in phonetic realization that are not phonetically conditioned—between two forms that are otherwise linguistically equivalent, without any lexical, syntactic, or morphological conditioning. Thus, we find, for example, the construct state of “all” usually being read as לָל [ˈkʰo:l] when it is accented, as in Gen 3:17, but לָלְ [ˈkʰɔ:l] for what is lexically, syntactically, and morphologically the same form in the same phonetic environment in Ps 35:10 and Prov 19:7.<sup>18</sup> Since a trained Tiberian reader would consistently read [ˈkʰo:l] in one verse and [ˈkʰɔ:l] in the other and no phonetic conditioning determines which vowel is selected, this must be a phonemic contrast: even though these forms are linguistically the same, they form a minimal pair, conditioned by position in the corpus.

These unusual, non-linguistically conditioned phonemic contrasts will be relevant in the following phonological analysis. We will first identify the various vowels that occur in different types of syllables and then determine which contrasts are phonemic and which ones are phonetically conditioned.

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18. Note that this is the accented, prosodically independent form, not the more common proclitic לָלְ [kʰɔl].



### 3. PHONOLOGICAL ANALYSIS

Following Khan's interpretation, we find seven different vowels in stressed syllables, and they are all phonetically long. Examples are presented in table 4.

Table 4: Vowels attested in stressed syllables

vowel	example (Hebrew script)	example (phonetic)	meaning
[i:]	יָמִין	[jɔː'mi:n]	'right hand'
[e:]	עָמַל	[ʔɔː'me:l]	'toiling' (m. sg.)
[ɛ:]	כַּרְמֶל	[k <sup>h</sup> ar'mɛ:l]	'orchard'
[a:]	עָמַל	[ʔɔː'ma:l]	'he toiled'
[ɔ:]	עָמַל	[ʔɔː'mɔ:l]	'toil'
[o:]	נִמּוֹל	[nim'mo:l]	'he was circumcised'
[u:]	גָּמַל	[gɔː'mu:l]	'repaid' (m. sg.)

In open, unstressed syllables, all seven of these vowels also occur. Note that they are slightly shortened in open syllables directly preceding the stress, presumably because they do not form the head of their prosodic foot;<sup>19</sup> this shortening is clearly phonetically conditioned and does not reflect an underlying length contrast. Examples are given in table 5.

Table 5: (Half-)long vowels attested in open, unstressed syllables

vowel	example (Hebrew script)	example (phonetic)	meaning
[i:]	יִישַׁר	[jiː'ʃa:r]	'it will be straight'
[e:]	יִישֵׁב	[jeː'ʃe:v]	'he will sit'
[ɛ:]	אֶעָלֶה	[ʔɛ:ʔɛ'le:]	'I will go up'
[a:]	אֶעָבֶה	[ʔa:ʔa'le:]	'I will bring up'
[ɔ:]	יִשׁוּב	[jɔː'ʃu:v]	'he will return'
[o:]	יִוָּשֵׁב	[joː'ʃi:v]	'he will settle'
[u:]	תּוֹשֵׁב	[t <sup>h</sup> uː'ʃɔ:v]	'it will be settled' (pause)

19. G. Khan, "Vowel Length and Syllable Structure," pp. 44–47.

Short vowels also occur in this position. Many of these, the realizations of *shewa mobile*, are universally recognized as epenthetic vowels, inserted to break up what would otherwise be a syllable-initial consonant cluster. Their realization is completely predictable from the context.<sup>20</sup> Thus, they may be analyzed as allophones of zero. Before /j/, the epenthetic vowel is [i], as in וַיְדֹ [vi'jɔ:ð] ‘and a hand’; before gutturals, the epenthetic vowel takes on the quality of the following vowel, for example, וַיֵּשׂ [vi'ʔi:] ‘and a man’, וְהֵם [ve'he:m] ‘and they’ (m.), וְחֶסֶד [ve'hε:sεð] ‘and kindness’, וְאַרְבַּע [vaʔar'ba:ʕ] ‘and four’ (f.), וְעָשׂוּ [vɔʕɔ'su:] ‘and they will make’, וְהֹלֵךְ [voho'le:χ] ‘and going’ (m. sg.), וְעוֹרָה [wu'ʕu:ɔ:] ‘and arise’ (m. sg.); and [a] occurs elsewhere, for example, וְלֹא [va'lo:] ‘and not’.<sup>21</sup>

Besides these epenthetic vowels, short [a], [ε], and [ɔ] also occur, indicated by the *hatef* vowels: ְ, ֿ, and ֿ, respectively. While these are most common after gutturals, ְ and ֿ also occur after other consonants, as in the examples given in table 6.

Table 6: Short vowels attested in open, unstressed syllables

vowel	example (Hebrew script)	example (phonetic)	meaning
[ε]	טְלִי	[ʕε'li:]	‘pestle’
[a]	וְשָׁבָה	[ʔu:'sa've:]	‘and take captive’ (m. sg.)
[ɔ]	דְּמִי	[dɔ'mi:]	‘silence’

In closed, unstressed syllables, the picture is quite different. Here, we find only five long vowels, and no fewer than five short vowels, illustrated in table 7.

Table 7: Vowels attested in closed, unstressed syllables.

vowel	example (Hebrew script)	example (phonetic)	meaning
[i]	יְלָדֵי	[jil'ðe:]	‘children’ (construct)
[ε]	יֵאָסֵר	[jεʔ'so:rʕ]	‘he will bind’
[a]	יִשְׁמַד	[jaʃ'mi:ð]	‘he will exterminate’
[ɔ]	הִשְׁלַךְ	[hɔʃ'la:χ]	‘he was cast’

20. G. Khan, “The Tiberian Pronunciation,” pp. 17–18.

21. That ַ ‘and’ historically goes back to \**wa-* bears no relation to the quality of the epenthetic vowel.

[u]	יִשְׁלְכוּ	[juʃ'lo:χu:]	'they (m.) will be cast' (pause)
[i:]	יִשְׁנוּ	[ji:ʃ'nu:]	'they (m.) will sleep'
[e:]	יִשְׁבוּ	[je:ʃ'vu:]	'they (m.) will sit'
[ɔ:]	יָשְׁבוּ	[jɔ:ʃ'vu:]	'they sat'
[o:]	יֹשְׁבִים	[jo:ʃ'vi:m]	'sitting' (m. pl.)
[u:]	יִכְלוּ	[ju:χ'lu:n]	'they (m.) will be able'

Now, let us consider how many different phonemes these vowels represent. It is uncontroversial that the seven vowels found in stressed syllables are contrastive.<sup>22</sup> In open syllables, the same goes for most of the attested vowels, but there are no clear minimal pairs for the contrast between [a:] and [ɛ:]. However, both vowels occur in positions where it is hard to identify a conditioning factor, for example, בְּאֲדֹנָי [ba:ðo'ni:] 'in my lord', הָאֶהְלֵה [hɔ:'ʔo:hɛ:lo:] 'into the tent', so we may tentatively assume that this contrast is phonemic, too.

The phonemic status of the *ḥatef* vowels is less certain. Khan notes that some cases of [ɔ] must be phonemic, based on a phonological rule determining the realization of /r/.<sup>23</sup> If /r/ is in immediate contact with or in the same phonological syllable as a preceding alveolar consonant or a following alveolar resonant, it is realized as [r<sup>ɛ</sup>]; elsewhere, it is realized as [R]. The epenthetic vowel in words like צְרוּפָה [s'ar<sup>ɛ</sup>u'fɔ:] 'refined' (f. sg.) does not block this alveolar assimilation, since it is not present at the phonemic level. In צָרִי [s'ɔ'ri:] 'balm', however, the assimilation is blocked, showing that the *ḥatef* vowel must be underlyingly present. The case for the phonemic status of some cases of [ɛ] and [a] is less compelling, but their occurrence is often unconditioned, which suggests their presence at the phonemic level.

Moving on to the closed, unstressed syllables, we are confronted by a length contrast: five vowels are long, five are short, and no phonetic conditioning is apparent. We even find minimal pairs such as יִרְאוּ [jir'ʔu:] 'they (m.) will see' versus יִירְאוּ [ji:r'ʔu:] 'they (m.) will fear' and אֶכְלָה, either [ʔɔχ'lo:] 'food' or [ʔɔ:χ'lo:] 'she ate'. Note that these syllables were considered to be open in the five- and seven-quality interpretations if the vowel was long, since a *shewa* was supposed to follow (e.g., according to

22. For a full set of minimal pairs, see J. Blau, *Phonology and Morphology*, pp. 112–113.

23. G. Khan, "Syllable Structure," pp. 666–668.

the five-quality interpretation, יִרְאוּ [ji:rə'ʔu:] ‘they [m.] will fear’, אָכְלָה [ʔa:χə'la:] ‘she ate’). In the Tiberian pronunciation, however, no epenthetic vowel, *shewa* or otherwise, occurred in this environment.<sup>24</sup> Sporadically, a long vowel also occurs in a closed, unstressed syllable before a geminate, as in the precativ particle אָנָּה [ʔɔ:n'nɔ:]; all interpretations agree that this syllable is closed. Since the vowel length is not phonetically conditioned, then, it must be phonemically contrastive in this position.

There is no indication that any of the long vowels in closed, unstressed syllables are allophones of the same phoneme, so we may safely assume that their quality is contrastive. In the case of the short vowels, we find a clear three-way contrast, largely tracing back to the Proto-Semitic contrast between *\*i*, *\*a*, and *\*u*.<sup>25</sup> Non-low front vowels are contrasted with [a], as in יִרְאֶה [jir'ʔe:] ‘he will see’ versus יִרְאֶה [jar'ʔe:] ‘he will show’. [a] is also contrasted with non-low back vowels, as in יִשְׁלַח [jafal'la:h] ‘he will release’ versus יִשְׁלַח [jaful'la:h] ‘he will be released’. Finally, non-low front vowels are contrasted with non-low back vowels, as in הִגְלָה [hiv'lo:] ‘he exiled’ versus הִגְלָה [hɛk'lo:] ‘he was exiled’. The contrasts of [i] versus [ɛ] and [u] versus [ɔ], however, are not so clear. The difference between two lexemes or two morphemes is never shown by a contrast between [i] and [ɛ] or between [u] and [ɔ]; these sounds are largely in complementary distribution, with [ɛ] usually occurring next to gutturals, [u] usually occurring before geminates, and [i] and [ɔ] occurring elsewhere. Recalling the possibility of non-linguistically conditioned minimal pairs discussed in section 2, however, we may identify some evidence for the contrastive status of all five short vowels in closed unstressed syllables: compare the consistent difference between הִגְלָה [hiv'lo:] ‘he exiled’ in 2 Kgs 24:14 and הִגְלָה [hɛk'lo:] ‘he exiled’ in 2 Kgs 17:11 and between גְּדֻלּוֹ [guð'lo:] ‘his greatness’ in Ps 150:2 and גְּדֻלּוֹ [gɔð'lo:] ‘his greatness’ in Deut 5:24. Which short vowel occurs in a word is thus not phonetically conditioned, nor is it in free variation, therefore the distinction is phonemic; we must posit a five-way contrast.

To recapitulate: in stressed syllables, we have identified at least seven contrastive vowels, all long; in open unstressed syllables, we have identified at least seven long and three short contrastive vowels; and in closed unstressed syllables, we have identified at least five long and five short contrastive vowels. Two of the long vowels that occur in stressed and open

24. G. Khan, *A Short Introduction*, pp. 100–101.

25. B. D. Suchard, “The Development of the Biblical Hebrew Vowels” (Ph.D. thesis, Leiden University, 2016).

syllables, [ɛ:] and [a:], are not found in closed unstressed syllables. This cannot be due to a restriction against long vowels in closed unstressed syllables, as the other five long vowels do occur in this position. Rather, we may posit that the five vocalic phonemes that appear as short in closed, unstressed syllables are lengthened in open or stressed syllables: [ɛ:] in open or stressed syllables and [ɛ] in closed, unstressed syllables are allophones of the same phoneme, as are [a:] and [a] in those positions. This lengthening neutralizes the contrast seen in closed, unstressed syllables between [i] and [i:], [ɔ] and [ɔ:], and [u] and [u:]: in open or stressed syllables, these merge into [i:], [ɔ:], and [u:], respectively, explaining why we find ten contrastive vowels at the surface in closed, unstressed syllables, but only seven in stressed syllables. The short vowels occurring in open unstressed syllables do not participate in this lengthening and would therefore appear to be underlyingly specified as short. Thus, there seems to be a distinction between five vowels that are always long, which we may represent as /ī ē ō ū/; three that are always short, which we may represent as /ĕ ā ɔ̄/; and five that are underspecified for length, being realized as long in open or stressed syllables and as short in closed, unstressed syllables: /i ɛ a ɔ u/.

#### 4. CONCLUSION

An overview of the vocalic phonemes identified in the previous section is given in table 8.

Table 8: The vocalic phonemes of Tiberian Hebrew

phoneme	realization in stressed syllables	realization in open unstressed syllables	realization in closed unstressed syllables
/ĕ/	—	[ɛ]	—
/ā/	—	[a]	—
/ɔ̄/	—	[ɔ]	—
/i/	[i:]	[iˈ] (right before the stress), [iː] (elsewhere)	[i]
/ɛ/	[ɛ:]	[ɛˈ], [ɛ:]	[ɛ]
/a/	[a:]	[aˈ], [a:]	[a]

/ɔ/	[ɔ:]	[ɔ̇], [ɔ:]	[ɔ]
/u/	[u:]	[u̇], [u:]	[u]
/i/	[i:]	[i̇], [i:]	[i:]
/ē/	[e:]	[ė], [e:]	[e:]
/ō/	[ɔ:]	[ɔ̇], [ɔ:]	[ɔ:]
/ō/	[o:]	[ȯ], [o:]	[o:]
/ū/	[u:]	[u̇], [u:]	[u:]

This analysis is similar to that found in Khan's recent discussions of the problem. Besides the phonemes given in table 8, Khan also posits underspecified /e/ and /o/. These vowels are meant to account for the interchange between stressed [e:] and unstressed [ɛ] or stressed [o:] and unstressed [ɔ] seen in alternations like ירד [jeˈreːð] 'he will go down' beside וירד [vajˈjeːreːð] 'and he went down', יקם [jɔˈqom] 'let him arise' beside ויקם [vajˈjɔːqom] 'and he arose', or as the result of *nesiga* (prosodically conditioned stress retraction), for example, ישב שם [ˈjeːʃevˈʃɔːm] 'he was to dwell there' (1 Kgs 7:8) for the usual ישב [jeˈʃeːv] 'he will dwell'.

In Khan's analysis, the underlying forms of these words can be made more similar by positing underspecified /e/ and /o/, for example, /jēréð/, /wajjéreð/; /jōqóm/, /wajjōqom/; /jēʃév/. These extra vowels also let the underlying representations of historically similar forms more closely resemble each other: for example, \**qill*- nouns like לב [ˈleːv] 'heart' and \**qull*- nouns like צב [ˈʕoːz] 'strength' can thus be represented as /lév/ and /ʕóz/, similar to \**qall*- nouns like עם [ˈʕaːm] /ʕám/ 'people'. But the fact that Tiberian Hebrew lacks a real grammar other than phonology, as argued in section 2, removes the motivation for making these underlying forms look similar. The vowels that Khan identifies as /e/ and /o/ can simply be interpreted as realizations of /ē/, /ɛ/, /ō/ and /ɔ/, for example, /jēréð/, /wajjéreð/; /jōqóm/, /wajjōqom/; /jēʃév/, /jēʃev/; /lév/, /ʕóz/. Since Khan posits the existence of three or all of these phonemes on other grounds, this results in a more economical phonemic inventory.

According to previous phonological analyses, the Tiberian vocalization was largely phonetic, since it distinguished between various allophones as they appeared at the surface, not between underlying phonemes; for a recent example, compare the different spelling of the allophones of /e/ and /o/ according to Khan's analysis in the last paragraph. In the analysis adopted in this paper, however, each phoneme is only ever written with one and the same vowel sign. The correspondence does not go

both ways—one vowel sign may represent multiple phonemes, for example, in the case of /i/ and /ī/, both written with וֹ—but sounds that are written with different vowel signs have been seen to be phonemically contrastive in every case. We do find cases of phonetically conditioned allophony: the different epenthetic vowels functioning as allophones of zero (*shewa mobile*), the two realizations of /r/, and, a case which we have not discussed above, the realization of /w/ as [w] (next to [u]) or [v] (elsewhere).<sup>26</sup> In all of these cases, however, the Tiberian vocalization does not normally mark which allophone should be read; this is most conspicuous in the case of the epenthetic vowels, which are not distinguished in the vocalization from the complete lack of a vowel (*shewa quiescens*). Thus, it appears that the Tiberian vocalization captures phonemic distinctions only, albeit not all of them.<sup>27</sup>

Another interesting feature of this analysis appears when we compare it to the vowel systems described by Joseph and David Qimhi. Although their descriptions have been held responsible for the birth of the five-quality interpretation of Hebrew phonetics, it is questionable whether they are actually talking about phonetics at all. The terms they use for the two classes of vowels, גדולות ‘large’ and קטנות ‘small’, are distinct from those they use for phonetic length (e.g., תאריך ‘you must lengthen’). Indeed, they describe certain environments in which “large” vowels are shortened and “small” vowels are lengthened, which shows that the terms refer to some deeper linguistic level than pure phonetics. In fact, the five Qimhian “large” vowels correspond exactly to our underlyingly long vowels, while the “small” vowels are those that we have identified here as being underspecified for length; the three phonemically short *hatef* vowels are left out of consideration by the Qimhis, as they saw them as variants of *shewa*. Far from being misled into an inaccurate description of Hebrew phonetics by a false comparison to Latin, then, it seems that Joseph and David Qimhi quite accurately described the phonology of the Hebrew vowels in terms of underlying phonemes, centuries before modern linguistics would even arrive at the concept.

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26. G. Khan, “The Tiberian Pronunciation,” p. 6.

27. The lack of written distinction between underspecified and underlyingly long vowels that share the same quality, /i ɔ u/ and /ī ɔ̄ ū/, seems to reflect a wider tendency of newly invented writing systems to only mark vowel quality, not quantity. Compare Latin, which marks its five vowel qualities but not the length contrast, or the even closer parallel of Greek, which only has separate letters for long vowels if they differ in quality from their short counterparts (*iota* for both /i/ and /ī/, *alpha* for both /a/ and /ā/, *upsilon* for both /u/ and /ū/; but *epsilon* for /e/ versus *ēta* for /ē/, *omikron* for /o/ versus *ōmega* for /ō/).