Benjamin Smith Lyman and His Law

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INTRODUCTION
Benjamin Smith Lyman (1835–1920) was one of the many technical experts (おやとい-がいこくじいん 御雇外国人) hired by the Japanese government during the Meiji era (1868–1912).

The research that later made him famous among linguists working on Japanese was published as a 17-page pamphlet in 1894.
Today’s presentation is a progress report on a project that I started working on about three and a half years ago.

The ultimate goal of the project is to produce a book-length account of Lyman’s work on the Japanese morphophonemic phenomenon known as *rendaku* ‘sequential voicing’.
RENDAKU
So what’s *rendaku*? Simply put, many Japanese morphemes have one allomorph that begins with a voiceless obstruent and another allomorph that begins with a voiced obstruent.

When a morpheme shows this kind of alternation, the allomorph that begins with a voiced obstruent can only appear when it’s not the first morph in a word.
For example:

鳥 /tori/  ‘bird’

蜂籠 /tori+kago/  ‘birdcage’

蜂鳥 /hači+dori/  ‘hummingbird’
Because of historical changes, the phonemes that alternate differ in more than just voicing in many cases.

But in terms of *kana* spelling, *rendaku* is a uniform phenomenon.
| /fune/ | ふね かわ + ぶね |
| /hako/ | はこ はし + はこ |
| /tama/ | たま め + たま |
| /kami/ | かみ かべ + がみ |
| /cuka/ | つか あり + つか |
| /sora/ | そら ほし + そら |
| /či/ | ち はな + ち |
| /širuši/ | しるし や + じるし |
What we know today as Lyman’s Law is a constraint on *rendaku*.

Lyman’s Law says that a morpheme containing a medial voiced obstruent will not show the *rendaku* alternation.
For example:

/ao/ ‘blue’
/same/ ‘shark’

青鯨 /ao+zame/

/ao/ ‘blue’
/sagi/ ‘heron’

青鸎 /ao+sagi/ ‘blue heron’
Modern theoretical linguists have tried to interpret Lyman’s Law as the a manifestation of the OCP (Itō & Mester 1986).

To make this work, there has to be a tier on which distinctive instances of [+voice] are adjacent. The voicing in sonorants and vowels isn’t distinctive.
A more recent analysis rules out two voiced obstruents within a morpheme by self-conjunction of a constraint prohibiting voiced obstruents (Itô & Mester 1998).

The required ranking is:

\[
\text{VOP}^{2} \gg \text{Ident-IO(voice)} \gg \text{VOP}
\]
There’s plausible story about the historical origin of *rendaku*.

It’s generally accepted that in Old (8th-century) Japanese voiced obstruents were prenasalized:

\[ [mb] \quad [nd] \quad [ndz] \quad [ng] \]
The proposed explanation for the origin of *rendaku* depends on the reasonable assumption that voiced obstruents were pronounced this way in prehistoric Japanese as well.

It also depends on the uncontroversial assumption that prehistoric Japanese (like Old Japanese) didn’t allow coda nasals (or any other codas).
Given these two assumptions, some well-known historical developments are easy to understand.

For example:

/suzuri/ < /sumi+suri/
‘inkstone’  ‘ink’  ‘rubbing’
硯 墨 擦り
[sumisuri]
[sũmsuri]
[sũⁿdzuri]
Prenasalization disappeared long ago in Tokyo and Kyoto Japanese, but it’s preserved in many other dialects, most famously those of the Tōhoku (northeastern Honshū) region.
Now imagine how the same kind of change (NVT > D) could have applied in cases of *rendaku*.

For example:

/asagiri/ < /asa+NV+kiri/

‘morning fog’  ‘morning’  ‘fog’

朝霧  朝  霧
The question is: What might the mystery NV have been?

/\textit{asagiri}/ \textless \textit{asa+NV+kiri}/

‘morning fog’ ‘morning’ ‘fog’

朝霧 朝 霧
The answer’s pretty obvious, since the ancestor of the modern “genitive” particle /no/ also had the form NV: OJ/nö/.

/asagiri/ < /asa+NV+kiri/

‘morning fog’ ‘morning’ ‘fog’
But there’s no reason to assume that every compound noun originated as a phrase of the form \( N \, nö \, N. \)

Compare two modern examples:

/te+no+hira/  
‘palm’  
[‘hand’s flat’]

/te+kubi/  
‘wrist’  
[‘hand neck’]

手の平  
手首
Here are some attested examples from Old Japanese.

<table>
<thead>
<tr>
<th>OJ</th>
<th>Word</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>/taka+pa/</td>
<td>'bamboo leaf'</td>
<td>竹葉</td>
</tr>
<tr>
<td>/kö+nö+pa/</td>
<td>'tree leaf'</td>
<td>木の葉</td>
</tr>
<tr>
<td>/sasa+ba/</td>
<td>'bamboo-grass leaf'</td>
<td>笹葉</td>
</tr>
</tbody>
</table>
Here are some attested examples from Old Japanese.

\[ O^J / \text{taka}+\text{pa}/ \]  ‘bamboo leaf’
\[ O^J / \text{kö}+\text{nö}+\text{pa}/ \]  ‘tree leaf’
\[ O^J / \text{sasa}+\text{ba}/ \]
\[ < PO^J / \text{sasa}+\text{nö}+\text{pa}/ \]
If the proposed account of the origin of *rendaku* is correct, these examples show why we’d expect the phenomenon to be as irregular as it was in Old Japanese.

These irregularities could have been leveled out in the subsequent 1,300 years, but they haven’t been. Modern Japanese is pretty much the same.
LYMAN’S LIFE
Lyman was born into a very prominent family in Northampton, Massachusetts in 1835.

His ancestors were among the earliest European settlers in Northampton, arriving in 1654.

His father, Samuel Fowler Lyman, was a judge.
Sophia Smith (1796–1870), whose bequest led to the founding of Smith College, was Lyman’s first cousin.

Sara Ann Delano Roosevelt, Franklin Delano Roosevelt’s mother, was Lyman’s second cousin. Her mother’s maiden name was Lyman.
Lyman graduated from Harvard in 1855.

There were no transcripts at that time, but most of the courses in the curriculum were required.

We can be sure that he took several semesters each of Greek and Latin, and a semester of French was required in his sophomore year.
Elective courses included mineralogy (for juniors) and geology (for seniors), but I don’t know whether Lyman took either of these.

German, Italian, and Spanish were also offered as electives for juniors and seniors.
After graduation, Lyman taught briefly at private high schools, but he apparently wasn’t suited to that kind of life.

In the summer of 1856, he got an assistant’s job on a geological survey in Pennsylvania headed by J. Peter Lesley, a well-known geologist who was Lyman’s uncle by marriage.
In the spring of 1857 Lyman gave up teaching entirely, and for the next two and a half years he worked for geological projects in Alabama, Iowa, and Pennsylvania.

From 1859 to 1862 Lyman studied at the School of Mines in Paris and at the Freiberg Mining Academy in Saxony.
After returning to the US, Lyman opened his own office in Philadelphia and did private geological work in the US and Canada for a few years.

At the end of 1869, he went to India and worked there more than a year surveying oil fields for the British government, mostly in the Punjab.
On his way home in the spring of 1871, Lyman stopped at several ports in China and Japan.

In January of 1873, he arrived in Japan to begin working for the Development Bureau (Kaitakushi 開拓使).

Lyman led the geological survey of Hokkaido and trained several assistants in the process.
This picture in the previous slide shows the veranda of Lyman’s house in Tokyo, which was in Kōjimachi 麹町.
Yedomizaka, Tokio.
March 29, 1886.

Sir:

Your kind note of this date is at hand and the deep copy containing 87 specimens you allude to received by certain officers on duty at the Kaitakushi office and not by me as it came just after I left the office.

I shall sorrow, attend to send over some other lot as you wrote me.

Very truly yours,

E. Inoue
After finishing the Hokkaidō survey, Lyman worked for the Ministry of Home Affairs (Naimushō 内務省) and then for the Ministry of Public Works (Kōbushō 工部省).

He traveled widely surveying for oil and coal, and after his last contract was up in 1879, he stayed on at his own expense to finish the reports and maps.
Lyman seems to have become quite proficient in Japanese.

In the Japanese language textbooks that he owned, there are lots of handwritten corrections of typographical errors in the romanized Japanese.
There’s also a newspaper story about Lyman that appeared in 1879 in the Chōya Shinbun 『朝夜新聞』.

Here’s a translation of the relevant passage.
Mr. Lyman of the Ministry of Public Works is able to write in Japanese just like a Japanese person; his only problem is that he says things such as “Kinō wa wakichi ga omahan no hō e mairu hazu de arimashita ga” [Yesterday I was supposed to go to your place] . . .

There must be something about the quoted sentence that would have struck an 1879 newspaper reader as odd, but I’m not entirely sure what.
When Lyman left Japan in December of 1880, he’d been there almost 8 years.

He returned to Northampton and was active in town affairs for several years, but he moved back to Philadelphia in 1887 and lived there for the rest of his life.
The Northampton house that Lyman lived in right after his return from Japan has been partially remodeled and is now a Smith College dormitory.
Lyman made one more visit to Japan when he took a trip around the world in 1907.

He visited his former assistants while he was there.
Lyman patented an instrument called a solar transit in 1871 and another called a topographer’s light transit in 1886.

He became a vegetarian in 1864, and in 1917 (at the age of 81) he published a cookbook of vegetarian recipes.
Lyman’s obituary in the New York Times (August 31, 1920) described him as a “geologist, mining engineer and inventor of worldwide reputation”.
THE LYMAN COLLECTION
In 1922, Lyman’s books and papers were donated to the Forbes Library (the public library in Northampton) by his cousin, Frank Lyman.

Ms. Yasuko Fukumi (副見恭子), a librarian at the University of Massachusetts, found out about the Lyman materials in the late 1970s.
The University of Massachusetts purchased the books in 1980 and the other materials in 1987.

Ms. Fukumi raised funds in Japan to preserve the materials in 1987–88. Now known as the Lyman Collection, these books and papers are managed by Special Collections and Archives in the W. E. B. DuBois Library.
W. E. B. DuBois Library
University of Massachusetts
Amherst, Massachusetts
This past June I spent a week at UMass looking at the materials in the Lyman Collection.

Funding for the trip came from the Northeast Asia Council of the Association for Asian Studies.
For enthusiastic help while I was in Amherst, I’m tremendously grateful to Mike Milewski (Senior Archives Assistant) and Sharon Domier (East Asian Librarian).
Mike Milewski
Special Collections and Archives
LYMAN’S WORK ON JAPANESE
One thing I found in the Lyman Collection is an article called “Notes on Japanese Grammar”, which originally appeared in two parts in the *Japan Weekly Mail* (a Yokohama English-language newspaper) in 1878.
NOTES

ON

JAPANESE GRAMMAR,

BY

BENJAMIN SMITH LYMAN.

YOKOHAMA:
PRINTED AT THE "JAPAN MAIL" OFFICE.
1878.
Despite the title, this article deals with the pronunciation of Japanese, and considering the date, it’s in some respects a remarkably sophisticated description.

I also found a 13-page handwritten manuscript of the first installment.
Notes on Japanese Grammar
By Benjamin Franklin

No schoolboy was admitted to a gym. In the gym, Japanese should make little exhibitions of the words used in the grammar. I say with the great teacher of grammar and language, "It is well to instruct the young in language.

Japanese should make little exhibitions of the words used in the grammar. I say with the great teacher of language, "It is well to instruct the young in language."

Communications

Mr. Samuel Brown spoke a few words in French. "I believe," he exclaimed, "I believe in grammar."
A has the sound of the “Italian a”, that is, of the a in father, longer and more open than the a of ask or French la, and closer and perhaps shorter than the a of arm or French âme.
The title of the 1894 pamphlet that contains Lyman’s statement of Lyman’s Law is “The Change from Surd to Sonant in Japanese Compounds”.

It was published by the Oriental Club of Philadelphia. Lyman was a charter member of this organization.
A few years ago, thanks to the Cleveland Public Library, I got my hands on a photocopy of the 1894 pamphlet via interlibrary loan.

Lyman says the article is based on a talk he gave at the 1883 meeting of the American Oriental Society.
The Change from Surd to Sonant in Japanese Compounds.

E. S. LYMAN.

From the "Oriental Studies" of the Oriental Club of Philadelphia.
More recently, I’ve gotten ahold of a 1910 critique of Lyman’s 1894 article by the Japanese linguist Ogura Shinpei 小倉進平 (1882–1944).

Ogura is best known for his later work on Korean, but his response to Lyman’s article is very well done.
My plan is to include Lyman’s 1878 article on pronunciation, his 1894 article on *rendaku*, and an English translation of Ogura’s 1910 critique in the book that eventually emerges from this project.
LYMAN’S LAW(S)
The rule in general for purely Japanese words is that the second part of a compound word takes the nigori; that is, if beginning with \textit{ch}, \textit{f}, \textit{h}, \textit{k}, \textit{s}, \textit{sh} or \textit{t}, those consonants are changed to the corresponding sonant ones; yet with only a slight preponderance, about 2361 cases against about 2316; \textit{[p. 2]}

\textbf{Note the absence of ts.}
This *ts* is the affricate I transcribe as /c/ (realized as [ts]), and its *rendaku* partner is /z/ (realized as [z]~[dz]). The fricative /s/ also has /z/ as its *rendaku* partner.

Lyman cites several examples of *rendaku* that involve *ts* (/c/) alternating with what he represents as *dz* (/z/).
It may be that Lyman saw $ts$ as just $t$ ($/t/$) followed by $s$ ($/s/$).

In his 1878 paper on pronunciation, he treats Japanese $ch$ ($/č/$) as a single consonant, and he argues at length that English $ch$ is not a “compound sound”, that is, not a sequence of $t$ followed by $sh$. 
But Lyman doesn’t treat Japanese $ts$ (/c/) as a separate consonant in his 1878 paper.

Since he’d studied in Freiberg, he must have known some German.

It may just be that his native English intuitions led him astray.
and the general rule does not apply:

(1) when \( b, d, g, j, p \) or \( z \) already occurs anywhere in the second part of the compound; [p. 2]

This is what linguists now call Lyman’s Law, except for Lyman’s inclusion of \(/p/\) on the list of inhibiting consonants.
and the general rule does not apply:
(1) when $b$, $d$, $g$, $j$, $p$ or $z$ already occurs anywhere in the second part of the compound; [p. 2]

Notice that Lyman says “anywhere in the second part”.
and the general rule does not apply:
(1) when \( b, d, g, j, p \) or \( z \) already occurs anywhere in the second part of the compound; [p. 2]

Some 20th-century scholars suggested that a voiced obstruent inhibits *rendaku* only if it’s in the syllable immediately following the potential *rendaku* site.
and the general rule does not apply:
(1) when $b$, $d$, $g$, $j$, $p$ or $z$ already occurs anywhere in the second part of the compound; [p. 2]

As for /p/, Lyman seems to have taken the Japanese term *han-dakuon* 半濁音 over-literally as denoting a mora beginning with a half sonant.
and the general rule does not apply: (1) when \( b, d, g, j, p \) or \( z \) already occurs anywhere in the second part of the compound; [p. 2]

And when it came to inhibiting *rendaku*, Lyman apparently thought that a half sonant was as good as a full one.
In reading the lists it is to be borne in mind that under the general rule \( h \), as representing an ancient surd labial, is changed to \( b \), or sometimes to \( p \), “half nigori.” [p. 2]

Lyman seems to have been aware of the earlier pronunciation of modern \( /h/ \) (and \( /f/ \)) as \( [p] \), but he still sees Meiji-era \( /h/\sim/p/ \) alternations as examples of *rendaku*. 
1. — *B, d, g, j, p, or z* in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

The lone exceptional item that Lyman cites contains */p/,* not a voiced obstruent, in its second element: /ama+gaQpa/ 雨合羽 ‘raincoat’.
Here’s what Ogura had to say about all this in 1910:

The word that Lyman cites as an exception to his first condition is *ama-gappa*. He treats the medial *p* in this word as a voiced obstruent, but this classification is based on the ideas of classical scholars [*kokugakusha* 国学者] and is not appropriate.
1. — *B, d, g, j, p, or z* in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

The noun /kaQpa/ 合羽 is a loan, and Lyman presumably knew this, since the entry in Hepburn’s dictionary (Lyman’s main source of examples) says “derived from the Spanish Capa”.
1. — $B, d, g, j, p$, or $z$ in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

In modern Japanese (as in Meiji-era Japanese), word-medial /p/ is found mostly in Sino-Japanese items (e.g., /šiN·pai/ 心配 ‘worry’) . . .
1. — *B, d, g, j, p, or z* in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

... more recent loans (e.g., /suupu/ スープ ‘soup’), or mimetic words (e.g., /poQpo/ ぽっぽぽ ‘choo-choo’).
1. — *B, d, g, j, p, or z* in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

And it’s well known that elements in these three categories (Sino-Japanese, recent loans, mimetic words) resist *rendaku* anyway.
1. — $B, d, g, j, p, \text{ or } z$ in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

Lyman mentions the tendency for Sino-Japanese elements not to show *rendaku*, but he doesn’t say anything about recent loans or mimetic words.
1. — $B, d, g, j, p$, or $z$ in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

In fact, a non-negligible fraction of Sino-Japanese elements do show *rendaku*, including /teQ·poo/ 鉄砲 ‘gun’, and Hepburn lists /mizu+deQ·poo/ as meaning ‘syringe’.
1. — $B$, $d$, $g$, $j$, $p$, or $z$ in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

A few native Japanese words also have /Qp/, including /haQpa/ 葉っぱ ‘leaf’ and /šiQpo/ 尻尾 ‘tail’, but I don’t know of any examples of *rendaku* in such an element.
1. — B, d, g, j, p, or z in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

Still, there doesn’t seem to be any reason to think that /p/ inhibits *rendaku* as voiced obstruents do.
1. — $B, d, g, j, p$, or $z$ in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

What about the well-known exceptions to Lyman’s Law in modern Tokyo Japanese?
1. — *B, d, g, j, p, or z* in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

**Hepburn’s dictionary lists**

/nawa+hašigo/ 縄梯子 ‘rope ladder’

and  /curi+hašigo/ 釣梯子 ‘hanging rope ladder’, neither with *rendaku*. 
1. — *B, d, g, j, p*, or *z* in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

In *NKD* (the Japanese *OED*), the older citations for the latter have */h*/ (/*/curi+hašigo*/), but all the citations for the former have */b*/ (/*/nawa+bašigo*/).
1. — $B$, $d$, $g$, $j$, $p$, or $z$ in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

Hepburn’s dictionary doesn’t list items corresponding to modern Tokyo /fuN+ũibaru/ ふん縛る ‘tie up’ or (not surprisingly) to proper names such as /keN+zaburoo/ 健三郎.
1. — $B$, $d$, $g$, $j$, $p$, or $z$ in the next syllable (363 cases), or any following one (35, in all 398 cases), prevents the nigori. The only exception, is amagappa. [p. 3]

In short, Lyman’s “database” contained NO exceptions to what present-day linguists think of as Lyman’s Law.
A sonant in the syllable before has no effect on the nigori (about 150 words with, and about 150 without). [p. 3]

This is an explicit denial of what Jim Unger dubbed the “strong version” of Lyman’s Law, which apparently did hold (at least very nearly) in Old (8th-century) Japanese.
... and (4) there are 1000 other cases where the nigori is not taken against 2220 where it is, or one case out of three. [p. 2]

This suggests that of the words in Lyman’s “database” to which no constraint is relevant, about a third fail to show *rendaku*. 
... and (4) there are 1000 other cases where the nigori is not taken against 2220 where it is, or one case out of three.

[p. 2]

But Lyman groups these 1,000 items into 5 categories, and some of his categories involve properties that present-day linguists think of as inhibiting factors.
and (4) there are 1000 other cases where the nigori is not taken against 2220 where it is, or one case out of three.

[p. 2]

The fact that Lyman discussed these other inhibiting factors led Shigeto Kawahara to wonder out loud why we don’t say Lyman’s Laws.
and (4) there are 1000 other cases where the nigori is not taken against 2220 where it is, or one case out of three.

[p. 2]

I’m still trying to find out who first used the name Lyman’s Law (or Raiman no hōsoku ライマンの法則) to refer to the inhibiting effect of a medial voiced obstruent.
(b) — 83 reduplicated words (against 67 with the nigori) . . . [p. 9]

Most of these 83 examples are mimetic, e.g., /koso+koso/ こそこそ ‘sneak-sneak’.
(b) — 83 reduplicated words (against 67 with the nigori) . . . [p. 9]

Reduplicated mimetic words resist rendaku, whereas most other types of reduplicated words strongly favor it, but Lyman says nothing to indicate that he was aware of this difference.
(b) — 83 reduplicated words (against 67 with the nigori) ... [p. 9]

Ogura (1910) points out this difference in behavior between reduplicated mimetic words and other reduplicated words, and he gives long lists of relevant examples both from modern Japanese and from Old Japanese.
(d) — 29 juxtaposed words of allied or contrastive meaning . . . [p. 9]

These, of course, are what present-day linguists call coordinate compounds, e.g., /ato+saki/ 後先 ‘after and before’.
(d) — 29 juxtaposed words of allied or contrastive meaning . . . [p. 9]

Lyman missed some of the coordinate compounds that appear on other lists elsewhere in his paper, e.g., /eda+ha/
枝葉 ‘branches and leaves’.
(d) — 29 juxtaposed words of allied or contrastive meaning . . . [p. 9]

Ogura (1910) points out that some of these 29 examples don’t fit Lyman’s description. (E.g., the second element in /sa + koso/ 然こそ ‘just so’ is an emphatic particle, and the second element in /kaku + te/ 斯くて ‘thus’ is a conjunctional particle.)
SO WAS LYMAN’S LAW LYMAN’S?
There’s understandable suspicion among linguists working on Japanese that Lyman didn’t actually discover Lyman’s Law on his own.
The famous classical scholar Motoori Norinaga 本居宣長 (1730–1801) wrote a mammoth commentary on the 8th-century *Kojiki*『古事記』 (Record of Ancient Matters).

Norinaga’s commentary is called *Kojiki-den*『古事記伝』. Although he completed it in 1798, it was in 1822 that the final volumes were published.
In an article published in 1932, Miyake Takerō 三宅武郎 cited a passage in *Kojiki-den* that seems to be statement of Lyman’s Law.
Lyman owned a copy of *Kojikiden*, and it’s in the Lyman Collection at UMass.

But unlike his Japanese language textbooks, his copy of *Kojikiden* doesn’t have handwritten notes in it.

And in fact, it’s very unlikely that he would have been able to read it.
In his 1910 critique, Ogura cites lots of Old Japanese examples from *Kojiki*, and he says that he took these from *Kojikiden*, so presumably he had read at least parts of it.

But in his discussion of what he calls “Lyman’s first condition”, he doesn’t say anything about Motoori’s statement.
If Ogura had known about Motoori’s statement, he surely would have said something about it.

The upshot is that I don’t think there was anyone in Japan that Lyman could have stolen the idea of Lyman’s Law from.
So how did a geologist and mining engineer figure out (approximately) what we now call Lyman’s Law?

First, as we’ve already seen, Lyman knew Japanese quite well, so it’s not surprising that he was aware of *rendaku* and puzzled by it.
Second, Lyman had Hepburn’s dictionary to work with.

And third, he clearly had the kind of intellect and perseverance that he needed to go systematically through the data available to him.
I was a really smart guy.