

# Mountain cartography of Hokkaido in the nineteenth century

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**Abstract:** The nineteenth century was a period of profound cultural and environmental change on the island of Hokkaido, Japan. It was also a period when Japanese cartographers began to incorporate Western methods of terrain representation into their maps. This article sketches a preliminary chronology of Hokkaido maps in order to document changes in methods of terrain representation over this period and to connect mountain cartography to the island's history of cultural and environmental change. Distinctive patterns of terrain representation in early maps include horizon strip diagrams and portraits of distinguished mountains with shifting orientations and abundant white space. After the middle of the century, Japanese cartographers began incorporating Western methods of terrain representation, including hachures, waterlines, and contours. These changes in terrain representation also reflect shifting purposes of maps that include claiming territory, remembering indigenous knowledge, and systematic planning of cultural and environmental change.

**Keywords:** terrain, map design, Hokkaido, Japan, colonial

## 1. Introduction

This article briefly sketches a chronology of maps made in the nineteenth century by Japanese cartographers that depict mountains on Hokkaido. The purpose of this research is (1) to identify methods of terrain representation developed by Japanese cartographers in isolation from western cartography, (2) to document when and how Japanese cartographers integrated western methods of terrain representation into their maps, and (3) to situate these cartographic histories in the process of colonization and modern development of the island.

## 2. Historical context

Historical events of the nineteenth century on Hokkaido make this region an interesting case study of mountain cartography. When the century began, Hokkaido was part of Japan's northern frontier, called *Ezo*. It was inhabited by the indigenous Ainu people, who lived in *kotans* (settlements) along rivers and moved seasonally within hunting and fishing territories (Watanabe 1973). Immigrants from Honshu (the main island of Japan, directly to the south of Hokkaido) then living in Ezo were small in number but economically powerful. The Matsumae clan occupied a castle on the southern end of the island and controlled a system of trade between Honshu merchants and Ainu people. By the end of the eighteenth century, the island also drew increasing attention from the Tokugawa Shogunate in Edo (Tokyo), primarily due to concerns that Russia aimed to colonize the island from the north (Takakura 1960; Watanabe 1973). At the start of the nineteenth century, Tokugawa claimed direct political control of the island from the Matsumae clan and began to send surveyors to the island to map this frontier and lay claim to the territory.

The nineteenth century also witnessed remarkable shifts in cultural interactions between Japan and the West and between Honshu and the Ainu people. In 1633, 1635, and 1639, the Tokugawa Shogunate had issued a series of

exclusion decrees that banned travel and limited trade between Japan and Western countries, with the exception of trade with Dutch merchants in the southern harbor of Nagasaki (Unno 1994, 377). This long period of isolation from the West broke in 1854, when the United States sent a naval squadron to Edo and demanded permission to trade. By the following year, Tokugawa agreed to allow trade with the Americans at a limited number of ports, including Hakodate on Ezo. In 1868, the Shogunate's rule ended with the Meiji Restoration; the new imperial government of Japan officially affixed the name Hokkaido to the large island just to the north of Honshu and established a colonial government that took possession of all Ainu lands. The new government prohibited Ainu from practicing traditional methods of hunting and fishing and initiated policies that aimed to increase agricultural settlement by Honshu immigrants and assimilate Ainu in this new land system (Watanabe 1973).

Japan's colonization of the island in the nineteenth century created many opportunities for making maps. Initially, maps were instruments for claiming and defending the northern territory from foreign invasion. Later, maps were instruments for systematically transferring land from Ainu to Honshu control. In between, maps were instruments for documenting Ainu knowledge of their lands as they were being forced to abandon them.

The historical cartography of Hokkaido also provides an interesting opportunity to investigate both the innovation and diffusion of methods in mountain cartography. Initially, while Japan was isolated from the West, the Japanese cartographers who made maps of the island may not have been aware of the many new methods that European cartographers had developed to represent terrain on planimetric maps, including hachures, contours, hypsometric tints, slope shading, and illuminated relief (Imhof 2007, 5–14). After 1854,

YEAR	CARTOGRAPHER	ARCHIVE	TERRAIN PATTERNS
1801	Inō Tadataka	Tokyo National Museum	Horizon strip diagrams, distinguished peaks, empty interiors
1802	Kondō Morishige	Hakodate City Central Library.	Coastal orientation of mountains, distinguished peaks, empty interiors
1821	Inō Tadataka's apprentices	Northern Studies Collection, Hokkaido University.	Horizon strip diagrams, distinguished peaks, empty interiors, inland divides
1841	Imai Hachikurō	Tokyo National Museum	Horizon strip diagrams, distinguished peaks, empty interiors
1860	Matsuura Takeshirō	National Diet Library Digital Collections	Hachures
1890	Hokkaido Geography Division	National Diet Library Digital Collections	Contour lines

Figure 1. A preliminary chronology of Hokkaido mountain cartography in the nineteenth century.

however, when Americans began to trade from Hakodate, examples of these Western methods of cartography likely became more accessible to Japanese cartographers.

### 3. A brief chronology

This section sketches a brief chronology of maps that depict mountains on Ezo (and later Hokkaido) in the nineteenth century (Figure 1). It is not exhaustive, but rather represents a preliminary effort to describe patterns for representing mountains on maps made by Japanese cartographers when isolated from the West and to document when Western methods began to appear on maps of the island.

### 4. Inō Tadataka's first survey

In 1800, Inō Tadataka led a small party to survey the

length of Hokkaido's eastern coast between Matsumae and Nemuro. After arriving at Hakodate, Inō's team surveyed on foot, counting paces to measure distance, measuring azimuths to landmarks with a stick-theodolite, and measuring the latitude of camps by observing the meridian altitudes of fixed stars at night (Otani 1932, 81–86). After returning to Inō's workshop in Edo, the team created 21 map sheets at the scale of 1:43,636 and a smaller-scale map on a single sheet at 1:436,360. The Tokyo National Museum map collection includes digital copies of nine sheets that are thought to be representative in form to the large-scale maps that resulted from this survey (Inō 1801). These maps illustrate several distinct patterns of terrain representation.

- *Horizon strip diagrams.* Inō's team depicts the side profile of mountains as a continuous strip along the survey path. This method evokes the

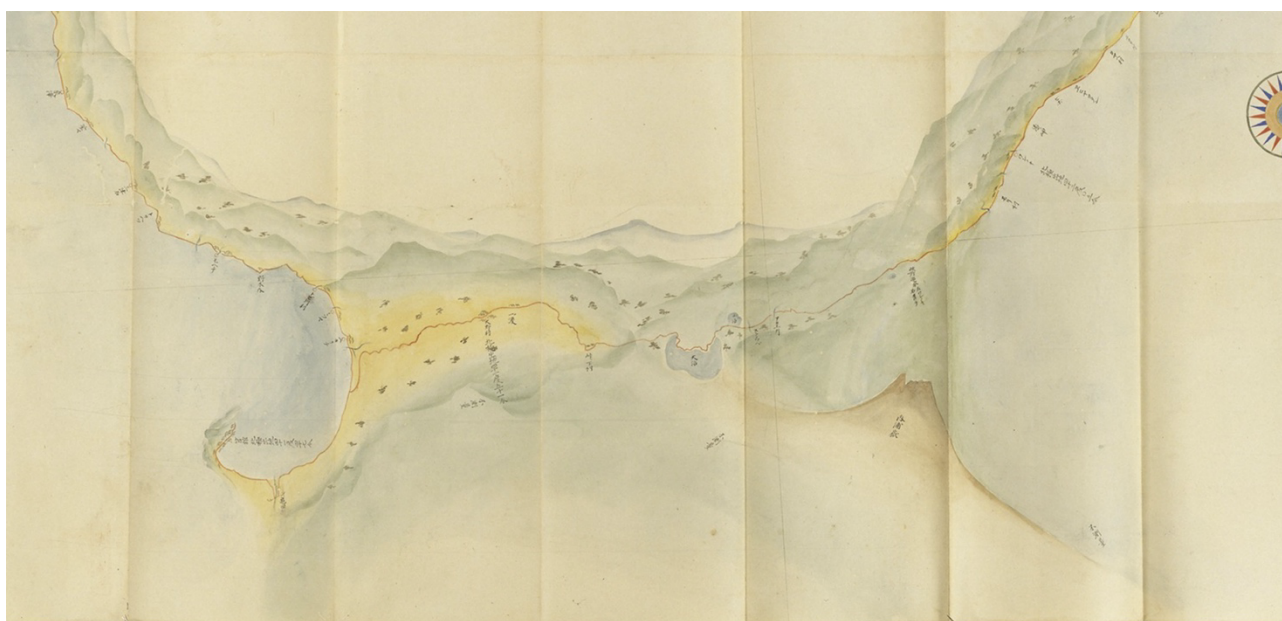


Figure 2. Excerpt from Inō Tadataka's first survey of Ezo (1801) Tokyo National Museum.

constrained but continuous perspective of Inō's survey along a path traveled by foot. In rugged terrain, the diagram depicts a side view of green hills and mountains that define a horizon, two to four ranges deep, while a plain yellow border marks valley bottoms and coastal plains. The strip's orientation largely parallels the surveyors' route, so that the mountains appear to rise from the sea or from the party's inland routes. As a result, the topography can appear "upside-down" to a stationary map reader.

- *Distinguished peaks.* Inō's maps distinguish some mountains with color, texture, detail, and orientation. These peaks often rise independently of the horizon strip along the route and, perhaps as a result, they are shown with unique orientations, or not necessarily oriented towards the surveyors' path. Their profiles are also less generic than the topography of the strip and instead often portray distinctive features of the specific mountain.
- *Empty interiors.* Beyond the horizon strip and the distinguished peaks, Inō's maps largely leave the sheet empty of ink. This white space conveys the limits of the survey and a humanist dimension to the maps as portraying what the surveyors could see. Yet this pattern also visually conveys an idea that the island's interior was empty space.

Figure 2 illustrates these patterns. The figure is oriented with west at the top. On the left side, the thin red line marks the surveyors' route following the coast to Hakodate. The route then cuts inland through a broad valley. The horizon strip rises from either side of this route, making the eastern side of the valley appear upside-down. The route passes to the west of Koma-gatake in Volcano Bay, but this tall peak is not oriented toward it. Painted in a brown hue that offsets it from the green background, the mountain appears oriented toward the southeast and the profile shows the peak's distinctive horn.

## 5. Kondō Morishige

Between 1798–1802, Kondō Morishige traveled through Ezo as an official of the shogunate in Edo. In 1802 he produced *Ezochi zushiki* (Map of Ezo), which is accessible online through the Hakodate City Central Library Digital Archives (Kondo 1802). Kondō's map differs in scale from Inō's large-scale map described above. It shows the entire island of Ezo on a single sheet, along with Sakhalin Island (shown as a peninsula to the mainland) and the Kuril Islands. Regardless, it echoes the three patterns for terrain observed in Inō's maps with some variations:

- *Coastal orientation of mountain faces.* Like Inō's map, Kondō illustrates the side profile of mountains and largely orients these profiles so that they face the nearby coast. As a result, many

mountains appear "upside-down" to a stationary map reader as the coastline encircles the island. Unlike Inō's map, Kondō's mountains do not form a continuous strip, which may reflect differences in scale and purpose: Kondō describes an island as a part of a larger geography, while Inō's team depicts a route across portions of one island.

- *Distinguished peaks.* While some mountains appear as somewhat generic "molehills" (Imhof 2007, 2), the map uses color, texture, detail, orientation, and labels to distinguish some mountains from the more generic terrain. Kondō employs a green hue for most mountains and then distinguishes certain mountains with alternative hues, principally brown that signifies the bare volcanic slopes, but also blue for the unique instance of Mount Yōtei. He also draws distinctive profiles for some mountains that may resemble their physical appearance from the ground. Some mountains do not appear oriented to the nearby coast like the more generic terrain and this shift in orientation also helps visually separate them. Finally, Kondō recorded the names of certain mountains, generally for mountains that had been distinguished with visual methods from the generic terrain.
- *Empty interiors.* Kondō's map also depicts much of the interior as empty space. In addition to individual mountains, he shows the main rivers, but he does not label their main stems or tributaries. The vast majority of labels appear along the coast. Other than the few labels on interior mountains, the only interior labels describe a few routes that cut through the interior to reach the coast.

## 6. The Inō Maps

After his initial survey in 1800, Inō never returned to Ezo. The remaining survey work appears to have been completed by Mamiya Rinzō, an official of the Shogunate who had met Inō by chance near Hakodate in 1800 (Otani 1932, 130–35). By 1811, Mamiya was living in Edo, where Inō had his workshop, and he sought instruction from Inō to improve his field skills in surveying. Mamiya then returned to Ezo and surveyed the parts of the island that Inō had not visited, providing his field data to Inō sometime around 1817.

Though Inō died in 1818, his team in Edo continued to work on a complete map series of Japan after his death. In 1821, they completed this work, producing a set of 214 large-scale maps (1:36,000), 8 medium-scale maps (1:216,000), and 3 small-scale maps (1:432,000). Ezo occupies one small scale sheet and two medium scale sheets. The Northern Studies Collection at the University of Hokkaido includes medium-scale sheets of Ezo (Ino 1821b), while the Tokyo National Museum includes the small-scale sheets with Ezo (Ino 1821a).

These maps again illustrate patterns described previously. A horizon strip follows the survey route, often making the terrain appear upside-down. Some mountains appear distinguished by hue, texture, orientation, detail, and location with respect to this strip. Thin, red azimuth lines converge on these peaks, often from multiple places on the surveyors' route, indicating that the cartographers likely distinguished peaks on the maps that served as landmarks for the surveyors in the field.

One novel pattern that appears on these maps concerns the depiction of inland divides. On the medium- and small-scale maps, the profile of the horizon strip continues to parallel the coastal routes, but on inland routes, the mountain faces align perpendicularly with the route, lending the appearance of moving *towards* or *away* from the mountains rather than *along* the mountains. As a result, by shifting the direction of the faces, the cartographers could signal an inland topographic divide.

Figure 3 illustrates several of these patterns. The excerpt includes the same region near Hakodate as Figure 2, but now the geographic orientation of the figure is north up. When the survey route follows the coast, the horizon strip

bends with the coastline so that the mountains consistently face the water. As the route moves away from the coast, the topographic profiles are perpendicular to it and their direction shifts near two water bodies (Ōnuma and Konuma ponds), suggesting a passage from one topographic region of the island to another.

## 7. Imai Hachikurō

In 1821, the Tokugawa Shogunate returned authority of Ezo back to the Matsumae clan, but did not provide the clan with the maps of Ezo that had been made by Shogunate officials. As a result, the Matsumae authorized a survey of the island and retained Imai Hachikurō for this purpose. Imai had learned surveying methods from Mamiya Rinzō, when Mamiya surveyed Ezo for the Inō maps. Between 1828 and 1838, Imai surveyed a different region of Ezo each year, and then drafted maps from his surveys between 1839 and 1841. The Tokyo National Museum includes digital copies of some of his survey sketches and a few large-scale maps of offshore islands (Imai 1841). These materials illustrate patterns seen previously in the Inō maps. The sheet titled “Rebun Island Survey and drafting” is a particularly interesting

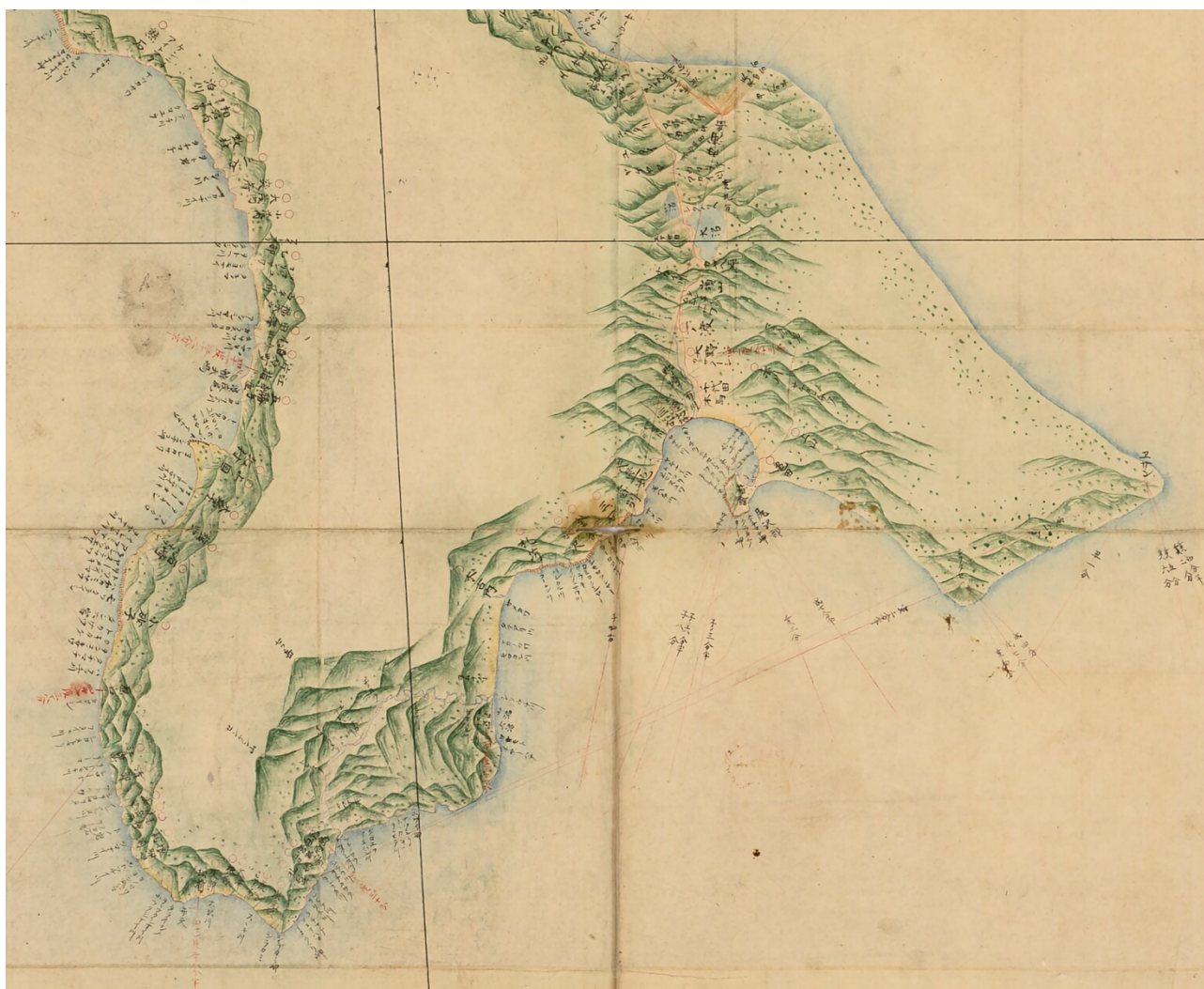


Figure 3. Excerpt from medium-scale Inō map (1822). *From the Northern Studies Collection, Hokkaido University.*

example (Figure 4). The map employs a horizon strip encircling the coast of Rebun Island, though it appears roughly sketched. On Rishiri island, it shows a detailed side-view portrait of Rishiri's high peak. This portrait is intriguing because it depicts the eastern face of the mountain in profile, while also depicting the deep canyon that carves into the mountain's opposite side and flows towards the island's western shore. In effect, the map juxtaposes two different views of the mountain on a unified visual plane.

## 8. Matsuura Takeshirō

Between 1845 and 1858, Matsuura Takeshirō made six trips through Ezo and Sakhalin, initially as a private citizen and then, beginning with the fourth trip, as an official of the Tokugawa Shogunate. During his last two surveys in 1857 and 1858, he explored a number of Ezo's rivers and in 1860 produced the "Atlas of Geographical Research on Mountains and Rivers in Eastern and Western Ezo" with more than two dozen separate map sheets (Takeshiro 1860). This map collection is available online through the National Diet Library Digital Collections (Figure 5 shows an example).

Matsuura's maps are important for the wealth of Ainu place names that they record. Labels appear encased in boxes for many mountains and landforms, while many other labels align with rivers and tributaries. Matsuura's maps help reveal how the Ainu inhabited the island's interior (fishing, hunting, wintering) through the abundance of place names associated with the river system and represent a break from previous patterns that had largely left the interior empty and unnamed.

Matsuura's maps are also notable for his use of hachures to represent terrain. The hachures suggest the direction of slope and the relative elevation of landforms. By using an abstract, planimetric system to represent terrain, Matsuura's maps mark an important break from traditional patterns for mountains used previously by Japanese cartographers.

## 9. Hokkaido Geography Division

The National Diet Library contains a series of 1:200,000 scale maps published by the Hokkaido Geography Division between 1890–1899. Unfortunately, these maps are not accessible online and can only be viewed from computer terminals at the Diet Library. The metadata for the maps credit Japanese authors for both the surveys and cartography. These maps are noteworthy because they employ contour lines to represent topography. In a number of ways, the maps appear strongly influenced by contemporaneous methods of the United States Geological Survey and show patterns that were not visible in the earlier Japanese maps of the island. They use a waterline pattern (a series of blue lines on water



Figure 4. Excerpt of Rishiri Island from the "Rebun Island Survey and drafting" sheet by Imai Hachikurō circa 1841. Tokyo National Museum.

features that parallel the shoreline) for near shore ocean and inland lakes and ponds. They use Latin alphabet characters for some towns and regions. The frame of each map shows the ticks of a coordinate system.

The maps appear to serve the purpose of both inventory and plan. The legend for the series distinguishes over fifty symbols, including mineral resources, land cover types, and administrative boundaries. Along many roads and rivers and over wetlands, the maps show grids, drawn in black ink, that likely aim to partition and distribute lands for agricultural development. Hatch marks on some grids seem to indicate where windbreaks should be planted. Many of the gridlines that Japanese cartographers drew on these late nineteenth century maps are now expressed in the patterns of urban, agricultural, and forest lands visible in satellite images of Hokkaido today (for example, look near present-day Nakashibetsu, Obihiro, and Kiyosato).

## 10. Observations

With this brief chronology, we can make at least four observations that contribute to the field of mountain cartography. The first concerns the recognition of several distinct patterns for depicting topography by Japanese cartographers. It is interesting to see how mapmakers in Japan adapted traditional patterns of cartography to accommodate increasingly accurate methods of measurement, creating distinctive patterns like the horizon strip that bent and turned with the shoreline and the shifts within this strip to distinguish inland divides, while also retaining artistic traditions that honored the uniqueness of individual mountains.

The second observation concerns the adoption of Western methods of terrain representation in the mid-nineteenth century by Japanese cartographers. After trade opened

with Americans at Hakodate in 1854, simple hachures appeared very quickly, while contour lines, nearshore waterlines, and grid frames appeared by 1890. The latter methods show a strong influence of contemporaneous methods in American cartography.

The third observation concerns the functions of terrain patterns in the annexation and colonization of the island frontier and the displacement of the Ainu people. The Japanese patterns helped construct the image of the island as a part of modern Japan's territory, not simply because the coastline stood for a political boundary, but because the methods for representing the island's terrain made the island look like a Japanese landscape. The Japanese patterns also conveyed a sense of interior emptiness that minimized the presence of the Ainu people. Towards the end of the century, the maps that illustrate American patterns also inherited the functions of their source as means to inventory resources and systematically transfer indigenous lands to immigrants through agricultural development.

The fourth observation concerns relationships between terrain patterns and the preservation of indigenous knowledge. The early nineteenth century Japanese cartographers were effective at evoking the aesthetics of the landscape and the experience of passing through the landscape. In contrast, Matsuura's maps place little visual emphasis on individual mountains and the aesthetics of travel. Instead, he abstracts terrain and helps bring to the

foreground geographic information that had been previously hidden.

## 11. Acknowledgements

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Figure 5. Excerpt from Sheet 5 of "The Geographic Survey Map of East and West Ezo Mountains and Rivers" by Matsuura Takeshirō. National Diet Library Digital Collections.

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