The Yandani Erosion Control Dam Complex

The Vanguard of a Grand National Land Development Plan

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Giant rock dam complex hidden in the valley

Horizontal erosion control of stones (photographed by the author)

This stonework, evoking the passage of ages, was constructed deep within the mountains. The ancient igneous rock face lies within the active Atera Fault Zone, which stretches from Gero to Nakatsugawa. The rock is extremely brittle, and for centuries, the area has seen repeated landslides, which has led to a local saying: “The mountain comes down”. It was here that one approach to addressing this type of sediment flow – modern sand control technology – was introduced. This is the Yandani Erosion Control Dam Complex in Kashimo Town, Nakatsugawa City. It is thought to have been constructed during the advent of modern erosion control measures in Japan. Its length extends over 300 metres and is comprised of 13 stone in-stream structures that are supplemented by belt structures and channel construction. Here, a sign indicates that the project was constructed under the supervision of Dutch engineer Johannis de Rijke.

Thanks to this formidable erosion control structure, the downstream alluvial fan area has seen developments such as the construction of the Meiji-za theatre, which marks a significant chapter in

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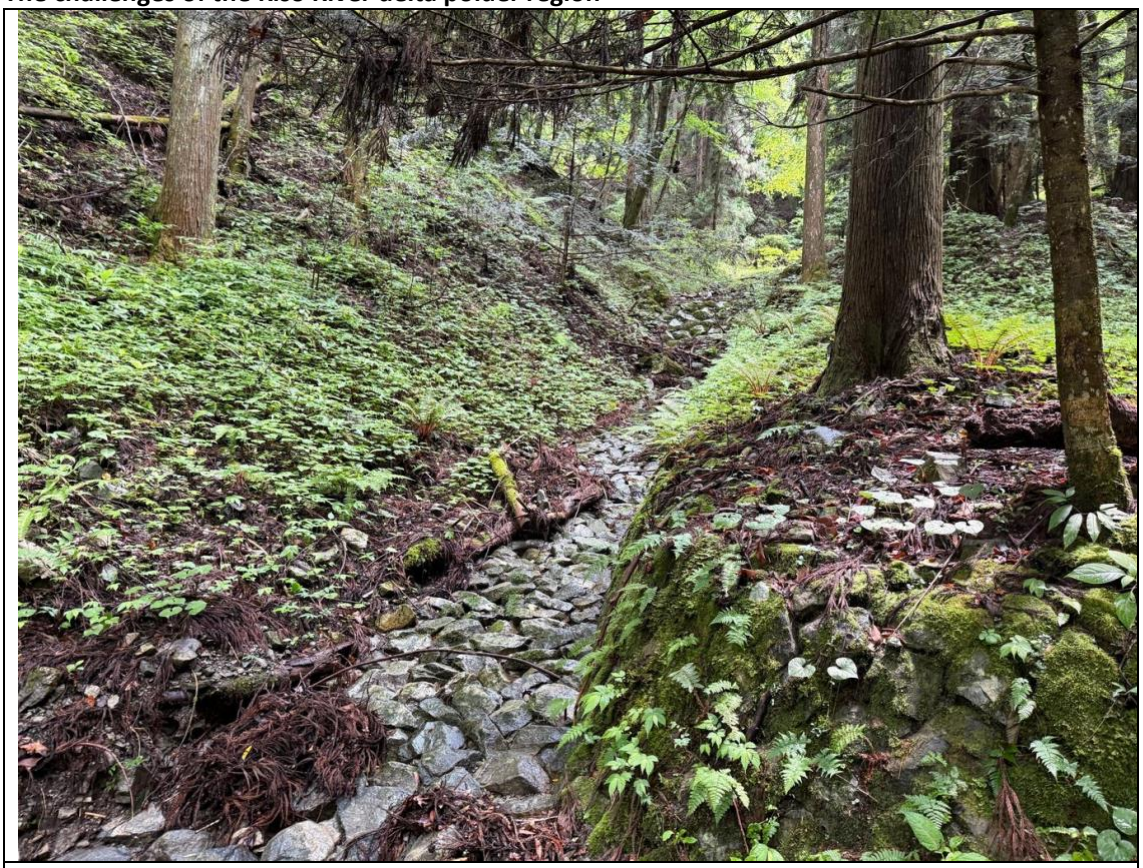
Kashimo's history. Yet its impact has extended far beyond the immediate area, as this project represented the beginning of a national land development vision in Japan and marked an extraordinary perspective at the outset of the nation's modern era.

The challenges of the Kiso River delta polder region



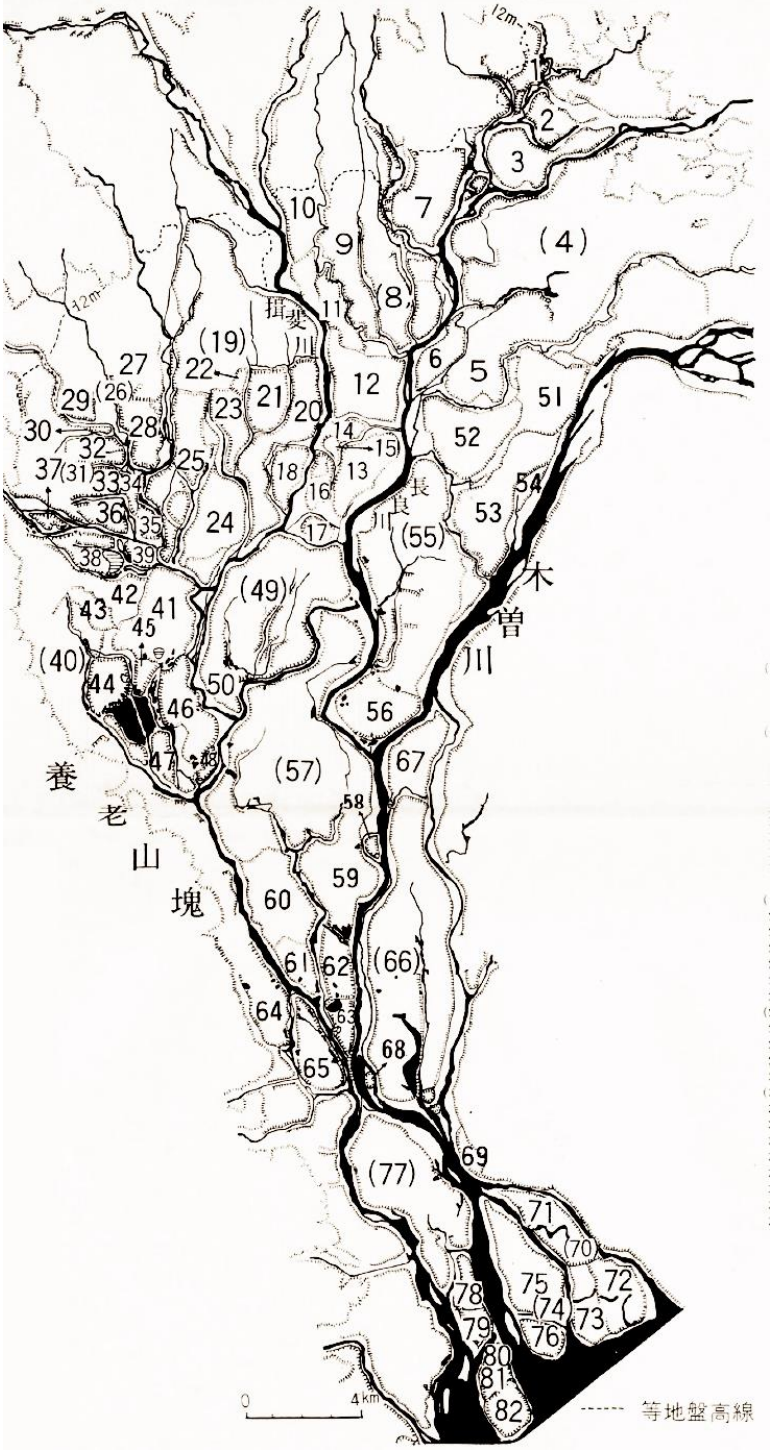
Channel works are well preserved (photographed by the author)

River management was a key challenge in Japan's Meiji era. As the nation moved away from a feudalist societal structure, its leaders sought to increase its economic productivity and strength by facilitating the unhindered traffic of people and goods. Thus, rivers, which previously stood as instruments of division, were now required to be managed safely and efficiently through planning approaches. As a result, from the early Meiji period onward, demands to regulate the Kiso River system, a major waterway in the Chūbu region, and to stabilise surrounding land uses grew increasingly urgent. Particularly important was the situation in the lower reaches of the Kiso River, where the perpetually flood-prone delta region consisted of "wajiuu", or polders, and where the communities that had developed within these levee-enclosed areas had become mutually immobilised.

Classification of Yandani sabo dams (information of the on-site information board)

De Rijke, who began working for Japanese government in 1873 (Meiji 6), had been involved with improvement projects for the Osaka Port and the Yodo River system. In 1878 (Meiji 11), he was sent to the Kiso River basin, where from February to March of that year he inspected the Kiso River, travelling downstream from Inuyama, where the river flows from the mountains into the plains. There, he surveyed this polder delta region, passing through Kasamatsu, Gifu, and Tsushima. In April, De Rijke authored a report titled “Overview of the Kiso River”, in which he discussed the situation regarding the lower reaches of the Kiso, Nagara, and Ibi rivers. Here, he identified the vast quantities of sediment carried by the Kiso River as the cause of the frequent and severe flood events.

In this system, transported sediment accumulated in the downstream riverbed. Consequently, during floods, the water level rose upstream, and as the river was prone to flooding, the surface water flowed into the Nagara and Ibi Rivers, leaving increasingly sediment-rich water to accumulate in the main Kiso River channel. As this process continued, it gradually increased the water volume of the Ibi River. In essence, this suggested the need to separate the Kiso River from the other rivers and discharge its water into the sea, which is the concept behind the Kiso River improvement project.



Distribution of ring levees in the downstream area of the Kiso river system

This model clearly reflected the situation in the Netherlands at the time, and it drew its inspiration from the mid-19th century Dutch national policy of radically reshaping Dutch river channels, which contained numerous streams and human interventions, to address the vast quantities of sediment carried downstream by the Rhine from Germany to the North Sea and to prevent the river from creating ice jams in winter. However, unlike the situation in the Netherlands,

in Japan's case the mountainous regions that were the source of the sediment were located within the nation's borders, thus making countermeasures more feasible. Thus, looking to the mountainous regions for opportunities was quite natural, and the Dutch engineer Van Doorn, looked here for ways to address these challenges when he first came to Japan.

The stone-built dam prototype had already been completed

In 1873 (Meiji 6), this approach gradually became clear when De Rijke came to Osaka to oversee the construction of its port. In 1874 (Meiji 7), along with fellow Dutch engineer G.A. Escher, De Rijke inspected the Fudō River, one of the headwaters of the Yodo River that flows into Osaka Bay, and one that had become a ceiling river[2] due to sediment flow from the mountains. Subsequently, Japan's first modern-era stone-built sediment control weir was constructed upstream. The weir is thought to be designed by Escher with construction overseen by De Rijke, who was testing traditional Japanese stone masonry techniques.

Subsequently, De Rijke and his colleagues urged the Japanese government to recognize the importance of protecting mountain forests and developing methods to prevent soil erosion. As a result, the third volume of the 1881 (Meiji 14) guide, "Essentials of Civil Engineering", introduced the approach termed the "Dutch method", and included fifteen techniques for "Bare Mountain Erosion Control Construction". The most often applied technique involved using brushwood to reinforce the bases of trees, and it is highly probable that this technique was also employed in the design of the Yandani erosion control project. Construction methods seen at this site include 'water-channel stone embankments', 'root stone walls', 'split-stone dams', and other techniques, as well as stone masonry constructions with slack-rope-shaped crests.

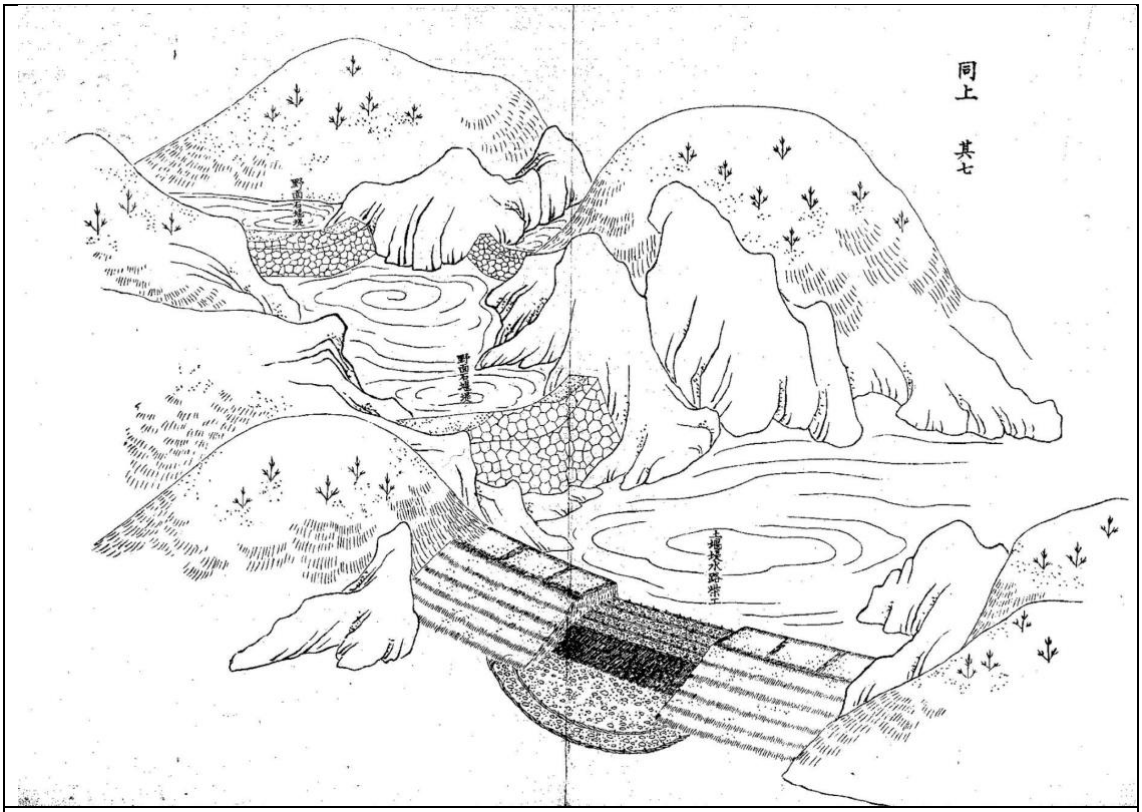
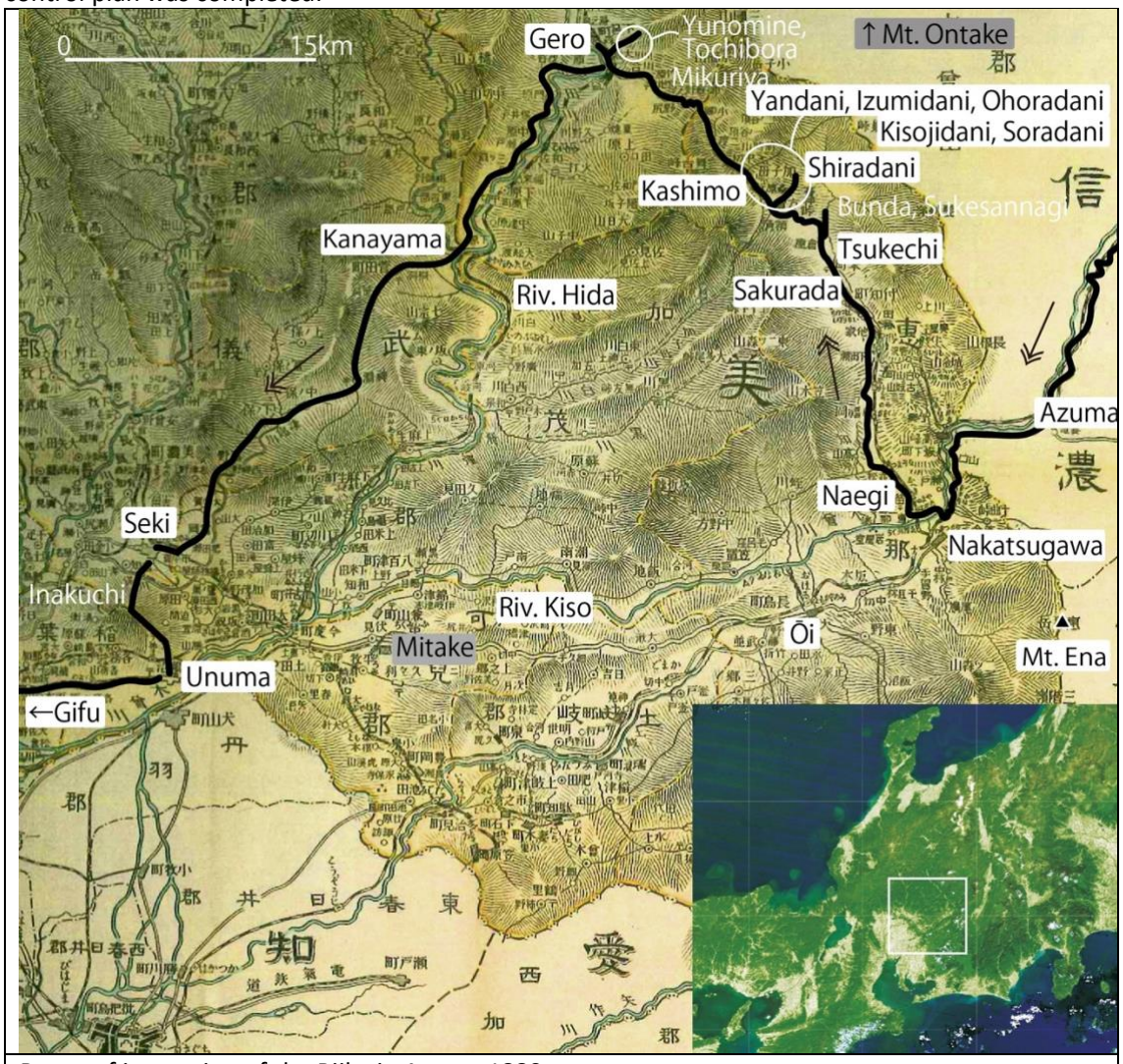


Figure of the Japanese-Dutch construction method "Nozura Ishi Entei" from "Dobokuko-youroku" (Essentials of Civil Engineering).

[2] This is a river where de bed is above the surrounding land.

De Rijke's inspections and instructions

In July 1878 (Meiji 11), when De Rijke published 'Overview of the Kiso River', he requested that the Civil Engineering Department of the Ministry of Home Affairs establish a post in the upper reaches of the Kiso River to investigate the causes of sediment generation for the Kiso River delta polder region. After his proposal was accepted, De Rijke himself inspected the 'most perilous areas' selected by local officials to determine appropriate construction plans and budgets. And while personal misfortunes and difficulties delayed its execution, by 1880 De Rijke's extensive erosion control plan was completed.



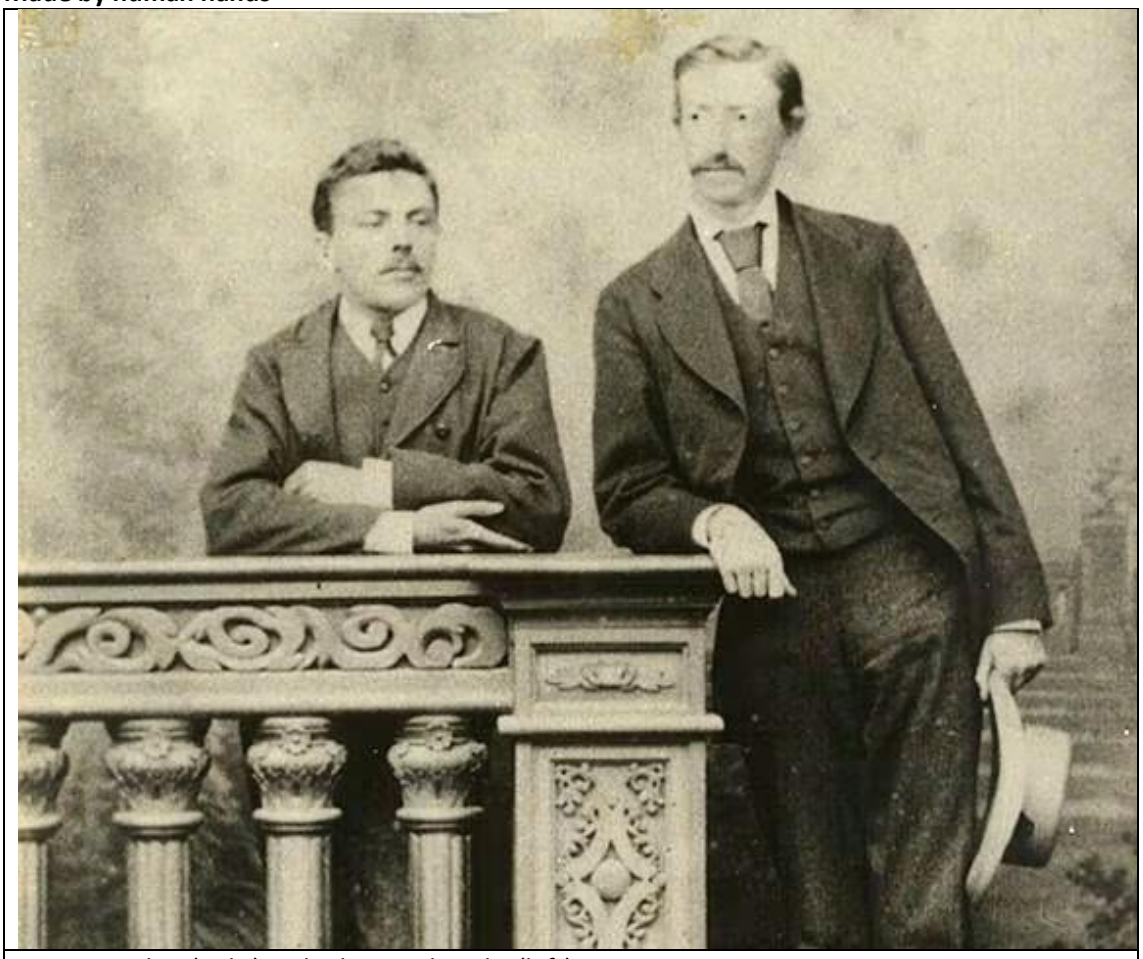
Route of inspection of the Rijke in August 1880

Over a ten-day period starting in August of 1880, De Rijke traversed a route from the Kiso River in Narai in Nagano Prefecture to Nakatsugawa, then followed the Atera Fault Zone to Gero, and finally moved onward via Kanayama and Seki to reach Gifu. During this journey, he advised on approaches for to address the collapsed and fragile sections of the mountains he travelled through. For example, he surveyed 4 km of the Shiradani near Yandani and specified a construction method for erosion control. And the same time, he recommended the same method for five other locations that he had not seen.

On the final day of his inspection tour, in Gifu, when asked which Kiso River corridor sections should undergo construction that year, De Rijke stated: 'Azuma Village, Tsukechi Village, Kashimo

Village, the western Kiso River area of the Naegi region, and Unuma Village.' Tsukechi, Kashimo, and Naegi lie within the Atera Fault Zone, which also contains the Yandani valley. However, as far as can be ascertained, the earliest record that explicitly mentions construction work in the Yandani valley can be found in an 1884 (Meiji 17) prefectural funding project document, which refers to 'Sakurada and Shiratani in the Tsukechi Village'. Both Sakurada and Shiratani were locations for which De Rijke directed the construction work.

Made by human hands



George Escher (right) and Johannis de Rijke (left)

Although he was initially hesitant, in 1881 De Rijke oversaw a project addressing the full-scale improvement of the Kiso River (Meiji 14). In August, De Rijke submitted a document entitled "Sand Control Works in the Kiso River Basin" to Japan's Civil Engineering Bureau. This document stated that the sand control construction budget in the upper reaches of the Kiso River was significantly underestimated, and argued that approximately four times the specified amount was required, which was likely a precaution De Rijke undertook before embarking on such a major undertaking.

Further, De Rijke wrote that he had heard how villagers had cooperated to swiftly restore the devastated forests in the region. Particularly noteworthy was his statement that 'in the vicinity of Ōi Ontake, approximately six villages had already planned the construction of small weirs and the planting of trees.' But where exactly were these six villages? Mori Yoshikazu, author of 'History of Erosion Control of Gifu Prefecture', reads Ontake as "Mitake" (both can be read with the same Chinese character) and presumes it to be slightly downstream. However, considering the close

vicinity of sites such Ōi and Mount Ontake, this may actually refer to the Atera Fault Zone.

Another clue lies in the work of Dr. Kamibayashi, who discovered, translated, and published correspondence between De Rijke and Escher, with whom he frequently exchanged letters. This correspondence reveals the route De Rijke took in 1881 when he revisited the upper reaches of the Kiso River. For example, one letter notes that on August 10th, he travelled “about seven miles north from Nakatsugawa to the boundary of Hida”, inspecting “parts of the hillslope projects constructed or paid for by residents themselves”. This route corresponds to the Atera Fault Zone, and the border with Hida aligns with the area of Kashimo and Tsukechi. Thus, it seems that the aforementioned villagers, who were among the first to undertake erosion control projects, were indeed from this region.

In conclusion, the Yandani Erosion Control Dam Complex, a project that remains today, was likely constructed in part through the collaborative efforts of residents who were motivated by the realisation that methods existed to address the challenge of soil erosion, and probably under the guidance of prefectural officials. Moreover, it is likely that undiscovered erosion control facilities from that period still exist across the slopes of this mountainous region, suggesting that narratives of this kind may still lie dormant.

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