報　　文

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Geology of the Dam Site Areas on the Nakagawa and Midorikawa Rivers

by
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Introduction

As a part of the Nakagawa and Midorikawa composite development project, the Minamihata and Shin-ōiso dams are now under contemplation. The present writer has surveyed the geology of the areas in the neighbourhood of the projected dam sites from the standpoint of engineering geology.

The Minamihata dam site area, situated along the upper course of the Nakagawa river to the south of Fukuoka city, presents a rugged topography flanked with mountains, and its geology consists largely of the Mesozoic Sawara granite. In the projected site of power plant and control dam, this granite constitutes the bed rock which is so widely exposed that there is no problem in geology for a large-scale construction. However, the weathered surface of the granite is highly friable and easily eroded. The weathered portion of the granite, generally called "masa", locally varies in thickness, and is supposed to cause much trouble in construction work. Therefore, boring survey in abvance is required.

The geology of the Shin-ōiso dam site area consists of granodiorite, granite-gneiss and limestone, which are the bed rocks, though they are covered by thick "Aso lava" or Aso welded tuff formation, on either side of the Midorikawa river.

No serious difficulties would be encountered in the construction of power plant and control dam on the granodiorite and other bed rocks. As to Aso lava, however, its thickness, lithological character and hardness must be made clear whether or not it is competent for such construction, and for this need some test borings are desired.

I. Geology of the Minamihata Dam Site on the Nakagawa River, Fukuoka Prefecture

1. Location and communication

The Minamihata dam is located in Nakagawa-machi, Fukuoka prefecture, and the power plant and control dam are situated near the entrance to Chikushi Yabakei, a valley famous for scenic beauty, about 1500 m down the river. A bus service is available from the center of Fukuoka city to the dam site 15 or 16 km south of the city. Thus, the dam site is conveniently situated for communication and transportation.

2. Topography

The Nakagawa river rises from the summit of Mt. Seburi, then flows north-

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ward along the east foot of the mountain, and farther runs through the city of Fukuoka, until finally empties itself into Hakata bay. The surveyed area is in the Seburi massif, being 700 to 800 m above sea level. As the stream rising in the massif has intensely dissected the land, the area in question is generally steep and rugged, but from the neighbourhood of Horikiri hamlet to the downstream region, the land becomes level owing to the terrace deposit structure.

3. Geology

The geology of the area is composed mainly of the Sawara granite which is

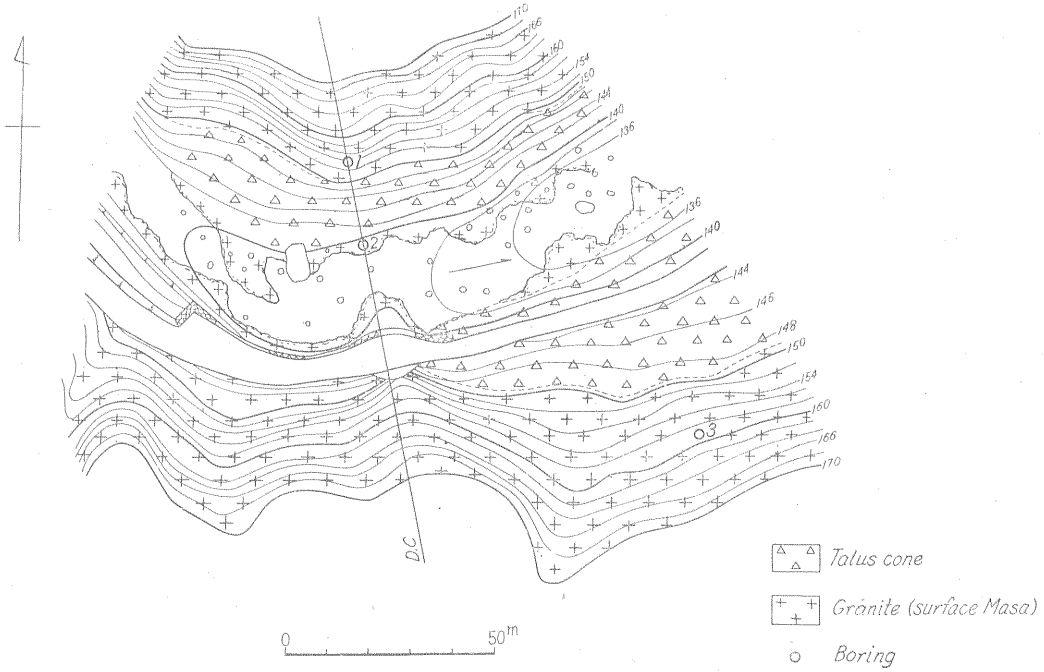

Fig. 1 Geological map of Shinminamihata dam site on the river Nakagawa (upstream)

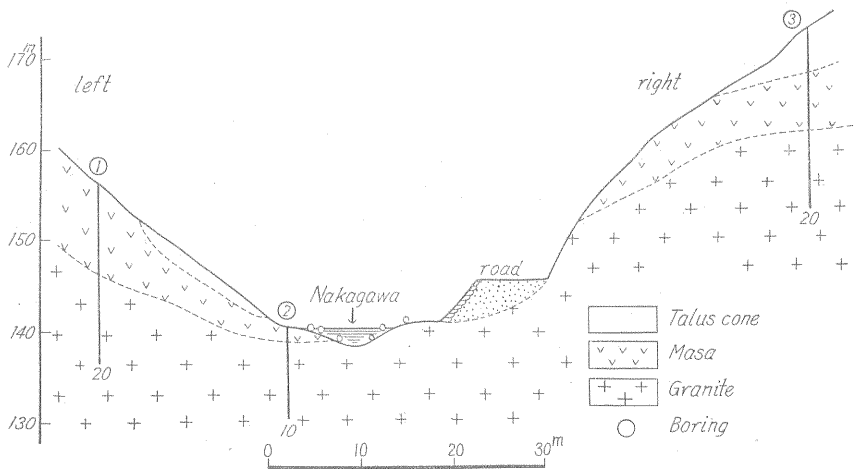

Fig. 2 Upstream section

widely distributed, together with "masa", talus cones, conglomerate, and terrace deposits derived from them. (Figs. 1 and 4)

The Sawara granite represents the last stage of the successive intrusions of granitic rock series in northern Kyushu, and is widely developed extending from the Chikushi Yabakei valley to Mt. Seburi. The granite is coarse-grained and gray, consisting of biotite, quartz and plagioclase, with a small quantity of muscovite. Basic inclusions are usually rare, but, if present, are often found in the portions rich in biotite. The weathered part of this granite is friable and sandy, and is called "masa". The boundary between "masa" and hard part of the granite is gradational, and the "masa" is locally as thick as several to ten meters. Talus occurs on the steep slopes of mountains or near river banks,

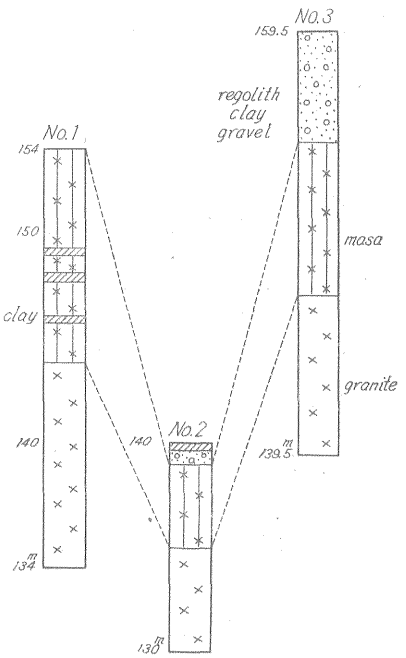

Fig. 3 Minamihata boring columnar section (upstream)

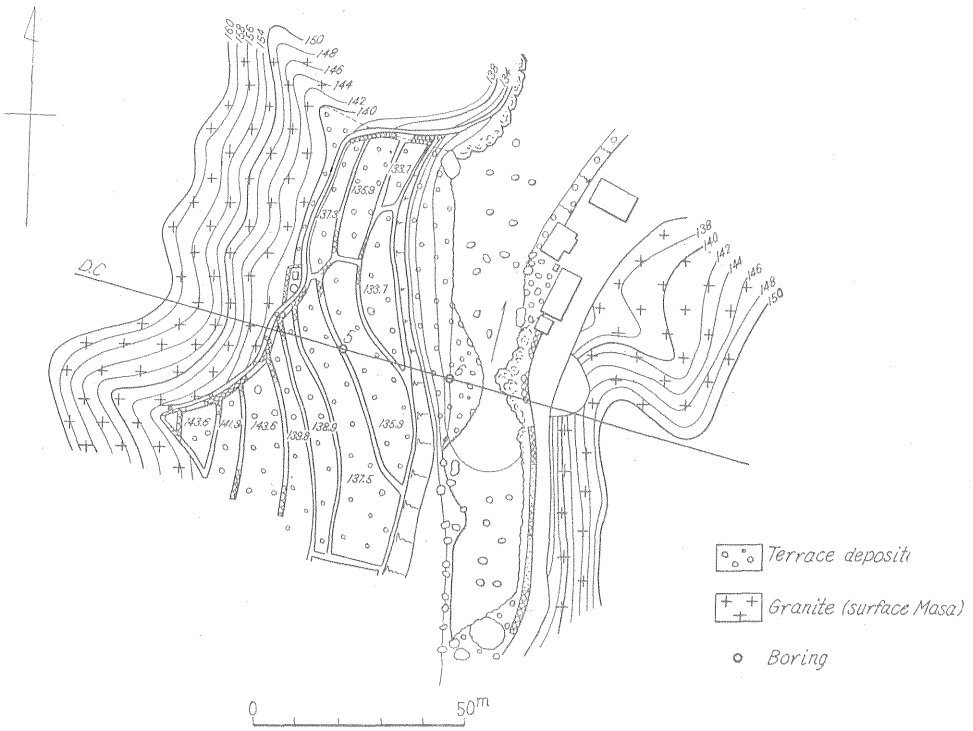

Fig. 4 Geological map of Shinminamihata dam site on the river Nakagawa (downstream)

and huge boulders are deposited on river beds. Terrace deposits are developed along the downstream from the hamlets of Horikiri and Oura.

4. Engineering geology

Construction of the Minamihata dam was contemplated by the Fukuoka prefectural office. The dam is a gravity dam, 63.5 m high, 241.0 m long, and has a 206,000 m^3 embankment capacity. With 4,860,000 m^3 water in total volume, the dam serves as a reservoir for irrigation and city water, as well as for flood-prevention purpose.

The water held back by this dam passes through the power plant which is planned to be constructed at about 1500 m down the river, and pours into the control dam farther downstream. The writer's survey in the vicinity of the control dam site has revealed that the bed rock is composed of the widely distributed Sawara granite and is well exposed in the valley and on the river bed. This hard bed rock would favor the construction of large structures, such as power plant and control dam.

The bed rock in the neighbourhood of the power plant and control dam site is covered by talus cones or "masa" of the granite. If all the overburden above the bed rock was stripped away, there would be no difficulties as far as the geology is concerned. With regard to the control dam site, there may be two different plans: one is what insists on fixing the site in the upper course of the river, and the other in the lower. In both cases, there arises a problem of overburden, because in the upper course the river bed is covered by boulders, talus cones and "masa", and in the lower granite boulders or small-scale terrace deposits are found on the left bank. The overburden was deposited on the bed rock or was derived from weathered bed rock. Hence, the thickness of overburden must be determined by boring tests.

5. Results of boring test

The columnar sections (Figs. 3 and 6) show the results of boring tests, and the geologic cross-sections (Figs. 2 and 5) illustrate the accumulated knowledge of geology of the area. Judging from the cross-sections, the upstream region

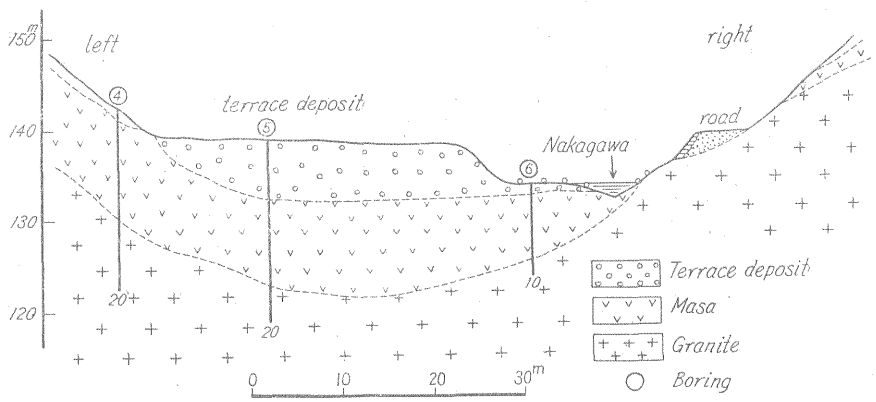

Fig. 5 Downstream section

seems to be more appropriate for dam site construction than the downstream region, because there the "masa", which must be removed, is the thinner of the two.

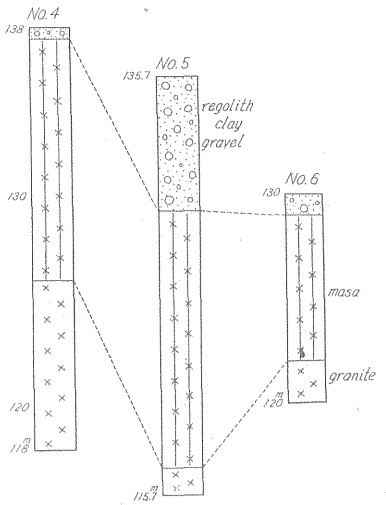

Fig. 6 Minamihata boring columnar section (downstream)

II. Geology of the Dam Site on the Midorikawa River, Kumamoto Prefecture

1. Location and communication

A bus service is available along the Midorikawa river to Tsuru hamlet on the south side of the prefectural highway between Kosa-machi and Hamano-machi, Kumamoto prefecture. The projected site of the power plant is in the hamlet of Tsuru, and the Shin-ōiso dam is located at about 1.5 km down the river.

2. Topography

The main stream of the Midorikawa river rises from the north of Mt. Mitakeyama in Kamimasuki-gun, Kumamoto prefecture, and flows westward. After joining several tributaries on its way, the river pours into Ariake bay. The drainage basin of the Midorikawa river covers an area of 1102 km^2 and 71.5 km

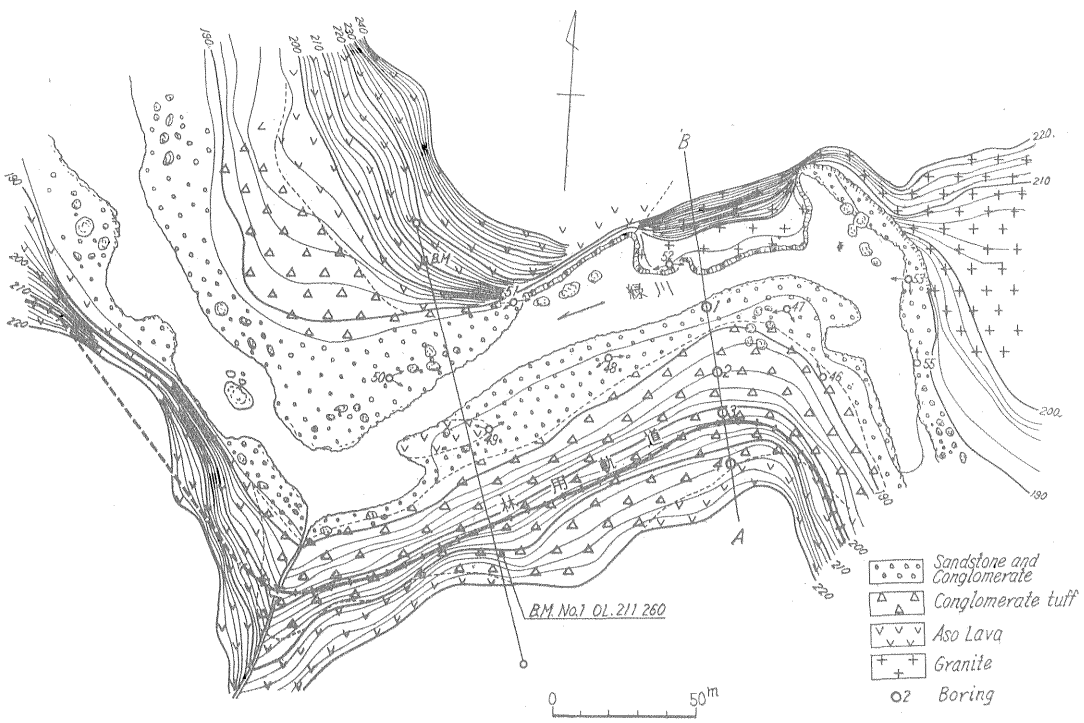

Fig. 7 Geological map of Shin-ōiso dam site on the river Midori

in length. The main stream flowing eastwest in the V-shaped valley is eroding and dissecting the Aso lava, and a few fluviatile plains are found only at the places where the river meanders.

3. Geology

The drainage basin of the Midorikawa river is bounded by the Midorikawa fault line which runs along the south side of the river. The area on the south of the fault line is composed of Mesozoic sedimentary rocks, whereas the area on the north Paleozoic rocks including granite-gneiss and limestone, together with granodiorite which occurs along the fault line, all being covered by the thick Aso lava. (Fig. 7)

The granodiorite is known as the Miyanohara granite, sporadically cropping out along the Midorikawa fault line. It is well exposed on the river bed and in the river cliffs. The rock is hard and partially leucocratic or marked with large phenocrysts of feldspar. The granite-gneiss is called the Higo gneiss and is widely distributed on the north side of the granodiorite. The rock is fairly schistose, occasionally resembling a biotite schist or a quartz schist. The limestone, sometimes considerably thick and extensive, occurs in the gneiss. It is crystalline with a few joints, locally silicified due to the intrusion of younger granodiorite.

The Aso lava, extensively covering the surveyed area, makes sharp-cut cliffs along the main stream of and tributaries to the Midorikawa river. Because of the remarkable columnar joints, the rock has a rugged and soaring aspect. The lava lithologically ranging from andesitic, basaltic, tuffaceous or muddy agglomeratic lava to ash-stone.

Where the lava is contact with the bed rock at low angles, a bed of weathered tuffaceous lava 1 to 2 m thick is found at the contact (Pl. 1), and this

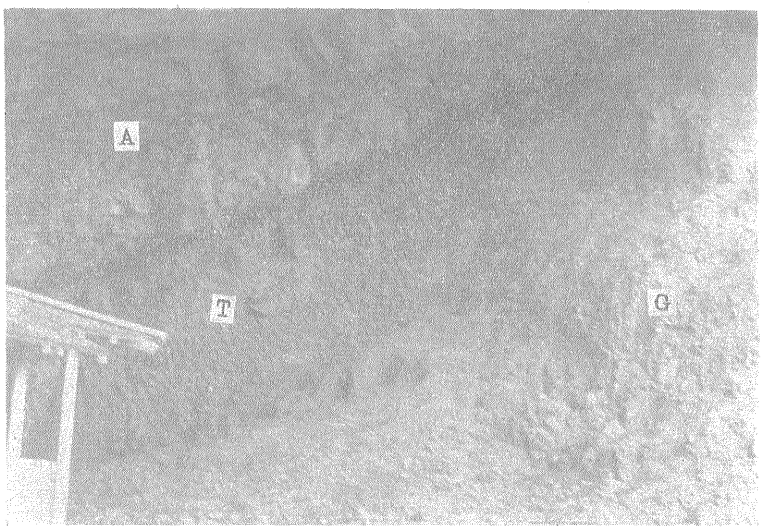

Plate 1 Aso lava (A) in contact with the bed rock (G : Higo-gneiss) at low angles; weathered tuffaceous lava (T) 1 to 2 m thick is found at the contact. On the left bank of the Tsuru power plant, Midori-kawa (river).

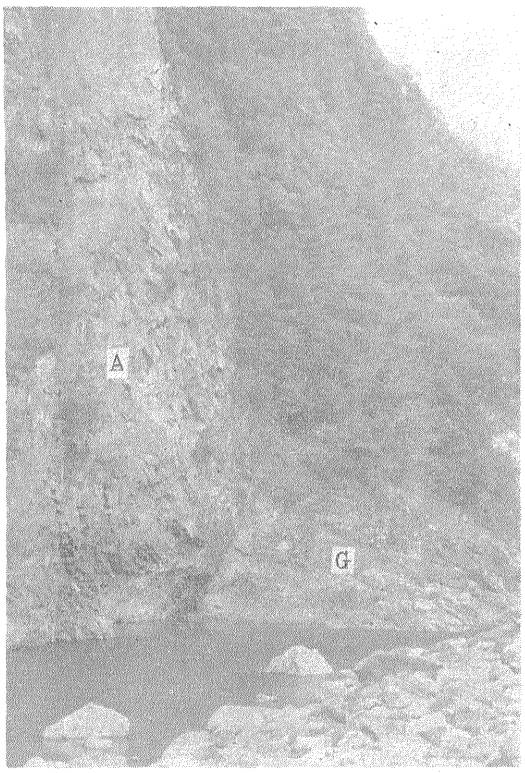

Plate 2 Aso lava (A) in direct contact with the Miyanohara granodiorite (G), on the right bank of Snin-ōiso dam site, Midori-kawa (river).

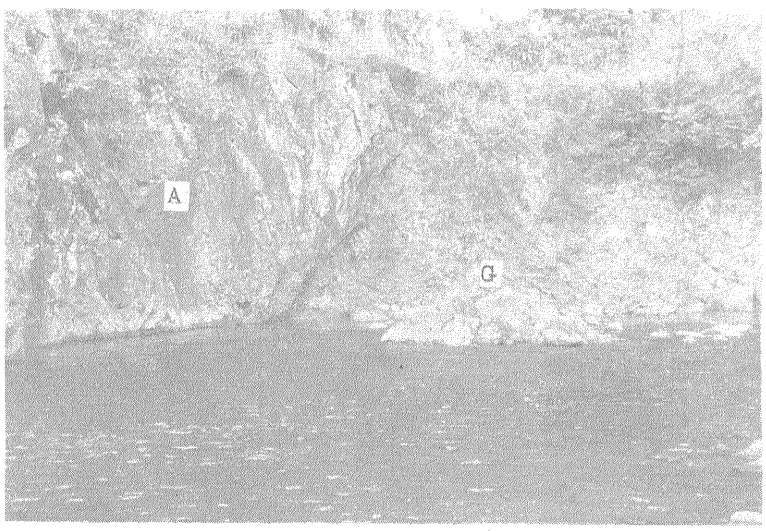

Plate 3 Aso lava (A) accumulated at high angles on the Higo-gneiss (G). At the Tsuru power plant, Midori-kawa (river).

weathered bed has become a sliding surface or a permeable bed. Where the angles are high, the lava is in direct contact with the bed rock (Pls. 2 and 3).

4. Engineering geology

4.1 Shin-ōiso dam site

The geology of the Shin-ōiso dam area consists of granodiorite and the Aso lava. On the right bank of the river, there is a place where the granodiorite is contact with the Aso lava at an apparent angle of about 65° (Pl. 2). This is a case where the younger lava flows rest directly upon the bed rock, and it is inferred that the deep part beneath the river bed is made up of granite. The left bank is covered by talus cone of the Aso lava and seems to be loose lithologically. Therefore, test boring is desirable in order to clarify the thickness of the river bed and the talus cone.

4.2 Tsuru power plant

The neighbourhood of the projected site of the Tsuru power plant consists of the Aso lava which has accumulated at high angles upon the granite or gneiss (Pl. 3); hence the geological condition is stable there.

4.3 Result of test boring

To acertain the above-mentioned geological conditions, four test borings were made at Shin-ōiso, and the result is summarized in the columnar sections (Fig. 9).

The result of boring has revealed that on the left bank the granodiorite constituting the bed rock plunges into the depths, and its surface is markedly weathered and oxidized forming a thick mantle of "masa". It has become known also that the sedimentary conglomerate bed, more than 20 m thick, rests upon

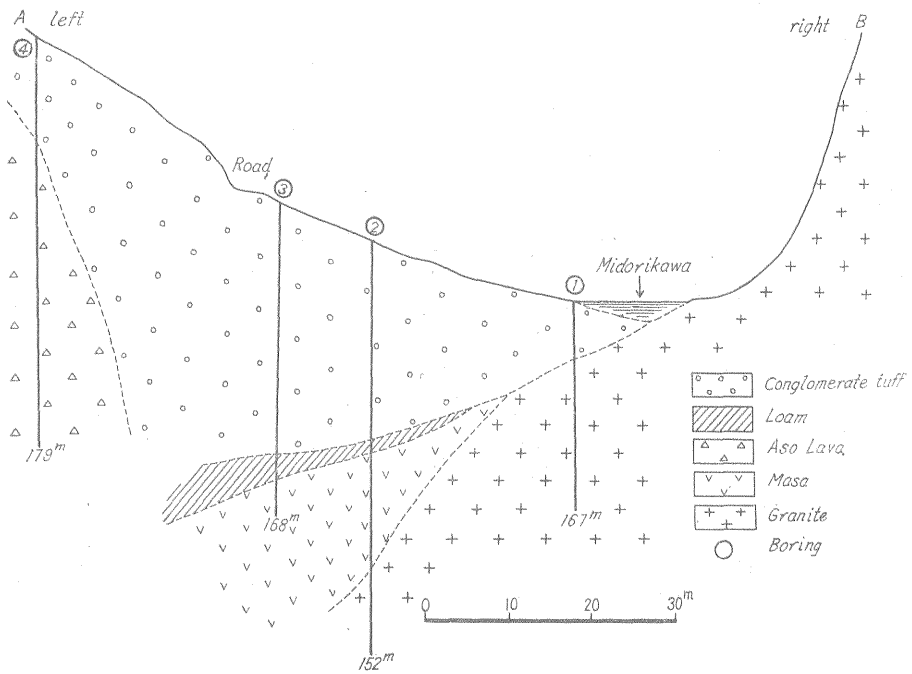

Fig. 8 Midorikawa Shin-ōiso dam section

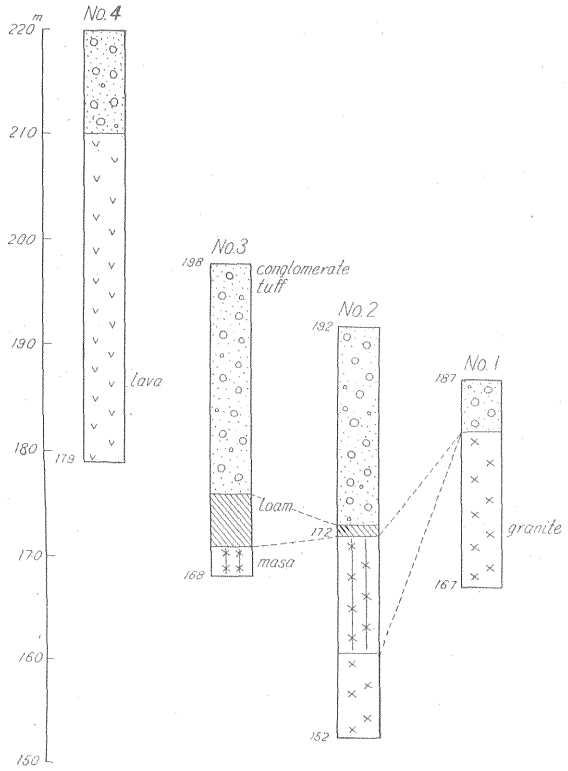

Fig. 9 Midorikawa Shin-ōiso boring columnar section

the bed rock (Fig. 8).

5. Conclusion

Although Shin-ōiso has been regarded as a suitable dam site in view of the topographical and geological conditions, the result of test boring proves that this site may not be the best place for dam construction, because the "masa" and sedimentary conglomerate are so thick. However, to the site of the Tsuru power plant, it may safely be said that there are no geological difficulties.

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福岡県那珂川南畑ダム地点，熊本県緑川新大井早地点地質調査

稲 井 信 雄

要 旨

福岡県那珂川総合開発事業の一部に南畑ダムサイトに伴なう調整池計画，熊本県緑川総合開発事業の一部に新大井早地点において調整池ダムを設けようとする計画がある。筆者はこれら地点の周辺の地質を主として応用地質学的見地から調査した。

前者は福岡市の南部，那珂川上流の山間急峻な地形をなし，その地質は中生代早良花崗岩である。発電所予定地，調整池付近の基盤は早良花崗岩が広く露出しているため，大きい構造物に対して難点はないが，この花崗岩は風化作用が著しく，岩石の表面は脆弱である。

後者を構成する地質は基盤岩である花崗閃緑岩・花崗片麻岩・石灰岩とこれを厚く覆っている阿蘇熔岩である。発電所，調整池ダム等の地上構造物に対して，花崗閃緑岩や，その他の基盤岩は問題でないが，阿蘇熔岩の厚さや岩質，硬度などの検討が必要である。

以上の両者に対し若干の試錐調査が望まれる。