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Paleogene talus deposits, Okayama City, Southwest Japan

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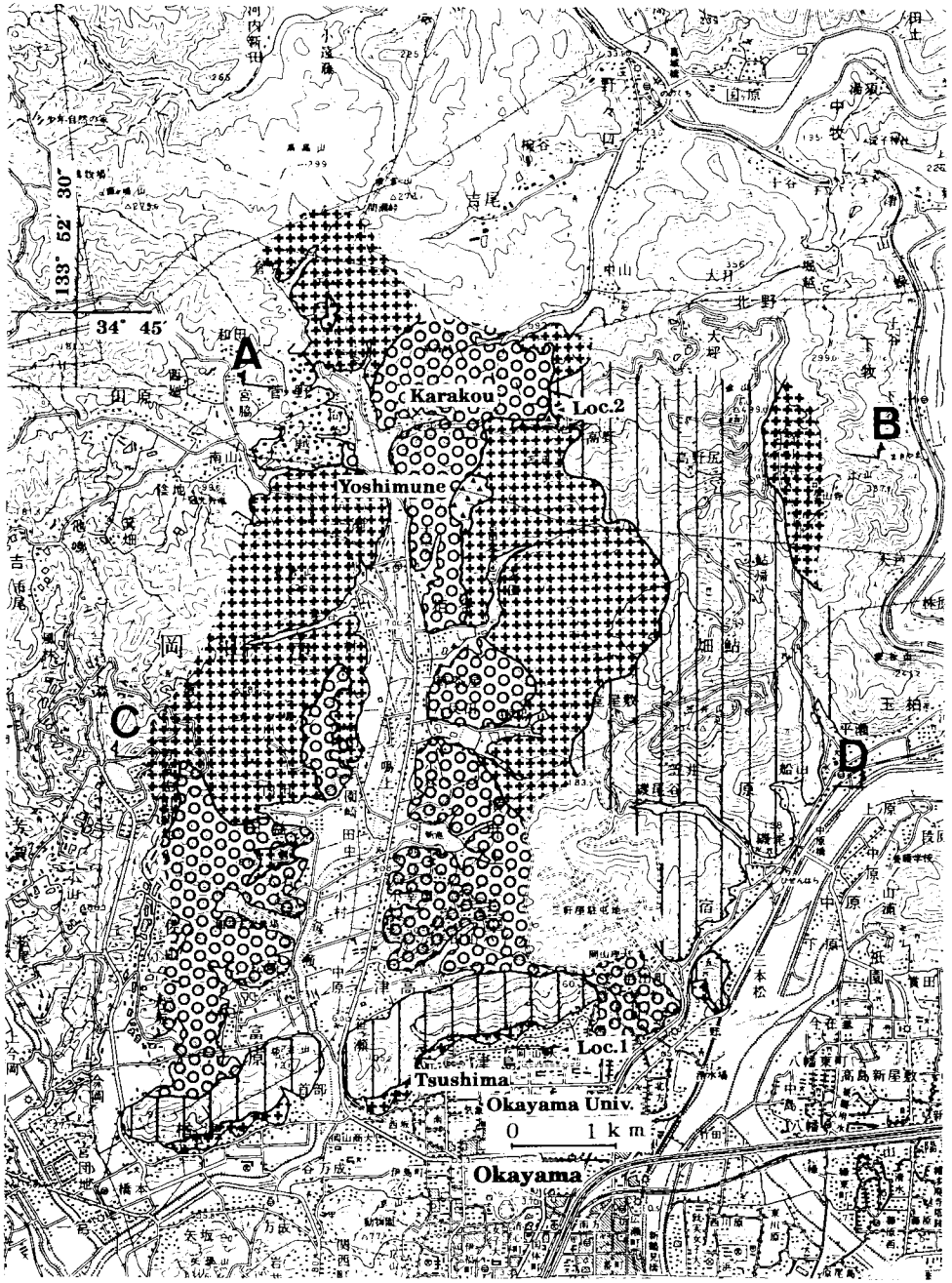
In eastern Chugoku area, Paleogene deposits have not been recognized until fission-track dating of so called "Mountain Gravels" was carried out (Suzuki et al. 1995). Two sedimentation events in Paleogene time (27Ma and 34-35Ma) are inferred by the F-T dating. Major lithology of the Paleogene deposits in the study area is gravel which is mainly composed of subrounded to rounded cobbles. The "Mountain Gravels" were previously thought to be lower Quaternary deposits. The "Mountain Gravels" is associated with coal bearing mud, sand, gravel and breccia deposits.

The breccia deposits is distributed sporadically between the "Mountain Gravels" and basement rocks. The deposits are mainly composed of poorly sorted breccia and associated granitic sands. It is inferred that the breccia deposits are talus deposits.

Keywords: Paleogene, breccia, talus deposits, fission-track dating

I Introduction

The Chugoku Province can topographically be divided into 4 E-W trending areas; Japan Sea side plane, Chugoku Mountains, Kibi Plateau and Seto Inland Sea side plane, from north to south in ascending order. The Kibi Plateau has steep slopes but remains comparatively flat land. This Plateau in central Okayama Prefecture is composed of Pre-Tertiary basement rocks with sporadic Tertiary covers. The Tertiary deposits consist of coal bearing strata (composed of coal bearing mud, sand and gravel deposits, and breccia deposits), gravel strata (so called "Mountain Gravels" or "Yamajari Formation") and marine strata. The marine strata are Miocene in age on the bases of abundant index fossils. The age of the non-marine strata are inferred to be Miocene because they are overlain by Miocene deposits without intense unconformity (Imamura, 1966). The "Mountain Gravels" was also estimated to be Pleistocene to Quaternary in age based on its unconsolidated nature, and is thought to deposit under the formation of the Kibi Plateau. However Suzuki et al.(1995) obtained fission-track dating of 35.8±1.4 Ma and 34.3±1.8 Ma from tuff beds in the "Mountain Gravels". These dating show that Paleogene deposits exist and it is thus necessary to reexamine the age of the Tertiary deposits in the Kibi Plateau. Recently Suzuki et al.(1996) obtained fission-track dating of 34.0±2.7 Ma from the non-marine strata and showed that the coal bearing strata and "Mountain Gravels" were deposited at the same episode. The aim of this paper is to describe the breccia deposits which form part of coal bearing strata.



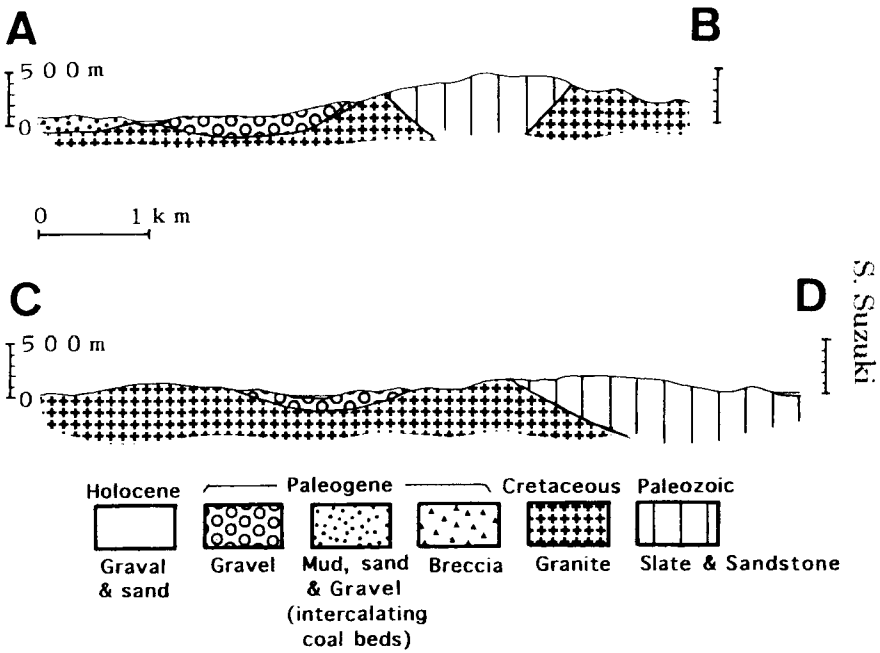


Fig. 1; Geological map and cross sections of the study area.
The topographic map of Okayama Hokubu at scale 1:50000 from the Geographical Survey Institute.

II Geological setting

Study area is located in the northern part of Okayama City. It is composed of Pre-Cretaceous rocks, Cretaceous granites and Paleogene deposits. The pre-Cretaceous rocks consist of deep sea deposits (the Mantomi and Ejiri Formations, Suzuki et al. 1988), the Yakuno complex (diabase and cataclastic tonalite) and the Lower Formation of the Maizuru Group (basic volcanic rocks) from south to north in ascending order. The pre-Cretaceous rocks are intruded by granites and occasionally by rhyolitic and andesitic dykes.

Paleogene deposits almost horizontally overlie these pre-Tertiary rocks. The Paleogene deposits consist of gravel deposits ("Mountain Gravels"), coal bearing mud, sand and gravel deposits, and breccia deposits. They thought to be of alluvial deposits which deposited taking place in river valleys in mountainous areas (Suzuki. 1996). These Paleogene deposits are not consolidated completely but are stiff. Fission-track dating (as mentioned below) and their close distribution show that they were deposited in the same sedimentation episode.

The breccia deposits is associated with sandy mud to muddy sand beds and granitic sand beds. They are interpreted as talus deposits as describe below.

III Breccia Deposits

This deposits is characterized by brecciation. Because the breccia is indistinguishable from Quaternary talus deposits and its narrow distribution, this deposits have not been recognized as Paleogene deposits and have not been described.

Distribution and typical locality

This Formation is exposed in some small isolated area; Tsushima, Yoshimune and Karakou(Fig.1). These areas are adjacent to where the "Mountain Gravels" is distributed. A typical outcrop is located in the northern part of Okayama University, Tsushima, Okayama City (Loc. 1 in Fig. 1). The deposits crops out well around a small hill (about 100 square meter and several meters high) in the University campus.

Stratigraphic relationship and age

The deposits rests unconformably on Cretaceous granites and Pre-Cretaceous rocks with undulating boundary. The "Mountain Gravels" cuts and overlies the breccia deposits with steeply inclined boundary in Karakou (Loc.2 in Fig.1). However, at an outcrop at Okayama University, the breccia deposits include gravel beds with rounded clasts which were possibly derived from the "Mountain Gravels". In addition to the close distribution of the breccia deposits and the "Mountain Gravels" they are thought to be deposited in the same sedimentary episode. Fission-track dating on a sample collected from the "Mountain Gravels" at Miyaji, Kumenan Town, which is traceable to the "Mountain Gravels" in the study area, is 27.1±1.5 Ma (Suzuki *et al.*, 1996). A similar age of 27.4± 1.9Ma (fission-track dating) was obtained on the coal bearing mud, sand and gravel deposits, source at Tsudaka, Okayama City.

From the above, it is concluded that the age of the breccia deposits in the study area is Oligocene (around 27Ma). And these three deposits; the gravel deposits, the coal bearing mud, sand and gravel deposits and the breccia deposits are successions of the same age.

Thickness

Total thickness of the breccia deposits are uncertain. It is however inferred to be more than

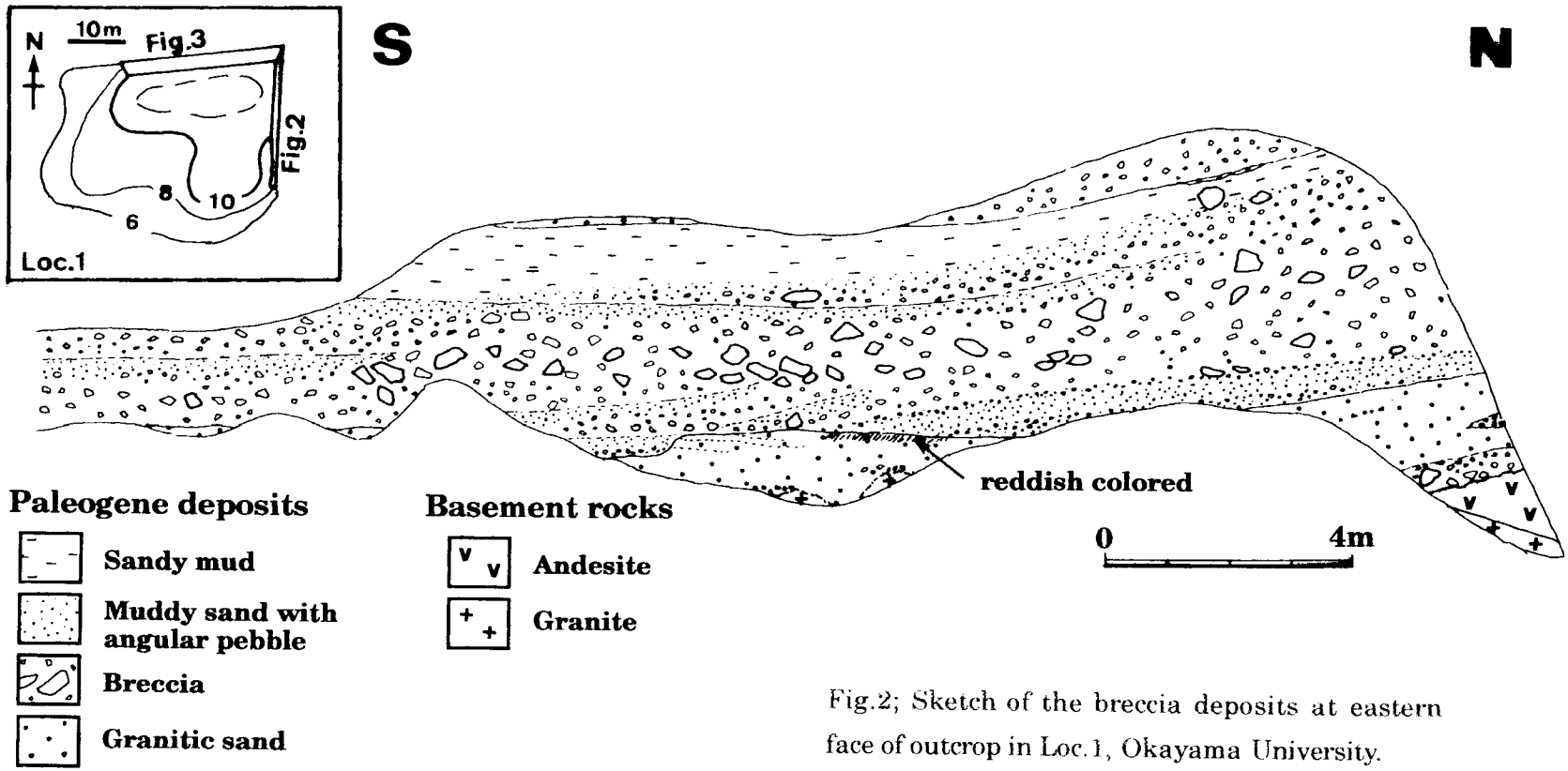


Fig.2; Sketch of the breccia deposits at eastern face of outcrop in Loc.1, Okayama University.

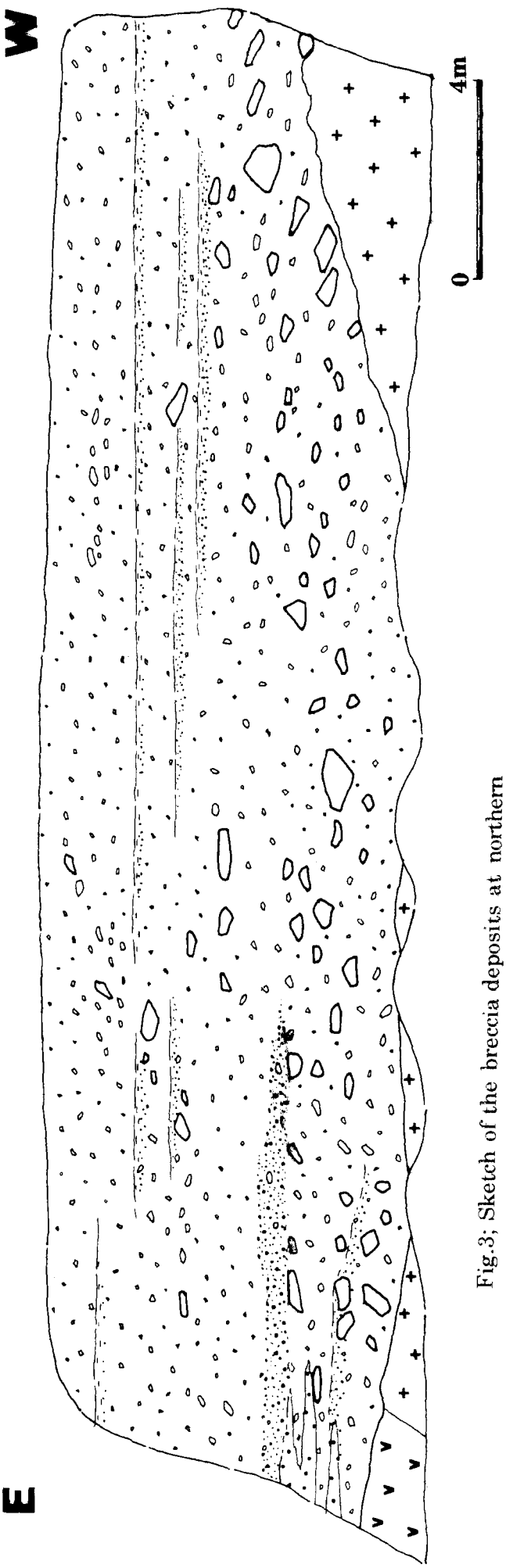


Fig.3; Sketch of the breccia deposits at northern face of outcrop in Loc.1, Okayama University.

200m from topographic map, because the deposits are almost horizontal.

Lithology

The breccia deposits are composed of two main units: breccia unit and granitic sand unit. The breccia unit is dominant and consist of poorly sorted breccia with lenticular thin sandy mud beds. The breccia part and sandy mud part are almost massive and structureless. However, some upward-fining places (lower breccia to upper sandy mud) are observed. The granitic sand unit overlies granitic basements and change laterally to breccia unit with interfingering relationship. This unit consists of clasts derived from weathered granites with occasional angular pebbles to cobbles clasts derived from the Pre-Cretaceous rocks.

Facies

Within the breccia unit, two facies are recognized: the breccia facies and sandy mud facies. The granitic sand unit is composed of deposits of granitic sand facies.

The breccia facies is rich in matrix and characterized by poorly sorted angular clasts. Some of them are matrix-supported. The clasts are angular to sub-angular in shape and pebble to boulder in size. The clast lithologies of breccia are Pre-Cretaceous rocks,granites and rhyolitic and andesitic dike rocks. Clast imbrication is not observed. The matrix material consists of coarse-grained lithic and crystal (quartz and feldspar) clasts, finer sands,silts and clay.

The sandy mud facies occurs within the breccia facies in a repetitive manner. The bases of this facies are not sharp. It is overlain by the breccia facies with rather sharp boundaries. It show that the breccia facies and sandy mudstone facies make up fining-upward successions. Generally, the facies consist of silts, clay and fine- to coarse-grained sands. It often contain angular pebble clasts and muddy sand part.

The granitic sand facies consists of coarse-grained sand and blue grayish clay and are characterized by bimodal sediments. Sandy clasts are angular in shape and compose of quartz, plagioclase and potassium feldspar. These clasts show granitic composition and are inferred to be derived from granites. Some upper parts of granitic sand are eroded, and have reddish brown color just like weathered parts.

Ⅳ Sedimentary environment of the breccia deposits

The breccia facies and sandy mud facies are interpreted as debris flow deposits. They are distributed just beside the provenance areas. Beddings of these facies are inclined up to 15 degrees to the opposite sides of provenance areas. These facts support the idea that the facies deposited on slopes and at bottom of slopes as talus.

The occurrence of granitic sand facies with angular clasts and bimodal sediments suggest that the weak transport current. The granitic sandstone facies are also interpreted as talus deposits with provenance of dominantly weathered granite.

It appears from the above that deposition of the breccia deposits took place in an undulating topography.

Ⅴ Summary

1.The breccia deposits are composed of breccia facies, sandy mudstone facies and granitic sandstone facies.

2. The breccia deposits are interpreted as talus deposits.

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