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Geological Situation of the Cretaceous Hiroshima Granite*

By.

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Introduction

The areal occurrence of granitic rocks in the Chûgoku and Setouchi districts has long been noted among Japanese geologists, and the name "Chûgoku batholith" has been applied to them. In recent years, however, it has proved to be incorrect to regard all the granitic masses iu Chûgoku and Setouchi as intruded at one and the same phase of igneous activity. In the eastern region of Yamaguchi Prefecture, the writer and Y. OKAMURA (1952) have distinguished between the Ryôké granitic intrusives (perhaps of late-Palaeozoic or early-Mesozoic) and the Cretaceous granite. While in the inland part of Chûgoku, Prof. Y. KINOSAKI (1953) has divided the area occupied by the "Chûgoku granite" in two provinces, the San-in granite province (the northern belt) and the Hiroshima granite province (the southern belt), which are characterized, respectively, by hydrothermal or mesothermal molybdenite and sericite deposits and by pneumatolytic and hydrothermal or hypothermal wolframite deposits and great pegmatite deposits. He has also pointed out the existence of intermediate zone between these two provinces and the eminent discontinuous character at the boundary between them. For recent several years the writer has been engaged in the tectonic study of the basement formations of Chûgoku and Shikoku, and the summary of recent knowledge has been published in this journal (G. KOJIMA, 1953). In the present paper, the writer intends to describe the geological situation of the Cretaceous Hiroshima granite on the standpoint of basement geology of Chûgoku and Shikoku.

Distribution and Characteristics of the Cretaceous Hiroshima Granite

The distribution of the Cretaceous Hiroshima granite may be read

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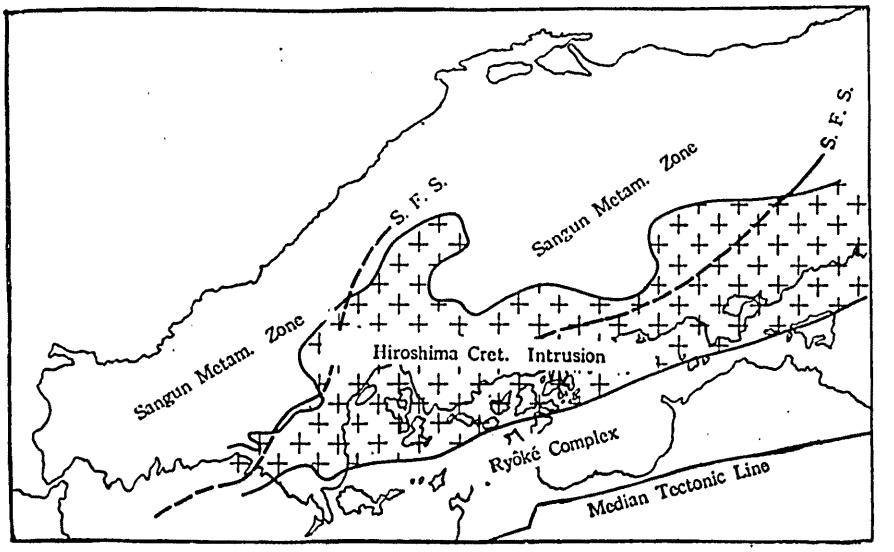

Fig. I. The distribution of the Cretaceous Hiroshima granite and the geological division of basement formations of the Chûgoku and Setouchi districts
S. F. S. Sangun frontal shear-zone

in Fig. 1. The area of the Hiroshima Cretaceous intrusion in Fig. 1 involves granite masses and the adjoining thermal aureoles. The southern boundary of the Cretaceous intrusion runs parallel to the Ryôké metamorphic zone, while the northern boundary is rather irregular. The width of the area of Cretaceous intrusion varies from 50 km to 100 km, and the extension in the direction ENE–WSW exceeds 300 km. The intrusion is the largest one of batholitic type in Japan.

Characteristic features of the Cretaceous Hiroshima granite are briefly summarized as follows:

1) The rocks are coarse-grained, leucocratic biotite-granite, often with hornblende. Potash-feldspar (mainly orthoclase) attains to 2~3 cm in length, but rarely porphyritic. It often assumes a pink colour. Plagioclase is zoned normally from andesine to oligoclase. Biotite is often chloritized.

2) The marginal facies of the intrusive becomes sometimse leucocratic (aplogranitic) or finer-grained, but the transition to granite-porphyry or quartz-porphyry can not be found.*

* Formerly, the transitional relation between granite and porphyry was believed in the inland part of Chûgoku, but so far as the writer knows, the porphyries and rhyolites are always intruded and thermally metamorphosed by the Hiroshima granite.

3) The rocks are highly homogeneous and massive. Xenoliths or basic inclusions are very rarely found. Basic inclusions show rounded shape or schlieren. Pegmatite is always found as pockets or schlieren-like masses, often intimately related to basic schlieren. Fine-grained aplite forms small dikes. Quartz vein is not rare.

4) Platy flow structure is generally recognizable, but linear flow structure can hardly be discriminated. The surface of pegmatite schlieren often coincides with the platy flow surface. Aplite dike and quarts vein cut the flow surface.

5) The width of thermal aureole related to the Cretaceous Hiroshima granite averages 500 m. The metamorphism is mainly caused by heat effect at the time of intrusion. Silicification and chloritization are sometimes found. The intrusion contact is sharp and discordant. Injection of granitic and aplitic vein or dike into country rocks is not developed. The growth of large andalusite porphyroblast in argillaceous sediment and the formation of skarn minerals such as wollastonite, hedenbergite-diopside, vesuvianite, garnet, epidote in impure calcareous sediment in the thermal aureole are characteristic. Ore deposits of contact type are abundant in the thermal aureole. The development of pneumatolytic and hydrothermal or hypothermal wolframite deposit and pegmatite deposits in granite also characterize the intrusion.

6) In the area of the Cretaceous Hiroshima granite are found patches of Palaeozoic and Mesozoic formations, porphyrites and porphyries as roof-pendant. The contact surface of these roof-pendants with granite is nearly horizontal. It is a striking fact that the middle-Cretaceous Inkstone series in the area of the Cretaceous intrusion shows no signs of deformation related to the intrusion. The Palaeozoic formations occurring as roof-pendants also retain the original structural trend. No signs of forcible intrusion are detected. Judging from these facts, the intrusion of the Cretaceous Hiroshima granite may have been connected with the gentle warping of Chûgoku in the late-Cretaceous.

Basement Structure of Chûgoku and Setouchi and Geological Situation of the Cretaceous Hiroshima Granite

In his paper treating of the mutual relations between three metamorphic zones of Chûgoku and Shikoku, the present writer has divided the basement formations of the Chûgoku and Setouchi districts into the

following zones (see G.KOJIMA, 1953):

N Sangun metamorphic zone
(Sangun frontal shear-zone)
Intermediate non-metamorphic zone
Ryôké metamorphic zone
(Median Dislocation Line)
S Sambagawa metamorphic zone

The Sangun metamorphic zone is composed of lower formations of crystalline schists (mainly belonging to the chlorite-zone, locally to the biotite-zone) and upper formations of non-metamorphic Palaeozoic sediment. The terrain of the crystalline schists is divided from the intermediate non-metamorphic zone with a distinct share-zone, named the Sangun frontal shear-zone, which consists of sheared Palaeozoic sediments. The Ryôké metamorphic zone is composed of schistose biotite-hornfels or biotite-schists, banded gneisses, migmatitic gneissoze granodiorites, and intrusive granodiorites.

The Cretaceous Hiroshima granite has been intruded mainly into the non-metamorphic zone, but near its northern and the southern boundary lines, the southern part of the Sangun metamorphic zone and the metamorphic rocks and granodiorites of the Ryôké metamorphic zone have also been intruded by the granite. It can safely be said that the intrusion of the Cretaceous Hiroshima granite mainly occurred in the zone of non-metamorphic basement rocks, which is believed to be more susceptible to igneous injection than the more crystalline zones composed of schists, gneisses, and granitic rocks. The distinct feature that the southern boundary line of the Hiroshima granite is rather linear, while the northern boundary line is very irregular, may be explained by the difference in crystallinity between the Ryôké and the Sangun metamorphic zones.

The abnormal width (ca. 100 km) of the Hiroshima granite in the Hiroshima district and the sharp decrease in width in the eastern region of Yamaguchi Prefecture may be related to the disposition of the Sangun metamorphic zone (see KOJIMA, 1953, Fig. 1 and 2). To the west of Hiroshima Prefecture, the Sangun metamorphic zone runs NE-SW, while to the east the zone runs ENE–WSW. There is fonud a gap in occurrence of crystalline schists in the zone running from Hiroshima to Matsué. In this zone the Hiroshima granite spreads far to the north.

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