Comment [on "Origin of the Chichibu Sea, Japan: Middle Paleozoic to Early Mesozoic plate construction in the northern margin of the Gondwana continent" by S. Otoh, S. Yamakita, and S. Yanai]
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SEA, JAPAN: MIDDLE PALEozoic TO EARLY
MESOzoIC PLATE CONSTRUCTION IN THE
NORTHERN MARGIN OF THE GONDWANA
CONTINENT" BY S. OTOH, S. YAMAKITA,
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INTRODUCTION

In a recently published paper dealing with the Late
Paleozoic-Triassic geohistory of SW Japan, Otoh
et al. [1990] deny the existence of a Permian-Triassic
orogeny. Nevertheless, this event has been studied in
many places and for a long time, from the petrologic,
stratigraphic, structural, geochemical and
godynamic points of view. It has been called the
Akiyoshi orogeny in Japan and, in a more general
sense, the Indosinian orogeny in eastern Asia [e.g.,
Kobayashi, 1941, 1978; Kimura, 1974; Tanaka and
Nozawa, 1977; Maruyama and Seno, 1986;
Caridroit et al., 1987; Faure and Charvet, 1987;
Faure et al., 1988; Charvet et al. 1990]. The
Akiyoshi orogeny is recognized from central Japan
up to the South Ryukyu islands for more than 2500
km. The deformation structures related to the
Akiyoshi orogeny are best preserved in the Inner part
of SW Japan (i.e., on the Sea of Japan side). They
are sealed by Late Triassic continental or shallow
water deposits which rework Permian sedimentary
and metamorphic rocks.

Before the flaws of the proposed geodynamic model
are discussed, some wrong statements have to be
corrected.

1. Although not directly concerned with the topic of
the paper, the assertion that the high pressure
Sanbagawa metamorphism is post-Aptian is
incorrect. Radiometric data obtained by the 39Ar/40Ar
method indicate older ages, around 130 Ma, i.e.,
Berrissian-Valanginian [Monié et al., 1988; Takasu
and Dallmeyer, 1990].

2. More important is the description of the
geological zonation. In particular, the so-called
"Chizu Belt" does not exist. The four arguments
given by the authors in favor of the existence of this
belt are groundless. Chaotic occurrence of Permian
and Triassic chert is not a characteristic feature of the
"Chizu belt." A similar occurrence is also observed in
the upper part of the Tanba zone and in the Ultra-
Tanba zone [Caridroit et al., 1985]. In the same way,
olistoliths of metamorphic and ultramafic rocks are
said to be found in the "Chizu belt" but not in the
Tanba belt. Such an observation is not surprising,
since the only possible source area for these rocks
lies in the pre-Tertiary units located on the Sea of
Japan side of SW Japan: i.e., Sangun schists,
Yakuno ophiolite, eventually Hida belt. There is
obviously a facies change into the Tanba basin; the
northern area or so-called "Chizu Belt" is richer in
chaotic blocks than the southern area, because it is
closer to the source area. The last two arguments
developed by Otoh et al. are meaningless: "the Chizu
belt is not a window because it is a thrust sheet" (p.
427). Such an assertion given without any detailed
map, nor cross section, is unconvincing. Moreover,
the map (Figure 1) suggests that the western part of
the "Chizu belt" extends into the Mino-Tanba belt.

Previous detailed field works [e.g., Hayasaka 1987;
Caridroit et al. 1985, 1987; Faure et al. 1986] have
shown that the so-called "Chizu belt" corresponds to
tectonic windows of the Mino-Tanba belt. The
geology of SW Japan is complex enough without
adding to the confusion by replacing a rather well
defined zone like the Tanba zone by approximately
defined ones which do not bring any new insight on
the geological understanding.

3. It is incorrect to include the Yakuno complex in the
Maizuru belt, because the Yakuno complex is
made of ophiolitic rocks of Carboniferous to Permian
age, while the Maizuru belt is formed by Permian
detrital rocks with various olistoliths, some of them
derived from the Yakuno ophiolite. When dealing
with the Permian-Triasic orogeny, even to try to
demonstrate its nonexistence, it is impossible to place
the Yakuno ophiolitic nappe and its tectonic substratum
into the same Maizuru belt.

4. In the same way, the Ultra-Tanba zone, though
imperfectly dated by radiolaria, is composed of rocks
more similar to the Jurassic Tanba zone than to the
Maizuru belt. According to the genuine definition of
the Ultra-Tanba zone [Caridroit et al., 1985], it
consists from bottom to top of Middle to Late
Permian chert over lain without unconformity by a
Mesozoic flysch and olistostrome. In addition, Otoh
et al. use the definition of the Ultra-Tanba zone of
Ishiga [1986] which is significantly different from the
initial definition of Caridroit et al. [1985]. As a matter
of fact, Ishiga [1986] includes in the Ultra-Tanba
zone a "greenish sandstone" formation assumed to be
Permian in age because badly preserved radiolaria are
found in chert pebbles in the greenish sandstone
formation. Of course, some pelitic elements are
Permian in age, like some of the olistoliths found in
the Tanba belt, since they are coming from the
Paleozoic belt, but the main part of the greenish
sandstone formation is still Jurassic and belongs to
the unit 2 of the Tanba belt.

5. The argument that the Permian-Carboniferous
basic rocks of the Outer belt were formed near land
because "interpillow arkose sandstone was reported
from a basaltic pillow" (p. 429) is questionable, as it
is based on one observation only. Indeed, the common facies of the interpillow sediments in Shikoku are pelagic limestone, red shale, and chert [Suyari et al., 1982], which suggest a deep sea origin for the basic rocks. The exceptional occurrence of the arkosic sediment can be explained by remembering that these basic rocks are olistoliths enclosed into a Jurassic matrix that can be locally very coarse grain sandstone.

6. Finally, it is said that the Jurassic sediments in the Outer zone of SW Japan (i.e., south of the fault of the Median Tectonic Line, on the Pacific side) "are dominated in reef limestone" (p.430). This assertion is wrong. Indeed, the Jurassic reef limestones, also called the Torinonou facies, are meter-to-decameter scale olistoliths included into a Late Jurassic-Early Cretaceous mudstone-sandstone matrix. The deposition place of the limestone is uncertain, although it is probably rather meridional. The Jurassic reef facies of SW Japan cannot be opposed to the Jurassic shallow water sediments covering the Inner belt since they are not in situ rocks. Moreover, the Sanbosoan zone is not correctly presented, since all the Carboniferous to Triassic limestone and the basic volcanics are olistoliths.

More generally, Otoh et al. introduce a confusion on the Carboniferous-Permian limestones and basic rocks of the Outer belt. They are alternatively interpreted as belonging to the Kurosegawa belt or to the Tanba-Mino belt. In fact, they are large slabs or olistoliths enclosed in a Jurassic olistostrome [e.g., Yokoyama et al., 1979; Tominaga and Hara, 1980; Suyari et al., 1982; Faure et al., 1986]. The largest blocks are found in the Onogahara, Torigatayama, Tosa-yama, and Sawadani areas. The olistostrome is quite different from the neritic rocks overlying the Kurosegawa belt. In the present state of knowledge, the limestone-basic rocks are in fault contact with the Kurosegawa belt and there is no evidence at all for considering that the olistoliths are coming from the south. Therefore it is not right to place the Permian-Carboniferous rocks in the Kurosegawa belt. Because it has been acknowledged for a long time by many workers, including Otoh et al., that the Middle to Late Permian faunas of the Outer belt, in the olistoliths, are similar to those of the Inner belt, and because all the tectonic data indicate a southward vergence for the structures in the Outer belt, we favor the following hypothesis. The Permian-Carboniferous rocks were part of the Inner belt, but fell, as slump deposits and olistoliths, into the Tanba basin, and they were afterwards tectonically transported as a nappe, called the Superficial nappe [Faure et al., 1986] onto the Outer belt. Presently, this nappe forms a part of the Chichibu belt of the Japanese geologists. But we have shown that the Chichibu belt is geologically meaningless [Faure et al. 1986].

DISCUSSION OF THE GEODYNAMIC MODEL

The geodynamic model proposed by Otoh et al. is very superficial. It is totally unrealistic to ignore deep seated phenomena when dealing with plate tectonics. Presently, the Yakuno ophiolite is thrust upon the Maizuru group, and both units are unconformably covered by undeformed Upper Triassic sandstone and conglomerate. Neither the origin of the granulite facies metamorphism experienced by the Yakuno ophiolite nor the emplacement mechanisms are discussed. From Figure 4 of Otoh et al., one gets the impression that the Yakuno ophiolite is "in situ," which is certainly unacceptable as the Permian obduction is demonstrated.

According to Otoh et al., the Silurian-Devonian rocks of the Hida-Hida marginal and Kurosegawa belts were deposited in the northern continental margin of Gondwana. However, according to Hiroi [1981] and Cluzel [1990a], the Hida and Hida marginal belts are closely related to the Ogocheon belt of Korea, where there is no evidence of south verging subduction. The Silurian-Devonian rocks of Japan are likely to belong to the southern margin of the South China-Korea block rather than the northern margin of Gondwana.

Because of its present width of a few kilometers, it is impossible to determine the vergence of the subduction below the Kurosegawa belt responsible for the Middle-Late Permian acidic tuff. There is absolutely no evidence for a southward dipping subduction zone below the Kurosegawa belt; on the other hand, a northward dipping subduction is perfectly acceptable.

The Otoh et al. model assumes that in Late Permian-Early Triassic times, the northward subduction zone below the Hida zone stopped. From a mechanical point of view, there is no reason for this subduction to stop, since more than 1000 km of oceanic crust would still exist at that time south of the Hida zone. More likely, the Permian subduction should have continued, perhaps with a different rate or direction, until all the oceanic crust was consumed and a meridional continental mass came in contact with the northern one. It is worth to note that everywhere in eastern Asia, the Late Permian-Early Triassic period corresponds to the climax of the Indosinian orogeny. The ductile deformation and high pressure-low temperature metamorphism observed into the Sangun schists are sealed by the deposition of Upper Triassic molasse like coarse sediments which unconformably cover the Indosinian nappes.

The model presented in the discussed paper is unable to account for numerous geological data such as (1) the emplacement of the Yakuno ophiolite, (2) the origin, deformation, and uplift of the high-pressure Sangun schists, (3) the Late Permian-Early Triassic deformations observed in Korea [Cluzel, 1990b] and (4) the syntectonic granitic magmatism and coeval high-temperature metamorphism also known in South Korea [e.g., Clift et al., 1985].

All these main features of the Indosinian orogeny of the Japan-Korea area are better explained by a continental subduction model such as that already proposed by Caridoir et al. [1986] or Faure and Charvet [1987]. When Otoh et al. complain that their model is "not adequately constrained by kinematic analyses" (p.
Indeed, the geology of Japan is very complex, and none of the published geodynamic models is able to account for all of the geological features. But the model presented by Otoh and his colleagues appears very unlikely, since it deliberately ignores the already established facts supporting the existence of Permian-early Triassic tectonometamorphic events.

REFERENCES


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