

Permian reef-building algae and algal limestones in the South Kitakami Terrane, North-east Japan

Hideaki Machiyama[1]

[1] KOCHI/JAMSTEC

Limestone as biogenic deposits is closely related to earth environments, such as climate, oceanic condition, and sea-level change, and has various records of ancient earth environments and their evolution. Since reefs consist of various organisms and respond sensitively to environmental changes, reefs are one of the best recorders of environmental fluctuation and the interaction between organisms and environments.

Permian is a time of the formation of the Pangea Supercontinent and the great biotic crisis occurred in Latest Permian. Permian reefs are different from recent coral reefs, and consist mainly of calcareous algae, calcisponges, and bryozoans.

The Permian of the South Kitakami Terrane (SKT) was deposited on a shelf area adjacent a volcanic arc around the North China Continent. Several reefal deposits are developed in the Permian of the SKT, and consist of abundant calcareous algae which play an important role for reef formation. I present a summary of reef-building algae and algal limestones in the SKT.

The following reef-building algae are recognized in the Permian of the SKT.

1) Halimedacean phylloid algae (green algae: *Eugonophyllum*, *Ivanovia*) are main constituent not only in the Sakmarian to Artinskian reefs but also in the Lower Permian limestones.

2) Peyssonneliacean phylloid algae (red algae: probably a new species) begins to occur in the Artinskian, and become abundant as principal reef-builders in the Middle Permian. They are also found in the limestone deposited by sediment gravity flow. The stratigraphic distribution ranges up to the Changxingian in the SKT.

3) Solenoporacean algae, such as *Parachaetetes*, occur in the Artinskian, and become principal reef-builders in the Murgabian coral reef.

4) *Tubiphytes*, one of the calcimicrobes, is one of common constituents through the Permian, but most abundant in the Middle Permian. *Archaeolithoporella* occurs in the Bolorian, and plays a role of reef-building process (but not so abundant).

Based on their roles for reef formation, the above reef-building algae are divided into the following three groups: 1) constructors which form a rigid framework, 2) binders/encrusters which bind or encrust the sediments, other organisms, or a framework, 3) bafflers/sediment-producers which traps the fine-grained sediments or produces the sediments. From this viewpoint, the reef-building algae are summarized as follows.

1) Bafflers/sediment-producers: Characterized by the predominance of halimedacean phylloid algae which baffle the fine-grained bioclasts and lime-mud or are sediment-producers themselves. On the other hand, peyssonneliacean algae also occupy an important place as bafflers/sediment-producers in the Middle Permian, because they are abundant in sediment gravity flow deposits.

2) Binders/encrusters: In the Artinskian reefs, the peyssonneliacean algae don't only act as bafflers/sediment producers but also act as binders/encrusters forming algal crust. Calcimicrobes such as *Tubiphytes* and *Archaeolithoporella* are not so important in the SKT. Solenoporacean algae are common in the Murgabian coral reef where these algae contribute the substrate stability in the early stage of reef formation.

3) Constructors: Only solenoporacean algae are recognized as constructors. They have complex or stacked form in the spaces among the coral framework in the Murgabian coral reef.

Algal limestones in the SKT change their constituents which are characterized by increase of binders/encrusters from late Early Permian through early Middle Permian.