THE PERMIAN OF LIANGSHAN AND ITS BEARING ON THE CLASSIFICATION AND CORRELATION OF THE PERMIAN ROCKS OF SOUTH CHINA

Lu Yen-hao

(Institute of Palaeontology, Academia Sinica)

ABSTRACT

Strata of Permian age are fairly well developed in the Liangshan region, S. Shensi. They differ in some degree from those of South and Southwestern China, particularly in their upper portions which are almost entirely composed of limestones. The subdivisions adopted here are as follows (in descending order):

Upper Permian-Lopingian

(5) Wuchiaping limestone	400 m.
(4) Wangpo shale	2 m.

Lower Permian-Yangsinian

(3) Maokou limestone	73 m.
(2) Chihsia limestone	38 m.
(1) Liangshan formation	10 m.

The Liangshan formation, lying disconformably upon the Silurian, consists of yellow and black shales and pale grey clays with poor ashy anthracite coal and contains abundant marine animals in addition to some fragments of plant remains. This formation appears to be the equivalent to the *Stylidophyllum volzi-Misellina claudiae* zone of the lower part of the Chihsia limestone in S. China which corresponds evidently to the Basal Chihsia Coal Measures with a flora of typical Lower Permian age.

The Liangshan formation is succeeded by the Chihsia limestone conformably. The lower and middle portions of this limestone series in the Liangshan region contain fusulinids and corals including many characteristic fossils of the middle zone of the Chihsia limestone in S. China, namely *Nankinella orbicularia, Hayasakaia elegantula*, etc., and the upper portion is characterized by

several species of *Polythecalis* of the Upper Chihsia. The coral fauna has been found in the Southern Shan States of Burma and in several localities of Iran; while the fusulinids are largely known outside of the Tethys.

The Maokou limestone in this region contains rich marine fossils, of which four faunal zones are recognized, namely: (1) the *Yabeina* zone, (2) the *Schwagerina douvillei* zone, (3) the *Verbeekina-Neoschwagerina* and (4) the *Wentzelella subtimorica* zones, the *Yabeina* zone is here considered to be the youngest formation of the Lower Permian. In South China, the Maokou limestone has a very wide distribution extending to W. Yunnan in the west, the Tsinglingshan range in the north, Kwangsi Province in the south and the East China Sea in the east. Locally, the limestone may be replaced by shales and sandstones known as the Kuhfeng formation of the Lower Yangtze Valley, and as the Wenpeishan Series of Fukien, especially in the upper divisions which in some places in Kwangsi contain thin coal seams. The limestone beds of the Lower Hoshan Series in Central Kwangsi yield *Chusenella*, *Verbeekina* and *Yabeina*. Similar strata known as the Lungchiakou Coal Series occur in Southern Kansu. The formation is characterized by alternating beds of shales or fine sandstones and limestones with *Neoschwagerina*. It also includes workable coal seams. The majority of the Maokou fauna is extensively distributed in the Tethys of Europe and Asia. Similar fauna has also been discovered in northwestern America.

At the close of the Maokou time, the Tungwu revolution took place. Folding and faulting are in evidence in South China and large sheets of basaltic lavas flowed over vast area of southwestern China. The movement was epeirogenic in character in the Liangshan region where the Upper Permian begins with a thin shaly bed, called the Wangpo shale which is obviously a continental facies and which rests disconformably on the Maokou. Fossil plants have been found in this shale series, but they are too fragmentary for a definite determination. As far as the stratigraphical position is concerned, the Wangpo shale may represent the lowermost part of the *Gigantopteris* Coal Series.

The Wangpo shale is immediately followed by a thick limestone series, the here named Wuchiaping limestone. In this limestone are found the index fossils

Lophophyllum zaphrentoidea and *L. kayseri* of the widely distributed Choutang Series of South China, and *Liangshanophyllum* of the Changhsing limestone in the Yangtze Gorge district. The Choutang Series is generally believed by most geologists as a corresponding marine facies of the *Gigantopteris* Coal Series. Besides corals, the abundant fusulinids found in the Wuchiaping limestone, particularly *Codonofusiella* (three species), *Reichelina* (two species) and *Nankinella minor*, are largely the characteristic fossils of the Changhsing limestone of northern Kweichou and elsewhere in South China. The fossils are regarded as belonging to the true Upper Permian type. As a whole, they are chiefly confined to eastern Asia and are also known from the Tethys of northern Caucasus.

The Wuchiaping limestone appears everywhere in the Liangshan region to be conformably overlain by the Lower Triassic fossiliferous limestone beds. A change of conditions of sedimentation occurs during the Permo-Triassic period in this region, i. e. from the pure limestone facies of the Wuchiaping to the muddy limestone facies (with shales) of Lower Triassic. It is of interest to point out that an almost complete change in faunal contents occurs also during the transitional time in this region.

A correlation table of the Permian rocks of the Liangshan region with those of other areas of the world is given in the Chinese text of this paper (p. 188).