Field Trip Guide to the Alishan and Yushan regions, Taiwan

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Introduction

The purpose of this field trip is to introduce briefly the geologic features of the Alishan and Yushan regions in the southwestern Taiwan. In general, the geology of Taiwan can be divided into six N-S trending tectonostratigraphic units (Ho, 1988): from west to east, the Coastal Plain, the Foothills fold-and-thrust belt, the Hsuehshan Range slate belt, the Backbone Range slate belt, the pre-Tertiary metamorphic complex, and the Coastal Range (Figure 1). The Alishan and Yushan regions are mainly located within the Foothills fold-and-thrust belt and the Hsuehshan Range slate belt of the Central Range. The two regions are noticeably characterized by imbricated and folded Tertiary sedimentary strata, which are also partly metamorphosed. Several major thrust systems run through the Alishan and Yushan regions, such as the Tachienshan-Chukou, Luku, Chenyolanhsi, and the Lishan fault systems. These fault systems together with the deformed Tertiary rocks show patterns of complex deformation due to the plate convergence of the Philippine Sea Plate and the Eurasian Plate.

General Geologic Features

Before the Philippine Sea Plate overrides the Eurasian continental margin, the faulted and uneven margin basement were covered by thick Tertiary sediments, which commonly reach several kilometers. These Tertiary strata vary in thickness and sedimentary facies from north to south in Taiwan. Although geologically very young, the strata are now all faulted, folded, and even metamorphosed. This gives evidence for the strong and rapid mountain building processes in Taiwan.

During this field trip we will mainly see rocks from the Foothills fold-and-thrust belt and the southern part the Hsuehshan Range slate belt (Figure 1). A few field stops are chosen for panoramic views of the regions. The Foothills fold-and-thrust belt was studied intensely by the Chinese Petroleum Company in Taiwan and has well-constrained subsurface geologic information (e.g., CPC, 1986). On the other hand, the subsurface structures of the Hsuehshan Range slate belt are mainly inferred from surface stratigraphy and structures.

The southwestern Taiwan can be divided into the Chiayi, Alishan, and Yushan regions (Figure 2). The Chiayi region is dominated by Quarternary deposits and is characterized by low and gentle foothills where several active faults are located (Figure 3). The Alishan region is dominated by folded and faulted Neogene rocks with minor Oligocene rocks. The Yushan region is part of the Slate Terrain of the Central Range. The Yushan region is dominated by Paleogene to Miocene argillite, slate, and sandstone. Stratigraphy includes the Shihpachunghsi Formation, the Tachien Formation, and the Chayang Formation (Lee, 1979; Ho, 1988).

The three regions are separated by two major faults: the Tachienshan-Chukou Fault and the Chenyolanhsi Fault (Figures 2 and 3). The Tachienshan-Chukou Fault is a high-angle thrust fault, which is considered active (Huang et al., 1994). The thrust fault
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Road Log

**Stop 1** (15 mins.) The Tashan Cliff (塔山斷崖) (Fig. 6a). We will first stop before the entrance of the Alishan Forest Recreation Area. The Tashan Cliff can be viewed from here toward the northwest. The well-exposed sandstone unit is the late Miocene Kuantaoshan Sandstone. The bedding of the cliff rocks dips gently toward the west. The rocks form the east limb of a gentle syncline with fold axis trending about NNE. Underlying the sandstone unit is the late Miocene Nanchuang Formation. The Nanchuang Formation is widely distributed in this region including the rocks where we stand. From this stop to the next stop is a winding road about 21 km (40 mins drive) up to the Yushan National Park.

**Stop 2** (30 mins.) The Tatachia Tourist Center of the Yushan National Park (塔塔加遊客中心). If we visit at open hours, the Tourist Center can provide introduction about several aspects of the spectacular Yushan National Park. Around the Tatachia area, we can see both the Alishan and Yushan Mountain Ranges (Figure 6b&c). The Alishan Range is composed of middle to late Miocene folded strata. The Yushan Mountain Range is composed of metamorphosed Eocene to Oligocene folded strata. They are, from west to east, the Eocene Shihpachunghsi Formation, the Eocene Tachien Formation, and the Eo-Oligocene Chayang Formation (Lee, 1979; Ho, 1988). These Paleogene rocks of the Yushan Mountain Range are in fault contact, the Chayanghsi or the Chuchih Fault, with the Neogene rocks of the Alishan Mountain Range. Next we will take a walk along a scenery trail.

**Stop 3** (50 mins.) A scenery trail for the Yushan mountain peaks (眺景步道). We will take a walk along a mountain trail to have different views of the Yushan mountain peaks. Please check Figures 2 and 3 to know what rocks and structures are around us. We will start the trail at the Tourist Center as indicated in the simplified map below. The planned trail is about 2.1 km. In the beginning the trail may seem steep, but it's not difficult to walk for the most part. Bus can pick up at the other end (Shentungpu). After the scenery tour, that will be the end of the field trip.
References


Chinese Petroleum Company (CPC), 1986. Geologic map of the Chiayi area (1/100,000), no. 5.

Ho, C.S., 1988. *An introduction to the geology of Taiwan -- Explanatory text of the geologic map of Taiwan (2nd ed).* Ministry of Economic Affairs, Taipei, Taiwan, Republic of China.


Figure 1. Tectonic and geologic settings of Taiwan. The geology of Taiwan is divided into six tectono-stratigraphic units (Ho, 1988). The schematic geologic cross section of the Taiwan mountain belt is modified from Teng (1990).
Figure 2. Geologic map of the Alishan and Yushan regions. Rock ages range from Eocene (E), Oligocene (O), Miocene (M), Pliocene (P) and Quaternary (Q). AA', BB' and CC' are lines of cross sections in figure 4. The geologic map is modified from the 1/500,000 geologic map of Taiwan (Ho, 1988).
Figure 3. Shaded relief map of the Alishan and Yushan regions. Several active faults are located on the west portion of the map based on the Central Geological Survey. The region of the map is the same as that in figure 2.
**Figure 4.** Geologic cross sections showing subsurface structures and stratigraphy in the southwestern Taiwan. (a) Redrawn from Suppe (1976), (b) Redrawn from Yang et al. (2001), and (c) Modified from Chang et al. (1999) and Liu et al. (1989). See figure 2 for cross section lines and figure 5 for symbols of stratigraphy.
Figure 5. Correlation of Stratigraphy in (a) the Western Foothills and (b) the Central Range in Taiwan (Ho, 1986).
Figure 6. Panoramic views of (a) the Tashan Cliff looking toward northwest from the entrance of the Alishan Park, late Miocene Kuantaoshan Sandstone, (b) the Alishan Mountain Range looking toward west from near the Tatachia Tourist Center, middle to late Miocene Tapang and Nanchuang Formations, and (c) the Yushan Mountain Range looking toward east from the Tatachia Tourist Center, Eocene to Oligocene west-vergent folded strata.