

A Study in the Environmental Background and Architecture Techniques of “Slate houses” in Taiwan

Hsiao Wen-Chieh * and Horigome Kenji **

* *PhD. Student, College of Design, Chung Yuan Christian University*
wen0199.chieh@msa.hinet.net

***Associate Professor, Department of Architecture, Chung Yuan Christian University*

Abstract: There is a great diversity in the architectural forms and styles of aborigines in Taiwan, and the use of local material reflects their close relationship with the nature and demonstrates the wisdom of Taiwanese aborigines to make the use of limited environmental resources. Located in the Central Mountain of Taiwan, the tribes of Paiwan, Rukai, and part of the Bunun have developed an architectural style, building walls with stones, pillars with timbers, and roofs with stone slates. Such buildings are named as “slate houses.” The present study found that such slate houses are characterized not only by the geological locale, but also the custom features and the recycling of stone slates. Furthermore, they adopt various components and materials with great diversities which can withstand typhoons and earthquakes. These characteristics are valuable for contemporary architectural concept that live in harmony with the nature and for cultural preservation. The study aims to explore the significance of “slate houses” in the history and their architectural concepts and to offer explanatory interpretations.

Keywords: *slate houses, aborigine, architecture, sustainability.*

1. Introduction

Aboriginal slate houses are mainly distributed along the piedmont of Ping Tung County’s Chau Chou fault line in Southern Taiwan. Paiwan, Rukai and part of the Bunun tribe continue the tradition of using “slate houses.” Tracing literature and relevant writings, vertically or horizontally stacked slate is a major construction characteristic of slate houses. According to Chung-hsuan Chou (1717), “Boulders are chipped into pieces to build walls, and roofs in place of roof tiles. The space is about 3 and 1/3m wide and seems like a natural stone room.” In addition, there is literature which describes in detail the application of slates on constructing of house as well as box-shaped tombs. I-yuen Li (1982) suggested that “In the early Paiwan tribe indoor funeral, the family tomb (rovan) is located in the center of the room and is usually completed during construction of the house. The “rovan” is a box-shaped tomb.” There are also researches mentioned: “The command post in the village cluster is the tribal leader’s place of gathering for meetings; it is stacked from slate.” (Shih-chiang Huang, 1987) From the above literature, it can be observed that in terms of lifestyle and craftsmanship, slate houses became an important element in aborigine architecture. Therefore, the study integrated the historical documents with field observation explored the technical background of the slate houses as a contribution to the contemporary study of sustainable development and sustainable design.

2. Concept and Craft of the Aborigine Slate House Construction

Traditional aborigine architecture relies heavily on natural resources; hence most constructions obtain materials from local sources and ecology. The southern mountainous region of Taiwan possesses abundant slate

or shale deposits, together with Hengchun's sandstones they provide convenient source of building materials. Houses of Paiwan and Rukai tribe are constructed mainly of local stones. Aboriginal slate houses are commonly built on comfortable and hygienic plateaus on both side of the river, where there is copious supply of water and good line of sight. Besides, residential houses are constructed closely, forming a cluster type residential area. In terms of art representation, most slate is treated as functional construction material, and some is used as engraved pillar or sculpture. The significance of slate can be appreciated from the fact that peasants are required to contribute the best stone materials to the landlords as a stone tax or "paivades tukatselai" (I-yuen Li, 1982). The actual operating mechanism and concept include: the selection of building material according to geographical and environmental circumstances, stone collection and selection technique, stacking of walls and space planning.

2.1. Selection of Construction Material According to Geographical Locale

Taking south Taiwan for instance, the Paiwan, Rukai and Bunun tribe's slate houses are made of slate and shale excavated from the local riverbed. As for the Hengchun Peninsula's prehistoric slate houses, there are often cases whereby the slate is made from sandstones. Slate is not simply a construction material, it is also used as engraved pillar or material for ornamental stone sculpture; hence it can be described as a fundamental and local building resource. The shale used in building a slate house is a type of sedimentary rock, which is formed by accumulation of layers of sediments; it is mostly dark gray in color due to its composition of sericite minerals. Slate is the most commonly found metamorphic rock in Taiwan's mountain regions, mainly distributed along both sides of the Central Mountain. Slate is metamorphosed from shale; since the stone is susceptible to weathering, it can be chipped off into sheets of slate with simple tools. As obtaining building material is convenient from local sources, it shows a simple primitive style in construction material. (Wen-shan Chen, 1997).

2.2. Exploring the Advantages of Individual Slates as Building Material

Aborigines of Paiwan, Rukai and Bunun tribe make use of single sheets of slate as the fundamental building material. The advantages of the singular slate are described below:

2.2.1 The Material is Indigenous and Local

Stone is a convenient material. The average slate house takes 3 weeks to complete; it is easy to build and requires only simple tools. Slate is a quality local material closely related to the surrounding ecology.

2.2.2 Recycling of Stone Slates

During construction of a slate house, no adhesives is used; hence if relocation of village or reconstruction is required, old slates can be recycled, providing high degree of environmental friendliness and versatility.

2.2.3 Windproof and Earthquake Proof

Taiwan is situated in a seismic region, with rain and typhoon attacks during summer. Since a slate house is constructed lower to the ground, with the back facing the mountain, also as slate carries a certain weight, the slate house is able to withstand typhoons and earthquakes. In addition, the slate is windproof and the slits between the sheets of slate allow good ventilation, making a slate house a comfortable residence for both summer and winter.

2.2.4 Great Versatility of Component Composition

Taking the front wall as an example, we can notice the structure of the slate house offers great versatility. For instance, by inserting a large slate slab into a prefabricated slot to form a wall; on the contrary, by removing the slate slab, it will become the door opening; what used to be a wall can be easily transformed into a door, while windows can be formed by inserting smaller slate slabs into the slots, thereby ensuring high degree of flexibility.

2.3. Intelligence for Selection of Stone and Chiseling Technique

Aborigines employ techniques such as visual observation and roasting to determine the suitability of stone. The aborigines refer to harder and denser slates as “male stone,” and refer brittle ones as “female stone.” For the convenience of slate excavation, aborigines usually search for suitable ores for excavation in riverbeds or cliffs in the vicinity of the village. They use various types of iron chiseling tools for excavation; spots along the texture of sedimentary stones such as shale and sandstone are chosen for nailing and hammering; chiseled surfaces are processed, smoothed and cut into sheets of slate according to requirement. For instance, the Paiwan tribe has at least 6 different types of slate in existence (Kung-ming Hsu, 2003).

2.4. Selection of the Slate House Cluster

The bottom of a slate house has a certain depth, usually between 30cm to 1m. The top half of the house protrudes above the ground; there is a taboo of Paiwan tribe tradition which prohibits construction of house on a hilltop, thus no building is to be taller than a tree; furthermore, workers dig downwards in accordance with the gradient of the slope, the excavated earth is then used as fillings to smoothen the surface of the front garden.

In other words, steep mountain slopes are deliberately chosen as construction site so that entry is via the direction facing the downward slope. This type of construction forces people to bow down before entering the house, apart from paying respect to the ancestral spirit, this also symbolizes respect towards the hard labor of the ancestors in building the house, as well as respect for the elderly in the family (Ta Hsi Wu La Wan, 1995). This feature can also prevent strong winds from damaging the house structure. Semi-caved construction technique form a comfortable dwelling environment of “warm in winter and cool in summer” (Chiung-jui Hsiao, 2003). Besides, this kind of small entrance can prevent intrusion by wild beasts, ensuring a great defensive advantage.

Additional considerations for selection of construction site include: wind hazard, water supply and suitable farming land in the vicinity; it must be a sun-facing slope, and should be in a advantageous defensive position, preferably in close proximity to the tribal leader and family; it must also be away from ominous location and must be augured. Last but not least, approval by the tribal leader is a prerequisite before commencement of construction (Ta Hsi Wu La Wan, 1995).

2.5. Preparation of Land and Stacking of Walls for Construction of Slate Houses

Before building the slate house, tribesmen will shovel the slope into dustpan shape; the various foundations of traditional slate houses can usually maintain rectangular shape to form common walls which are necessary for wall to wall construction of clustered house complexes. Generally speaking, they form box shaped spaces.

The slate house is constructed with its back facing the mountain slope; apart from combination of large vertical slate sheets to form the front wall, the two sidewalls and rear wall are also made by suitably sized sheets. Structurally speaking, the rear wall acts as the retaining wall, while the two sidewalls serve as weight bearing structure. There are also two lateral support slates to prevent the house from toppling forward. Since the rear wall rests against the mountain slope, there is no risk of the house tilting over. In addition, the stacking of roof and the wall needs to take into consideration water drainage to ensure indoor dryness.

2.6. The Pillar of Ancestral Spirit

It is common among Rukai and Paiwan tribe to have an engraved pillar at home, symbolizing respective authority of the big and small tribal leader. Occurrence of any major event will call for an augury at the ancestral pillar to determine good or bad. The pillar is mainly made of timber or stone, both are referred to as “tsukes” or “tjaz” with some figures engraved. Besides supporting weight of the roof, the pillar also acts as a sacred space.

The pillar is often engraved with totems of ancestral figures or snakes; it is a symbol of the presence of ancestral spirit. The stone pillar erected in the front yard is also called saulaulai.” When the new pillar, crossbeam or eaves is erected, strict rituals must be performed.

3. Wisdom of Utilizing Slate House Space

The space of a slate house typically comprises of bedroom, kitchen, grave, toilet, pigsty and storeroom. Windows are installed in the front of the slate house, which not only enhances lighting in the bedroom area, but also act as portals for the exchange of goods and friendships. The slate pedestal of a slate house is located by the window with storage space below; the pedestal is used by women for knitting and a place of conversation for visiting friends. Beds on either side of the bedroom are slate platforms roughly 30cm higher than the bedroom floor. Front yard is the space for social occasion, production and storage. The tribal leader’s home also has facilities such as command post, skull rack and stone pillar, providing a gathering place for villagers.

The establishment of the main pillar is closer to the back end of the slate house. As a result, most of the rainwater flows towards the front; as for the rear and back foundation, erosion by water is relatively limited. In addition, since slate house is a semi-cave dwelling, the roof can be easily accessed for drying crops; sometimes it can even act as a playground for children.

As for the tomb in the slate house, before prohibited by the Japanese in 1930, it was customary for Paiwan tribe from Ly-I region to bury their dead in the house. The body is buried into a rectangular tomb roughly 90~120cm in length, in a vertical crouching position. It can be concluded that the slate house is the living and resting place for traditional Paiwan and Rukai tribe; it is also the place for beginning and ending of life.

4. Conclusion: Exploring Advantages of Slate Houses through Perspective of Sustainability

With recent deterioration in global warming and the greenhouse effect, sustainable development and architecture has become a worldwide trend. The purpose of sustainability is to resolve the problem of human survival. Taiwanese aborigine’s slate house has stood the test of time; the ancestral archetype is in harmony with the land and is the accumulation of vernacular wisdom and culture identity.

The slate house may appear to be airtight, but it is referred as the “breathing house;” even when fire is started in the chimney-free slate house, thick smoke does not accumulate in the house due to its efficient ventilation. Slate is an indigenous material which is easy to acquire. No adhesive is required and it can be recycled. Interior partition and spatial element of the slate house tends towards “reversibility” (Pin Chiang, Ching-I Li, 1995). Thus, individual needs and environmental elements are all take into consideration. Built with ancestral wisdom, the aborigine slate houses can be described as the pioneer of modern green buildings.

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