CHAPTER VII

DISCUSSION AND CONCLUSION

Evolution of the Quaternary Sedimentary Formations

Bo Phloi district is one of gemstones production field of Thailand. Geologically, the alluvial gemstone deposits appear to be related directly to geomorphological landforms and their sedimentary characters. Hence a systematic research on Quaternary deposits together with age dating are carried out in this study. The distribution of gemstones, relationship between the occurrence gemstone and its host-sediments and the study of their paleoenvironment are concluded as follows.

The Bo Phloi Basin is situated between the western and eastern montain ranges to the north of Kanchanaburi town. Geologically, Thabsila Precambrian gneisses represents the oldest rock unit in this area underlying the Cambro-Ordovician U-Thong Marble and the Ordovician limestone. Stratigraphically, they are overlain by the Silurian-Devonian rocks which consist dominantly of quartzite and chert. The latter is especially in the middle part of the study area showing low angle plain. The unconsolidated deposits are the youngest deposits in the area and can be divided into recent (Qa) and Pleistocene (Qt) Epochs of Quaternary period. (Bunopas and Bunjitradulya, 1975).

Structurally, Bunopas and Vella (1983) reported that despite the Mae Ping and Three Pagodas faults had ceased their movement since late Cretaceous or early Tertiary, these sinistral strike-slip faults dislocated main geological provinces of

Thailand. Moreover, late Tertiary to early Quaternary basalts were broadly distributed in several regions of the country. Mae Moh Basin is one of Tertiary intermontane basins which was originated from these sinistral faults. The shape of Mae Moh basin is roughly triangular elongated in NNE/SSW direction as similar as intermontane basins in northern Thailand. Further to the fact that basalt is overlying on a gravel bed at Nam Mae Jang in the north. According to Baum et al (1970), the late Tertiary and/or Pleistocene normal faulting and uplifting has influenced on the present day topography of northern Thailand. Likewise, Bo Phloi Basin is situated on the eastern part of the Three Pagodas fault. The basin is a small intermontane basin with NS trending. In contrasing with the Mae Moh and other intermontane basins in the other parts of the country, the Bo Phloi Basin might probably be developed along NS fault which occurred in the middle part of the area. This NS fault may probably be late Tertiary in age.

Landforms in the Bo Phloi basin were initially caused by natural weathering, erosion and mass-movement processes since late Tertiary. The occurrence of laterite in the peneplain at both sides of the basin could be used as evidence to confirm the age of the basin. The author has proposed that the age of the peneplain ranges from late Tertiary to early Pleistocene as already mentioned in chapter IV. The occurrence of basalt overlying on gravels in the middle part of the basin (figure 6.3) indicates that the age of the alluvium deposits in the area is older than the basalt.

Geomorphologically, landforms in this area can be divided into three units. Firstly, units of denudational origin which consist of mountains and hills area of Precambrian gneiss and schist, karst area of Cambro-Ordovician limestone and marble, Silurian-Devonian quartzite, chert, siltstone and shale, Triassic granite and Tertiary basalt and peneplain which is characterized by laterite and residual deposits. Secondly,

units of fluvial-colluvial origin consist mainly of piedmont alluvial-colluvial and piedmont fluvial-colluvial calcareous deposits. And thirdly, units of fluvial origin which are composed mainly of terraces and floodplain. Based on field evidence, it can be concluded that the high potential gemstone bearing area occur in the middle part of the basin related to floodplain and low terrace.

The stratigraphy of Quaternary placer deposits are important for gemstone exploration. Based on their sedimentary structures and textures, the deposits can be divided into eight lithofacies. Massive gravels (Gm) and foreset-bedded gravels (Gp) are assigned to be gemstone paystreak. Trough and wedge-shaped cross bedded sand (St), cross lamination sand (Sc) and foreset laminated sands (Sp) facies indicate fluvial processes especially point bar and braided stream deposits. Planar stratified sand (Ss), horizontal laminated silt (Sl) and silty and mud (Sm) represent Holocene fluvial deposits.

The authur would like to make an assumption concerning the evolution of this basin related to its geomorphological landforms and Quaternary sedimentary deposits which can be divided into three phases as follows :

Phase I : After the erosional and depositional landforms had been developed in late Tertiary. Tectonic movements might have occurred and followed by extrusion of the basalt along the fracture zones in eastern mountain ranges which can be clearly observed at Khao Lan Tom and Huai Nam Pu (Huai Ma Kah). The basalt also flowed to the west into the basin and covered the older alluvial deposits. The age of Khao Lan Tom basalt is most probably Pliocene. At present, no field evidences are available to conclude the numbers of its flow layers.

Phase II : The upper alluvial sediments had been developed by a narrow sinusoidal river which became braided in the middle part of the area. The river developed river terraces into three levels which can be easily seen in the area. The terraces consist of high terrace, middle terrace and low terrace, and they are ranged in age from late Pliocene to early Pleistocene, middle Pleistocene and late Pleistocene, respectively.

Phase III : From Late Pleistocene until the present time many tributaries of the Lam Ta Phoen developed in the basin. Moreover, the ages determination of wood fragments dated by C-14 radiocarbon method. From the evidences of young tributaries and the age of wood fragments, it can be postulated that there was a major flooding event leading to the formation of sedimentary layers occurring during late Pleistocene to Holocene.

Abundance of alluvial gemstone deposits have been observed within gravel beds of Lam Ta Phoen paleochannel. According to radiocarbon dating of wood remains and peats found in sedimentary layers overlying gemstone paystreak, it can be stated that the youngest gemstone depositional age is 35,600 $\pm$ 4,200 years BP. Geomorphologically, low terrace and floodplain have covered all parts of gemstone placer area. The relative age of low terraces and foodplain is ranging from late Pleistocene to Holocene. Thus, the abundant gem-bearing layer is most probably occurred in floodplain and low terrace. Geomorphologically, the evolution of the Bo Phloi related to its basin is summarized and shown in table 7.1.

Table 7.1 Evolution of the Bo Phloi Basin related to its geomorphological landforms

Phase	Events	Relative age
I	Development of peneplain and alluvial deposits by fluvial processes followed by extrusion of Late Tertiary basalt along fracture zones at Khao Lan Tom and Huai Num Pu. The basalt also flowed westward into the basin.	Pliocene (3.14 $\pm$ 0.17 Ma and 4.17 $\pm$ 0.11 Ma)
II	Accumulation of upper alluvial deposits by river processes and formation of high terrace followed by Middle terrace formation Low terrace formation	-Late Pliocene to Early Pleistocene -Middle Pleistocene -Late Pleistocene
III	Flooding formed thick uppermost sediments, and recent Lam Ta Phoen drainage system developed respectively.	Holocene

Potential for Future Gemstone Prospecting

Once it was used to be rich and shallow, gemstone mining area at Bo Phloi now becomes rapidly depleted due to extensive mining activities during the hasty production period of the last decade. Although the total area, where gemstones have been found, is widespreadly recognized the exact amount of gemstone in the area is still unascertained. By this reason together with the increasing depth of gemstone depositonal layer, it is difficult for gemstone producers to select their future profitable mining areas.

In order to locate the potential area of gemstone in this region, the author has attempted to determine the area of gemstone distribution. At first, aerial photographs were used for delineating various landforms. According to Hansawek et al. (1996), they suggested the high potential gemstone depositional area based on banka drilling as shown in figure 7. By using the quantity of spinel and pyroxene, the gemstone bearing area can be divided into high potential gemstone bearing area which contains a combining amount of spinel and pyroxene being greater than 320 grams per cubic-meter, and the other is the area where spinel and pyroxene have been found being less than 320 grams per cubic-meter. Moreover, some concealed basalt may have occurred in other places within the area. Based on airborne magnetic information, four possible anomalies of the basalt were recognized. However, due to a preliminary fieldwork carried out by the author and a DMR's team, no field evidence of basalt has been observed. Also, the author would like to suggest that a deep exploratory bore-hole should be carefully carried out to verify the existence of the basalt at one of the most promising magnetic anomalies.

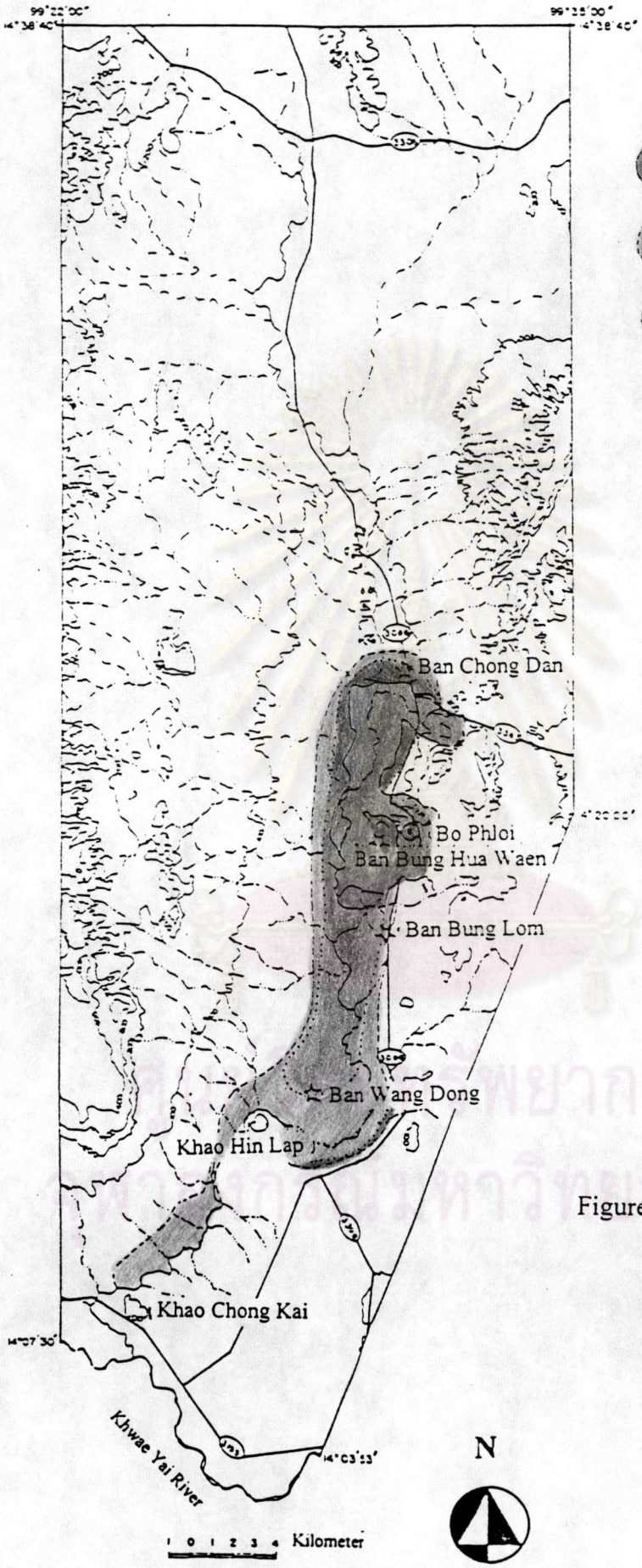

Figure 7. Gemstone distribution in Amphoe Bo Phloi, Changwat Kanchanaburi. (Hansawek et al., 1996).