CHAPTER V

Conclusion and Discussion

Pollen grains, spores and other remains recorded from intramontane peat bog (1A) of Doi Inthanon, Chiang Mai Province, summarize modern depositional patterns in this site. Summary pollen and spore diagrams include only taxa encuontered in the vegetational survey or plant macroremain assemblages.

The pollen diagrams can be divided into six pollen zones (Fig. 5). The main features of each zone are summarized as follows:

Zone I (1-16 cm depth) : The upper peat layer contained the dominant pollen grains of *Polygonum chinense* Linn., *Polygonum plebejum* R. Br., *Schima wallichii* Korth., Myrtaceae, *Rhododendron, Vaccinium, Agapetes, Quercus,* Rubiaceae as well as Araceae (Fig. 11). Moreover, plant macroremains of Graminae, Cyperaceae and other higher plants could be found in this layer, so could the fresh water algae remains of *Lyngbya* sp. and *Stenronesis* sp. and fungal remains. This evidence proved this layer a damp habitat. The actual habitat of *P. chinense* Linn., *P. plebejum* R. Br. and *Rubus*, which were the dominant pollen of Zone I peat layer, are opened sunny places or roadsides (McMakin, 1988). So the high percentage deposition of pollen grain of species *P. chinense* Linn., *P. plebejum* R. Br. and *Rubus* show that this sampling area during that period would be the clearing area which might also be deforested by human. However, the vegetations was conformed to the vegetations of upper montane rain forest which was represented by the pollen grains of *Schima wallichii* Korth., *Quercus* as well as Myrtaceae (Suntisuk, 1988 and Koyama, 1986). The palaeoclimate of that period was cool as supported by the presence of domonant pollen grains of temperate plants as shown in (Fig. 5). The humidity of the area might have been high according to the existance of Araceae and Polygonum grains. The occurence of algae and fungal remains as well as Araceae pollen grains indicated the wetland. However, as the small amount of glass land pollen in the deposition was seen, it cuold be assumed that the upper most sediment was the discontinuous opened glass land which might be due to human activities. And the density of unidentified pollen grains and upper montane rain forest as in Figure 5 represented high potential of plant species diversity in that period.

Zone II (16-25 cm depth) : This zone shows the increase of *Betula, Rhododendron, Agapetes, Quercus*, grass and unidentified grains as in Figure 11. It is assumed that the palaeoclimate of the Zone II wuold be warmer than that of Zone I because the sediments consisted of Graminae, *P. chinense* Linn., *P. plebejum* R. Br. and legume, the dominant lowland plants. The vegetation of this period was still the upper montane rain forest as indicated by dominant pollen grains of *Schima wallichii* Korth. and *Quercus*. However, the deforestation could have expanded as shown by the dominant grains of Graminae, Legumenosae, *P. chinense* Linn., *P. plebejum* R. Br. The decline of temperate plant pollen grains and increase of unidentified pollen grains (Fig. 5) was the evidence that the weather could also be warm. Nevertheless, the area was still damp according to the alga and fungal remains as well as macroremains of grass and Cyperaceae found in the deposits.

Zone III (25-100 cm depth) : This zone is rich in pollen grains of *P. chinense* Linn., *P. plebejum* R. Br. , *Betula*, Myrtaceae, *Rhododendron, Vaccinium, Agapetes, Schima wallichii* Korth., *Quercus* as well as Rubiaceae (Fig. 11) as a moderate percentage of *Stauronesis* sp., and Graminae and Cyperaceae remains were found in this layer.

Compared to all pollen zones, the highly significant amount of pollen grains of both temperate and upper montane rain forest plants of Zone III were significantly increasing. This can be interpreated that this zone would have been the upper montane rain forest which was cooler than Zone II (Fig. 5). The alga remains shows that this area was still wetland.

Zone IV (100-111.5 cm depth) : *P. chinense* Linn., *P. plebejum* R. Br. , Myrtaceae, *Schima wallichii* Korth., Rubiaceae, Legumenosae, Graminae, Cyperaceae and unidentified pollen grains were high. The other macroremains were disappeared but the only alga remain, *Stauronesis* sp., was still found in this zone. The existence of abundant pollen grains of upper montane rain forest plants such as Myrtaceae, Rubiaceae and *Schima wallichii* Korth. (Fig. 11) reveal the vegetation of upper montane rain forest. Moreover, an increase in pollen grains of lowland and unidentified plants (Fig. 5) show that this area was warm, but it was stll moist wetland as supported by an increase in *P. chinense* Linn., *P. plebejum* R. Br., Graminae as well as Cyperaceae.

Zone V (111.5-113.5 cm depth) : The characteristic of pollen diagram of this zone is conformed to that found in Zone III. *P. chinense* Linn., *P. plebejum* R. Br. , *Schima wallichii* Korth., Myrtaceae, *Rhododendrn, Vaccinium, Quercus*, Graminae, Rubiaceae, Legumenosae and Cyperaceae pollen grains are dominant as well as pteridophyte spores (Fig. 11). The dominant presentation of upper montane rain forest pollen grains of Myrtaceae, Rubiaceae, *Quercus* and *Schima wallichii* Korth., in addition to pollen grains of temperate plants such as *Rhododendron, Vaccinium* and *Betula* show that the weather could also be cool. This assumption is supported by a decline in unidentified grains as well. Naturally, the plant diversity in temperate zone is limited by low temperature while the warn weather is not a limited factor of plant diversity in tropics.

Zone VI (131.5-152 cm depth) : This zone is of low concentration of pollen grains and spores. The spores were higher than pollen grains (Fig. 6). The feature of grain sedimentation was still upper montane rain forest because of the dominant pollen grains of *Schima wallichii* Korth. as well as *Quercus* (Fig. 11). Generally, the palaeoclimate of this period was warm and humid which was confirmed by rich pollen grains of lowland and unidentified plants. It was, however, a moist wetland as seen from the existence of alga (*Stauronesis* sp.) and pollen grains of Graminae and Cyperaceae. In the deposit layer than Zone VI beyond 152 cm depth, no pollen grains nor spores were found.

Based on spores and pollen grains in the counting diagram (Fig. 11), the existing pine pollen grains show high fluctuation. The discontinuous appearance of pine pollen grains in the core samples could be confined to airborne pollen from the neighberhood forests of the lower altitude. Actually, the pine pollen grains, the succate grains with aerolate wings, could have been carried to a very long distance away from their mother plants (Faegri, Iversen and Waterbolk, 1964)). Furthermore, the pine forests in the northern part of Thailand are confined to high land of altitude, about 700-1500 metres above sea level (Hasting and Leangsakul, 1984). In contrast, the pollen grains of *Betular, Quercus* and *Schima wallichii* Korth. which are recently dominant in upper montane rain forest (Yu, McAndrews and Siddigi, 1996) were dominant in every layer of this deposits. These conspicuously indicate that this area has been a typical upper montane rain forest since the past (about 4,300 B.P.) and confirm Wanthanachisaeng's research (1997) as well. But, this study can not confirm to the Hasting and Liengsakul's conclusion

(1984). They reported that this area in the past was a pine forest but is changed to upper montane rain forest in the present time.

Notwithstanding, *P. chinense* Linn., *P. plebejum* R. Br. which distribute around the bog are dominant pollen grains and are of the highest percentage of all found at the top layer of sediments. So it can also be assumed that this damp area was deforested by human. Fluctuations of Rosaceae, *Engerthadia, Agapetes, Vaccinium* and *Rhododendron* show that Holocene period in northern part of Thailand was an unstable climate. The unstable climate (Hasting and Leingsakul, 1984) could be seen from the disappearance and/or little pollen grains of temperate plants in certain subsampling core. This evidence support the mid-Holocene hypothesis as proposed by Liu (1990) and Webb (1993) as well as the early Holocene and early mid-Holocene hypothesis as proposed by Baker et al. (1992) and Yu (1995). Moreover, Doi Inthanon, the highest peak in Thailand, is a part of the Taunaosri mountain range which is uplifted as a part of Himalayan range (Sharma, 1977). Therefore, the *Plagiogyria communis* Ching which is common in the forest of Himalayas is a species of fern found only in this area of Thailand (Poungtaptim and Pyramarn, 1998). Thus, the discovery of this *P. communis* Ching to be exclusive only to the Ang-Kha peaks in Thailand has confirmed the theory that Doi Inthanon and the rest of Taunaosri mountain range are the part of the Himalayan range.

In the past, this area should also have been a wetland and be covered by trees of upper montane rain forest. The upper montane rain forest has never been wipped out nor replaced. Occurence of polygonum and grass pollen grains in all zones indicate the influence of human deforestation and farming.

However, the diversity of plants should also be reduced by human activities (Hasting and Leingsakul, 1984) for lodging and farming.

Recommendation

Certainly, there are many factors of the limitation in palynological study of peat bog of Doi Inthanon, Chiang Mai Province. These limited factors which are mainly difficult in determination are also accepted as follows :

1 The dispersal mechanism of pollen influences its deposition in the sampling area. Dry pollen grains and the wind-pollinated pollen grains are always better dispersed because of small size of the particle, and the greater number of pollinating units (Faegri, Iversen and Waterbolk, 1964). Moreover, the great majority of tropical species are not wind pollination but the insect-pollination, so that pollen production might be rather low (Faegri, 1966).

2 Geographical locations, aspects and local topography in relation to prevailing wind (Moore, Webb and Collinson, 1991) were also accepted.

3 Vegetational diversity of upper montane rain forest and the comformity of tropical pollen grains might lead to misdetermination of pollen and spore types (Jarupongsakul, 1987). We should be aware of this. The pollen grains and spores of plants around the bog as well as those of lower profile zone would also be studied in the details for supporting data.

4 Peat deposition and redeposition are the great factors which would be used to interpret the results (Moore, Webb and Collinson, 1991).

5 Water flow is a main factor of peat-forming ecosystem (Moore and Webb, 1978), so this factor would also be studied in details. The research on underwater flowing system should be conducted.

The criticised factors are the limited factors in palynological study in Thailand. So the author has confidently realized that all factors are very important part of determination. Unfortunately, the three years of scolar period were so short to solve all problems.