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단양 수양개 후기구석기 유적 숯의 수종분석

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Species Identification of Charcoals Excavated at the Late Paleolithic Site of Suyanggae, Danyang

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초록 후기구석기 유적인 수양개 유적에서 출토된 숯의 수종을 분석하였다. 수양개는 단양 한강유역에 위치한 유적으로, 출토된 숯의 방사성 탄소 연대는 18,630~16,400 BP이었다. 수종식별 결과 두 수종만 식별되었다. 142점 중 139점의 숯이 소나무류(이엽송)이었다. 나머지 3점만이 가문비 나무속이었다. 이 결과는 소나무가 주로 출토된 상부층, 즉 지표면 기준 235~245 cm 층위는 후빙기 기간 중 건조 온난한 기후에서 형성된 것이고 한대성 수종인 가문비나무가 출토된 270 cm 이하의 하부층은 최후빙기 동안에 형성된 것을 제시해주고 있다.

ABSTRACT We examined the species of charcoals excavated at the late paleolithic site of Suyanggae. Suyanggae is located on the riverbed of Han river near Danyang, central Korea. The charcoals belong to the post-glacial period (radiocarbon dates: 18,630~16,400 BP). Only two species were identified. Most of samples (139 among 142) examined were *Pinus* spp. (diploxylon). The other 3 samples were *Picea* spp. The results suggest the upper layer at 235~245 cm below the ground level was formed during dry and warm post glacial period, predominated by two needle pines and lower layer at 270 cm below the ground layer during the last glacial maximum period, predominated by spruces.

Introduction

Charcoals excavated at archeological sites provide important information about environmental condition as well as cooking or fire evidences. The species of charcoals can be identified by examining their micro-structures of wood tissues because charcoals retain most of cell structures of woods prior to the carbonization. Through the species identification, we can compare forest composition of the present with the past one, and consequently obtain the information about the climate and environments at the sites and layers.[1]

In the present study, we examined the charcoals excavated during 1983~1984 at the late paleolithic site of Suyanggae. Suyanggae is located on the riverbed of Han river near Danyang, central Korea. Radiocarbon dates of the samples indicated that the charcoals belong to the post-glacial period (18,630~16,400 BP). During the excavation works, only 12 samples (10 pines and two hardwoods) were analyzed.[2] We extended the previous study by examining all of the charcoal samples of Suyanggae.

Method and Materials

Total of 142 charcoal segments were analyzed. They were collected from the open furnace ('whaduck') place at the Suyanggae Site I (18,630~16,400 BP). The charcoals were broken to reveal the three dimensional structures and they were mounted on the stub surface using double sided tapes. The charcoals mounted on the stub were placed in weighing bottles and were dried at 105°C using an ordinary drying oven for 24 hours. After drying, the charcoals were cooled down in the bottle covered to prevent heated charcoals from absorbing moistures in the air. The dried and cooled charcoals were gold-coated, then examined the structures using a Hitachi scanning electron mi- croscope.

Table 1. Charcoal samples excavated in the Suyanggae site

Sample block	Sites (excavated dates)	Location (below ground)	Numbers
1	'whaduck' (year 1984)	-	64
2	'whaduck' (year 1984)	사다 2 르 1 235~245 cm	44
3	'whaduck' (Nov. 5, 1985)	사다 2 르 1 235~245 cm	22
4	'whaduck' (Nov. 3, 1985)	라 3 ㄷ 4 르 4 270 cm	9
5	'whaduck'	사르 3D/ ㄷ 4 르 4 270 cm	3

Results and Discussion

Only two species were identified. Most of samples (139 among 142) examined were *Pinus* spp. (diploxylon). The other 3 samples were *Picea* spp.

Pinus spp. (diploxylon) has large vertical and horizontal resin ducts with thin epithelial cells (Fig. 1-Fig. 4). It has window-like crossfield pit and ray tracheids with dentate thickening. The characteristics of structure indicate that the species of diploxylon is Pinus khasya-type (hard) pines.[3] There are two pines, sharing *khasya*-type structure in the present Korean peninsula; *Pinus densiflora* and *Pinus thunbergii*. These two species could not be separated by wood anatomy.

Pinus densiflora Sieb. et Zucc. (Japanese red pine), also known as 'sonamu' in Korean common parlance, occurs naturally in Korea and

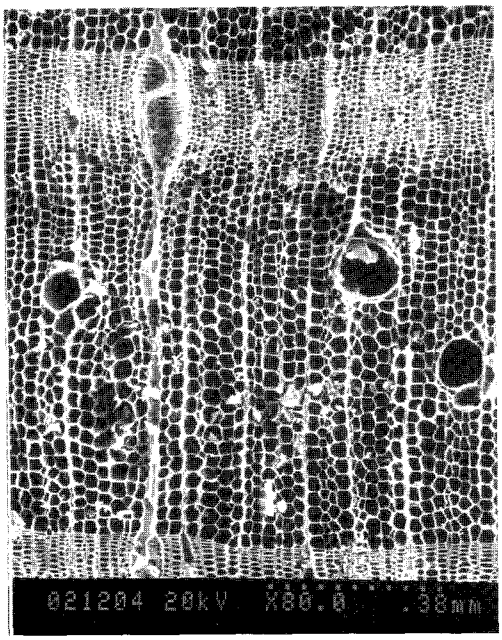

Fig. 1. Transverse surface of pines.

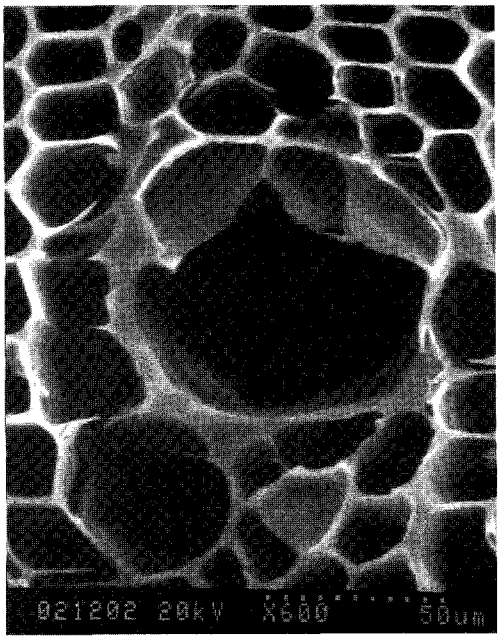

Fig. 2. Vertical resin ducts in pines.

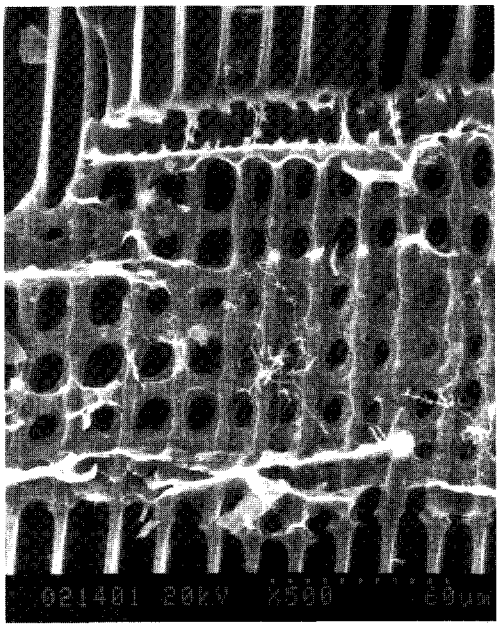

Fig. 3. Radial surface of pines.

Japan, although rarely in Manchuria, covering a wide ecological spectrum.[4] This species is one of the most favorite traditional building materials

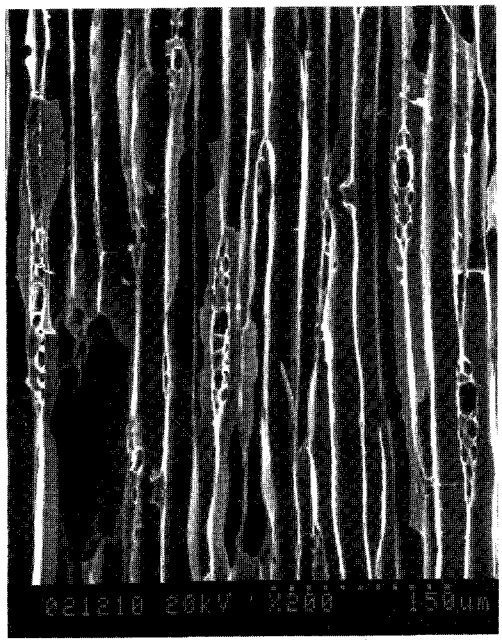

Fig. 4. Tangential surface of pines.

Table 2. The species of charcoal samples excavated in the Suyanggae site

Sample block	Sites (Excavated dates)	Numbers	Species
1	'whaduck' (year 1984)	64	*Pinus* spp. Diploxylon
2	'whaduck' (year 1984)	44	*Pinus* spp. Diploxylon
3	'whaduck' (Nov. 5, 1985)	22	*Pinus* spp. Diploxylon
4	'whaduck' (Nov. 3, 1985)	9	*Pinus* spp. Diploxylon
5	'whaduck'	3	*Picea* spp.

in Korea. Pure stands of Korean red pine are usually found at dry sites along the ridges over rock beds with thin soil cover, indicating that this species is most competitive on xeric (dry) sites.[4,5] *Pinus densiflora* occupies nearly 40% of the forests in Korea which cover about 65% of the total land area (Korea Forestry Adm, 1994). Its predominance in vegetation indicates warm and dry climate.

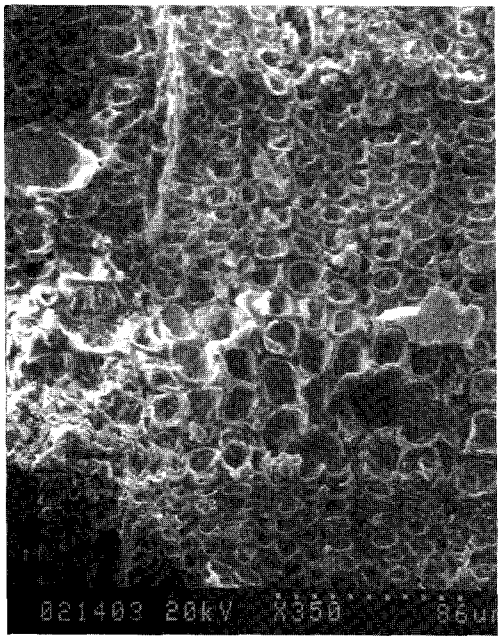

Fig. 5. Transverse surface of spruce.

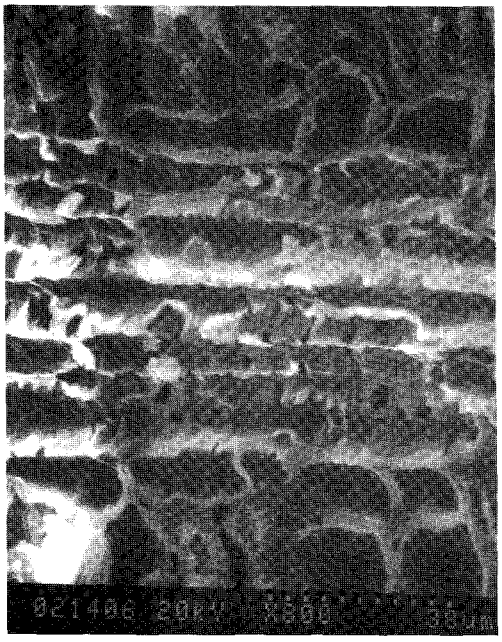

Fig. 6. Radial surface of spruces.

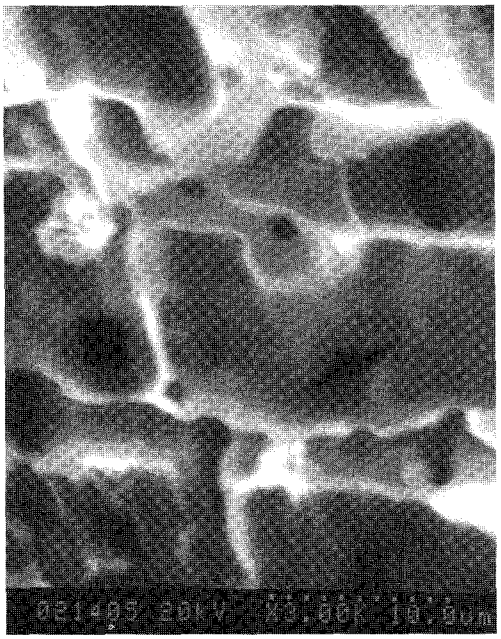

Fig. 7. Radial surface of spruces (piceiod crossfield pits).

Fig. 8. Tangential surface of spruces.

Pinus thunbergii (black pine) is living at the southern and coastal regions in the Korean peninsula, indicating less tolerant to both low temperature and dryness than *Pinus densiflora.*

Only three samples were identified as spruce

Picea spp. It possessed smaller resin ducts and ray tracheids which had bordered pits (Fig. 5-Fig. 8). Earlywood/latewood transitions were rather gradual. It had piceiod crossfield pits. There are two major spruce species in the present vegetation of Korea; *Picea jezoensis* and *Picea koraiensis*. These two species could not be separated by wood anatomy. Both species grow mainly in northern Korea and only in the subalpine zones at high elevation in southern Korea. They do not grow near Suyanggae sites any more at present. Spruce existence at the Suyanggae layers at the central Korea indicates cold climate during the last glacial maximum period.[6]

Conclusions

We examined the 142 charcoal segments excavated during 1983~1984 at the late paleolithic site of Suyanggae. Only two species were found; *Pinus* spp. (139 samples) and *Picea* spp. (3 samples). The results suggest the upper layer at 235~245 cm below the ground level was formed during dry and warm post glacial period, predominated by two needle pines and lower layer at 270 cm below the ground layer during the last glacial maximum period, predominated by spruces.

Acknowledgements

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