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Distribution of Saline Soils in the Khorat Basin of Thailand

— preliminary findings —

by

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Abstract

The Khorat basin of Northeast Thailand is divisible into five categories with respect to the surface salinity: 1) elevated ground underlain by saline Mesozoic rocks, 2) heavily salt-affected lowland, 3) moderately salt-affected lowland, 4) slightly salt-affected lowland, and 5) non-saline. These five zones are shown in Fig. 1.

Introduction

A previous report[1] showed that the salt deposited seasonally by groundwater emerging in the Khorat basin comes from shale and sandstone of the Mesozoic Mahasarakam Formation. The salt-bearing rocks release salt through erosion and weathering, and the salt released is accumulated in lower elevations. The present report shows the areal distribution of i) salt-retaining elevated areas and ii) salt-affected lowland, the latter being further divided into three zones by the degree of salinity.

I Method of study

Visible saline evidence such as salt encrustations and halophytic plants were traced and mapped. Beside this surface information, profile studies of chloride content (by silver nitrate) were made by augering and sampling of natural outcrops, to ascertain the vertical distribution of salt. The results reveal that saline subsoils are often detectable even in areas where no visible evidence of salinity exists on the ground surface. All these surface and subsurface data were plotted on the cross sections of Figs. 2 to 35.

The salinity of unvisited areas was assesed by extrapolating the field data on the cross sections by means of geomorphological interpretation, with the help of the 1 : 50,000 topographical maps,[2] soil maps[3-5], and a geological map.[6] The salt distribution map of Fig. 1 was prepared in this way. This is a first approximation subject to revision when more detailed information is available.

II Mapping unit

Elevated ground composed of saline Mesozoic rocks is "salt-releasing", while lowlands,

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which are either eluvial or allvial plains, are "salt-receiving". Upland and lowland are thus separated into entirely different categories.

Salt is released from saline rocks throughout the year, but it remains in the subsoil during the wet season and appears on the ground surface only during the dry season. The surface salinity is thus seasonal, controled by the monsoonal cycle. Though the salinity is most serious in the middle of dry season, only this situation is considered in this paper. The following mapping units and their descriptions are all based on this mid-dry season situation.

i) *Heality salt-affected lowland*

This is an area in which salt encrustations are common or even abundant and the salt content is comparatively high throughout the profiles. The land is mostly devoted to rice farming, but many salt patches are left uncultivated because of their strong salinity. In those particularly strongly salt-affected area, clumps of thorny bushes such as *Nam daeng* (Maytenus mekongensis), *Nam prom* (Carissa cochinchinensis) and *Nam phii* (Azima savmentosa), of which *Nam daeng* is a very good halophytic indicator, are characteristically dominant. In some swale portions, black colored ground surfaces of Solonchak type are also occasionally seen. Geologically speaking, this unit corresponds to the eluvial valley formed along the western margin of the basin, close to "salt-releasing" higher ground.

ii) *Moderately salt-affected lowland*

Salt encrustations are seen scatteredly but not significant. They appear mostly in a form of small patches along the marginal zone of "salt-releasing" higher ground. This zone is for the most part free from salt encrustations, but saline subsoils are often encountered within 1 m below the ground surface. This land is mainly devoted to rice farming and a feature of the landscape is the occurence of many isolated Dipterocarpus trees. Most eluvial valleys except for these on the western margin of the basin, which is the heavily salt-affected zone, fall within this unit.

iii) *Slightly salt-affected lowland*

Salt encrustations are rare or absent, and saline subsoils are also not common in this unit. But groundwater, as found in shallow wells and ponds, is in most cases more or less saline. Geologically the unit nearly corresponds to the Recent alluvial valleys of the Chi and Mur rivers. All the land in this unit, except for active floodplains which are left wooded, is covered by paddy fields with sparcely scattered clumps of trees of various kinds.

iv) *Elevated ground composed of saline rocks*

This unit comprises elevated ground underlain by saline Mesozoic rocks. Comparison with the existing geological map reveals that the unit nearly coincides with the Mahasarakam Formation. Since there is always a cover of vegetation and surface layers about 1 m thick are composed of leached material, visible evidence of salinity is not common on the natural ground surface. But along gullies and road cuts, evidence such as streaks of sublimated salt and *Nam daeng* columpsare often observed. Sometimes, fresh outcrops of salt retaining shale and sandstone, whose salt content is high enough to be readily tasted, can be en-

countered.

v) Non-saline area

This is the area in which no saline indications are found.

III Cross section

Selected cross sections are shown in Figs. 2 to 35.

Simbols used in the profiles are as follows:

× Salt crust

Saline rocks

Alluvium

Non-saline rocks

Auger hole: chloride content is checked by silver nitrate at 20 cm intervals; the degree of the reaction is* shown by such abbreviations as:

v v v we; very very very weak reaction

v v we; very very weak reaction

v we; very weak reaction

we; weak reaction

md; moderate reaction

st; strong reaction

pond or stream whose salt content is checked; in the case of pond, the ground water level is also recorded

In the descrpition following abbreviation is used

yl: yellow br: brown gr: gray H: heavy C: clay S: sand Li: light L: loam

References

1) Somsri and Takaya, 1974. "Saline Soils in Northeast Thailand; their possible origin as deduced from field evidence" *Tonan Ajia Kenkyu* (Southeast Asian Studies) Vol. 12, No. 1, Kyoto Univ.

2) U. S. Army Map Service, 1961 Topographical map of 1/50,000, Map series L 708.

3) Land Use Dept., Thailand, 1972 "Detailed Reconnaissance Soil Map of Kalasin Province" Province series No. 9.

4) ————————, 1972. "Detailed Reconnaissance Soil Map of Mahasarakham Province" Province series No. 13.

5) ————————, 1973. "Detailed Reconnaissance Soil Map of Khon Kaen Province" Province series No. 14.

6) Dept. of Mineral Resources, Thailand, 1966. "Groundwater Resources Development of Northeastern Thailand" Groundwater Bulletin No. 2.

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* for the detail refer the authors' previous paper[1)]

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Table 1 Localities shown in Fig. 1

K	Khon Kaen
L	Kalasin
M	Mahasarakam
C	Chaiyaphum
N	Nakhonratchasima
R	Roi Et
B	Buriram
1	Ban Non Tao Lek
2	Ban Lao Ya
3	Ban Dung Niam
4	Amphoe Chiang Yun
5	Ban Nong Phak Waen
6	Peak 222 m
7	Ban Hong Hi
8	Amphoe Kamalasai
9	Ban Nong Soeng
10	Ban Nong Sa Pheng
11	Amphoe Kosum Phisai
12	Ban Hua Khua
13	Ban Tha Ngam
14	Amphoe Thawat Buri
15	Amphoe Selaphum
16	Amphoe Channabot
17	Amphoe Ban Phai
18	Amphoe Borobu
19	Ban Non Muang
20	Amphoe Wapi Pathum
21	Ban Khwao Noi
22	Amphoe Chaturaphak Phiman
23	Amphoe Kaset Wisai
24	Ban Ngo
25	Ban Na Yai
26	Amphoe Suwannaphum
27	Ban Khok Kaeo
28	Ban Krasang
29	Amphoe Tha Tum
30	Ban Ku Phra Ko
31	Ban Tha
32	Ban Rawiang
33	Amphoe Ban Han Dan Khum Thot
34	Ban Non Rawinag
35	Ban Kut Tha Lat
36	Amphoe Chaturat
37	Ban Kan Hong
38	Amphoe Non Thai
39	Amphoe Ban Kham
40	Amphoe Non Sung
41	Ban Nong Tha Yom
42	Ban Si Suk
43	Ban Samrong
44	Ban Don Muang
45	Ban Wat
46	Ban Ya Kha
47	Ban KM O
48	Ban Nong Ya Khao
49	Amphoe Phutthaisong
50	Amphoe Phayukkhaphum Phisai
51	Ban Nong Kheng
52	Ban Yang Si Surat
53	Amphoe Satuk

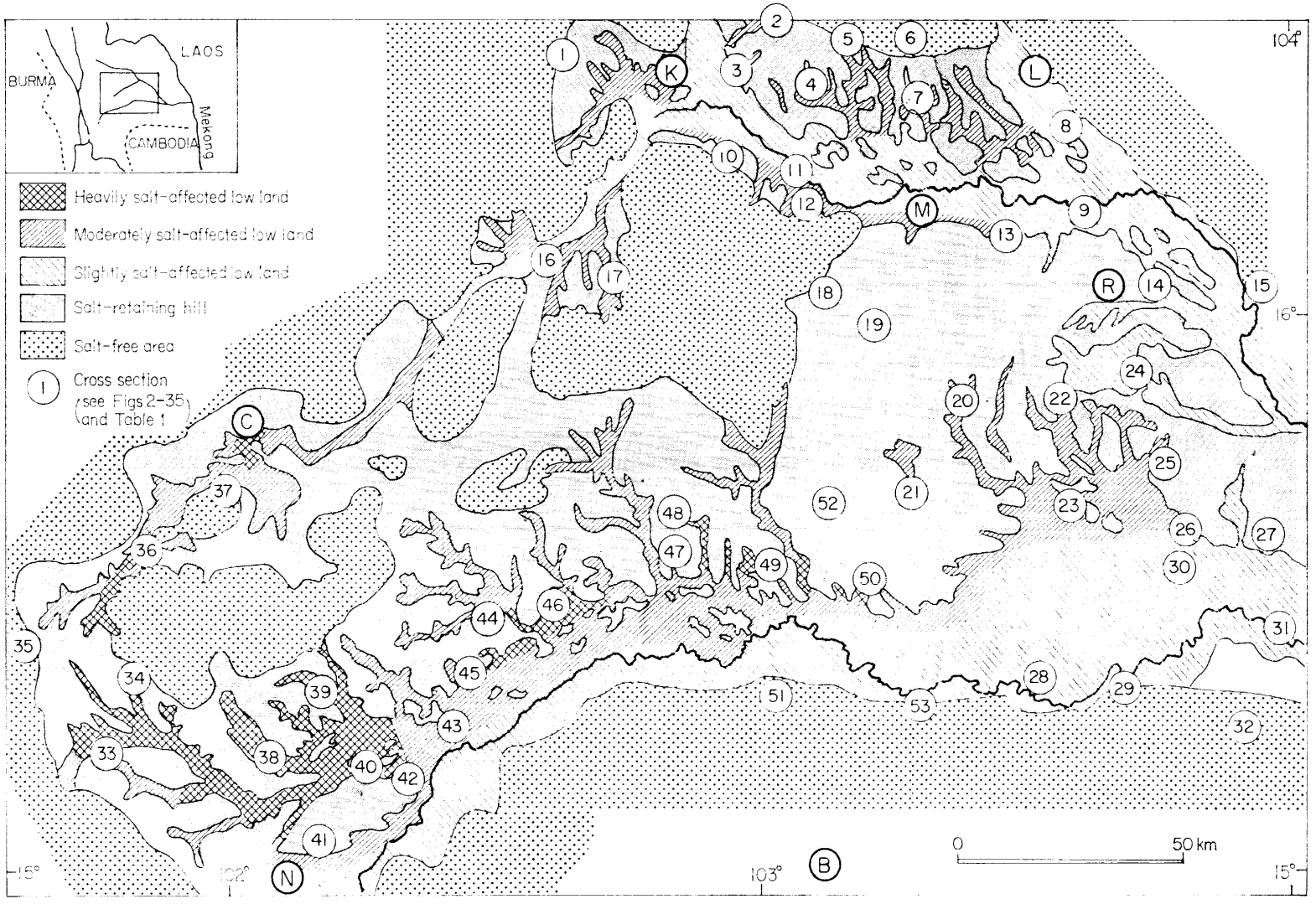
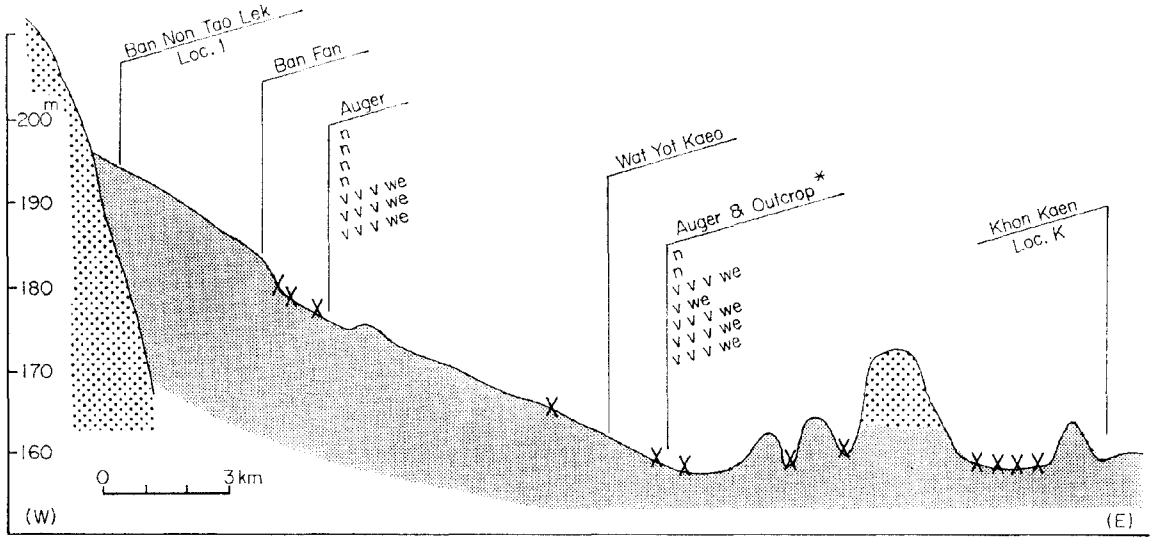


Fig. 1 The Salt distribution in the Khorat basin



Outcrop

0.0–0.2 m: purplish dark gr L; no R

–0.7 m: do, but with profuse pink quartz and more compact; v v v we R

–(0.8 m): lense of shell, charcoal, earthenware and animal bone fragments

–0.8 m: Mn-pisolith accumultion; v v v we R

–1.0 m: dark gr C with profuse yl mottlings, common lateritic concretions and few Ca-nudules; we R

–2.0 m+: yl and white SL; indulated; we R

Fig. 2 Cross section ①-Ⓚ

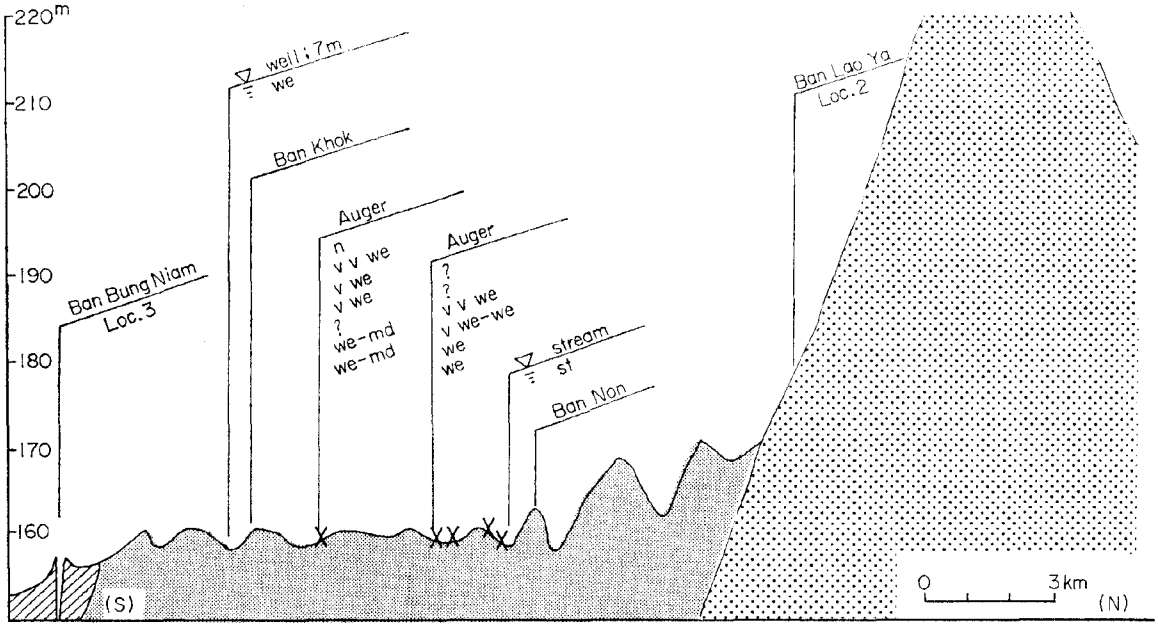


Fig. 3 Cross section ②-③

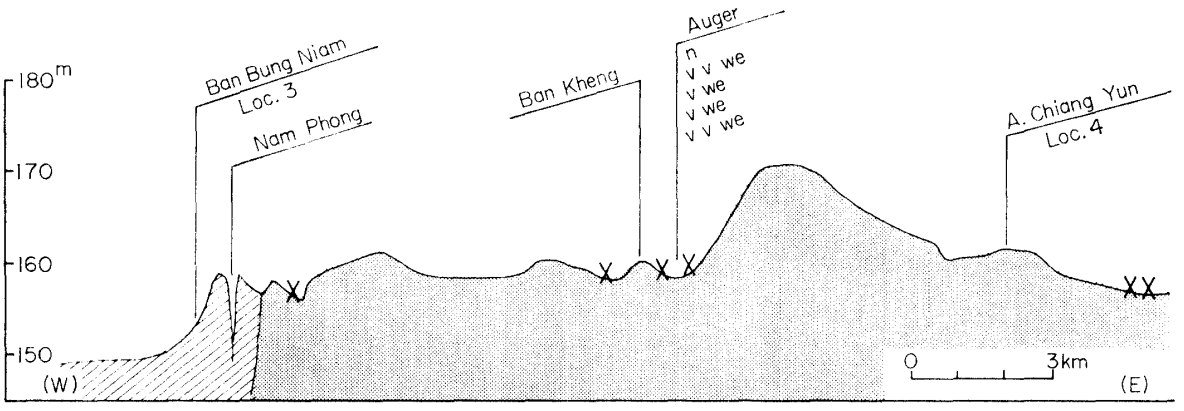


Fig. 4 Cross section ③–④

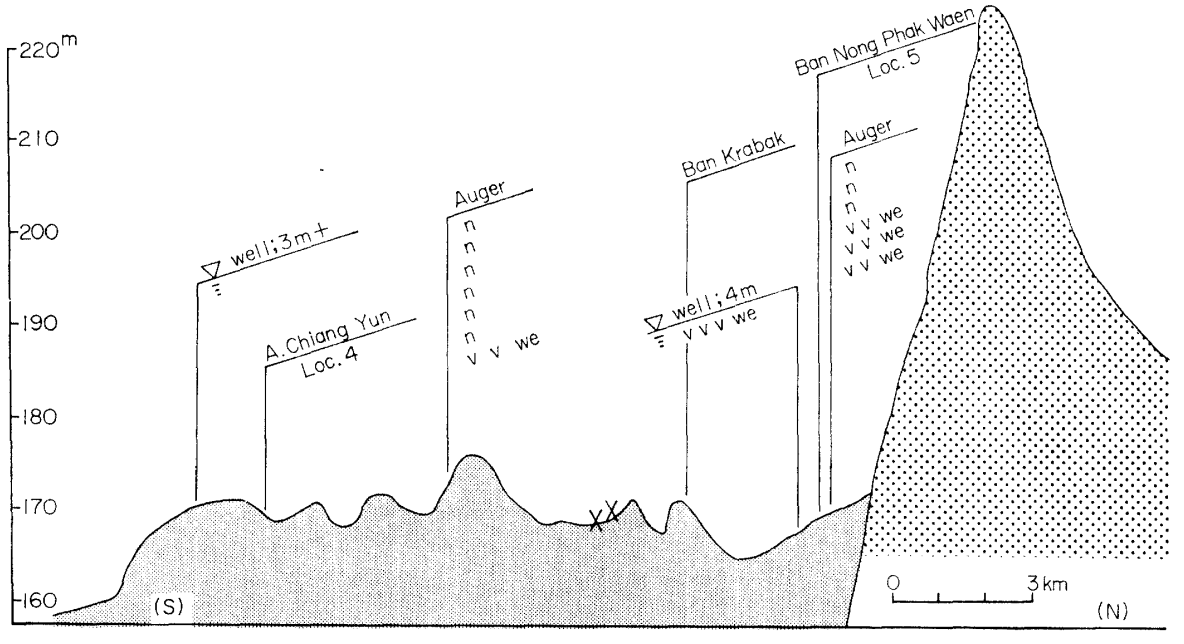


Fig. 5 Cross section ④–⑤

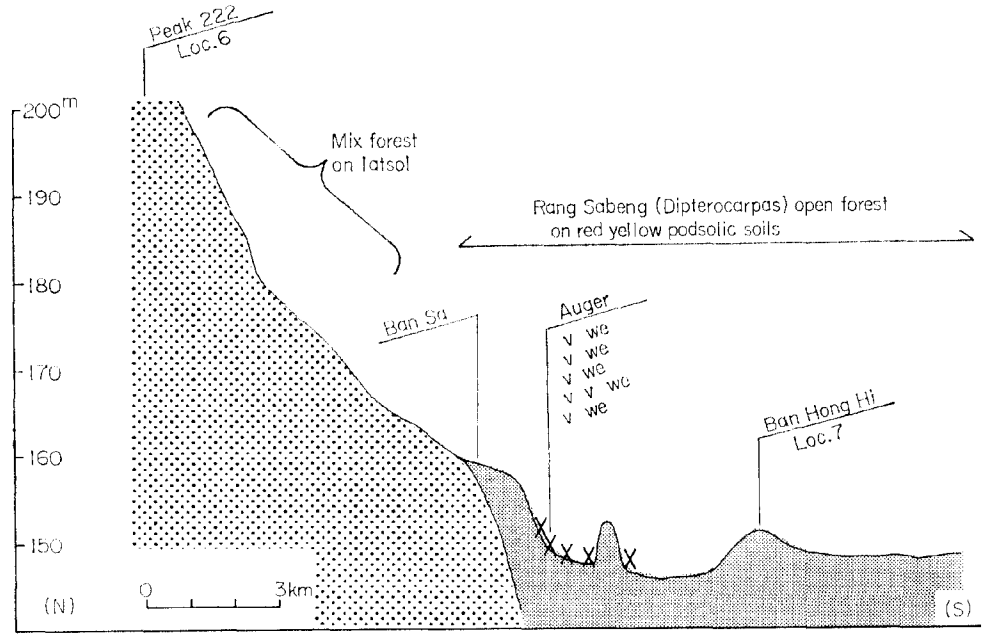


Fig. 6 Cross section ⑥-⑦

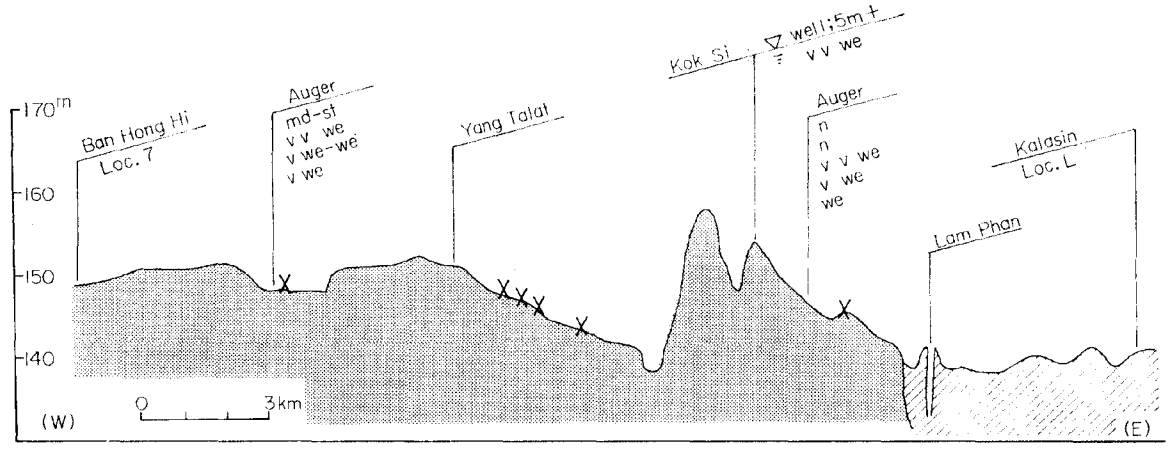


Fig. 7 Cross section ⑦-Ⓛ

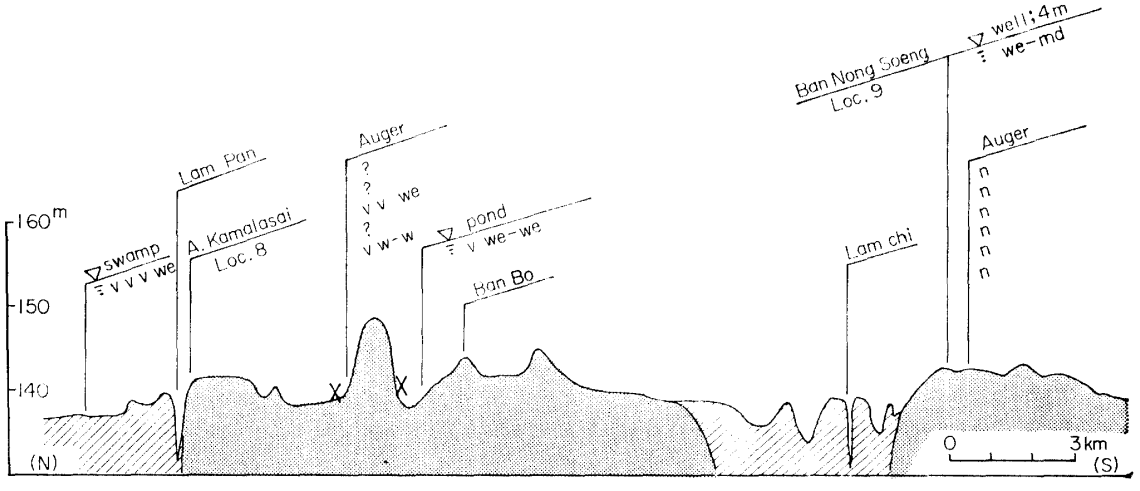
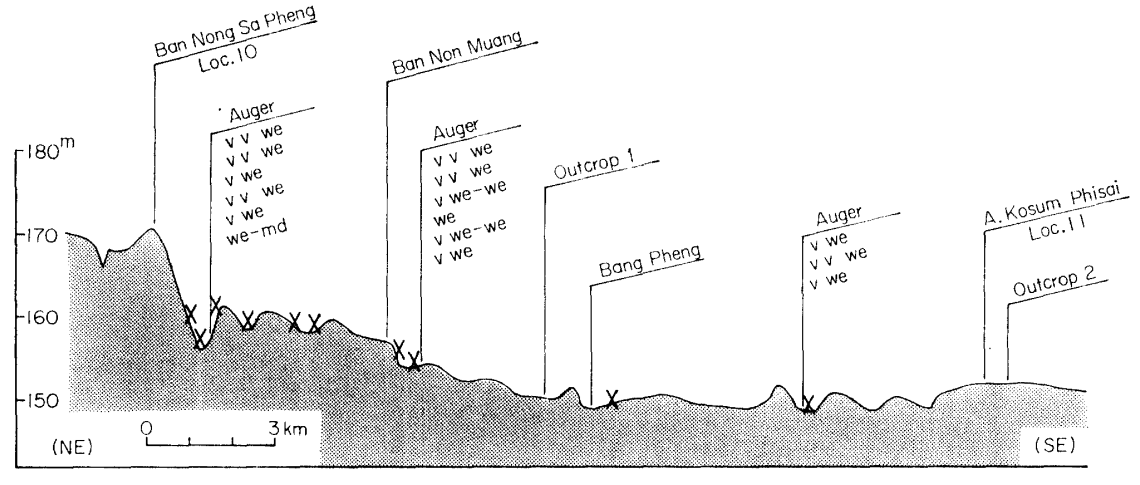


Fig. 8 Cross section ⑧-⑨



Outcrop 1

0.0–0.3 m: br gr L with few Fe-concretions; no R
–0.7 m: do v we to we R
–0.8 m: aggrigation of Fe-concretions and rock fragments
–1.2 m: weathered red br shale; we to md R

Outrcrop 2

0.0–0.7 m: br gr L with profuse pink quartz; no R
–0.8 m: do; v v v we R
–1.2 m: pisolitic laterite; v we to we R
–1.4 m: gr and yl mixed SC, indurated; we to md R
–1.8 m+: bluish gr gravel and sand; we R

Fig. 9 Cross section ⑩-⑪

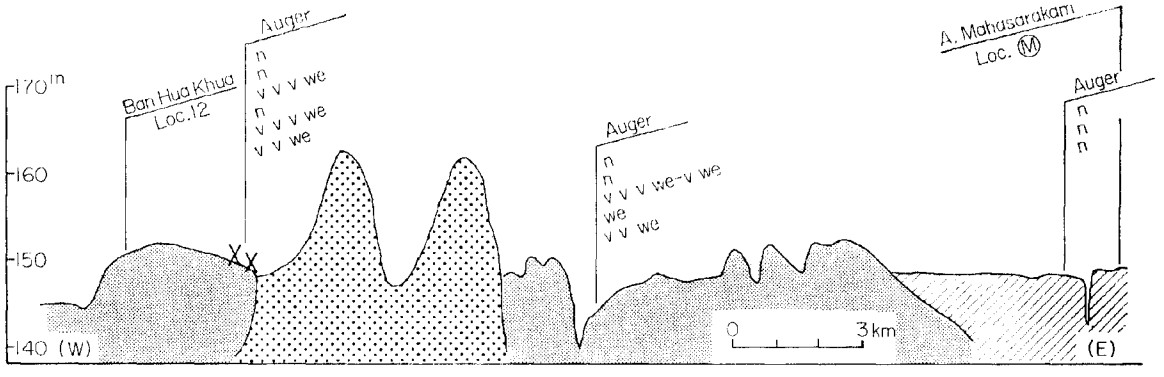


Fig. 10 Cross section ⑫–Ⓜ

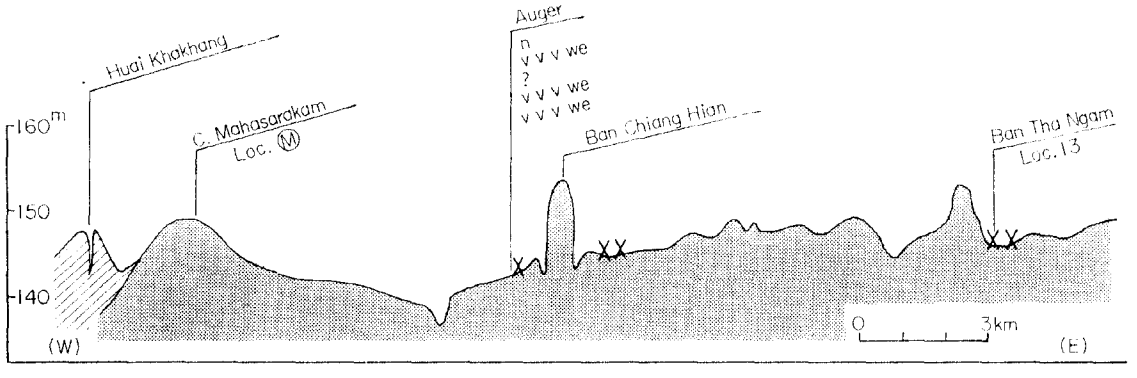
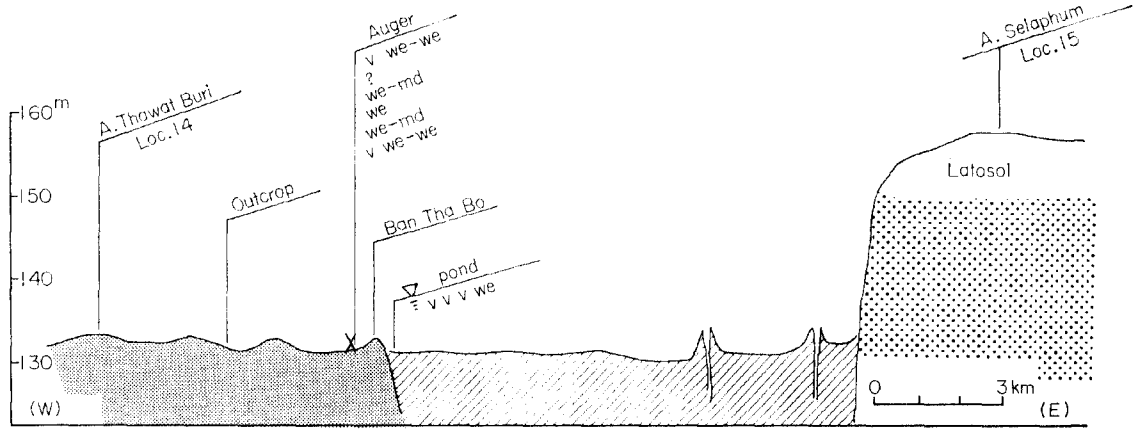


Fig. 11 Cross section Ⓜ–⑬



Outcrop

0.0–0.5 m: gr L with few pisoliths; no R
–0.7 m: gr br L with many br mottlings; no R
–1.2 m: bluish gr C with many br red lateritic mottlings; no R
–1.5 m: mixture of gr C and pink quartz with common br mottlings; no R
water: no R

Fig. 12 Cross section ⑭–⑮

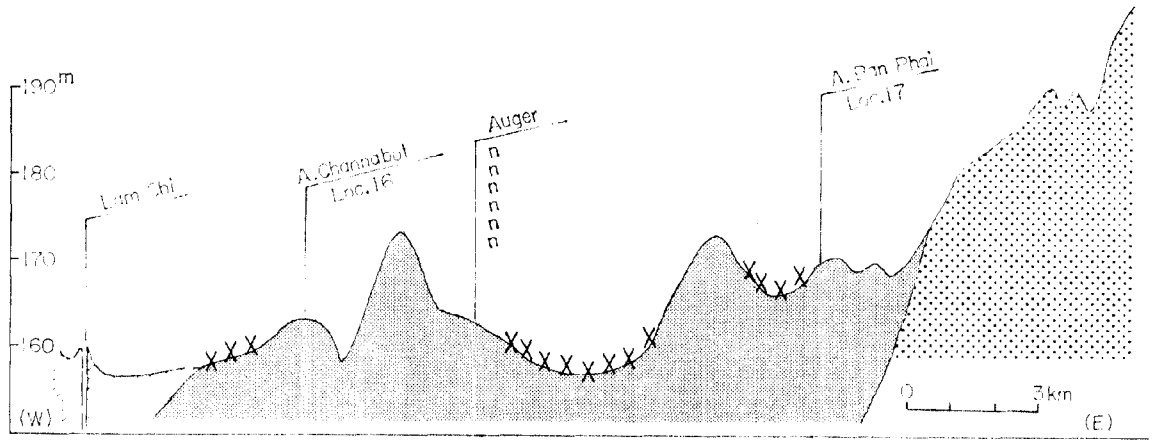


Fig. 13 Cross section ⑯ ⑰

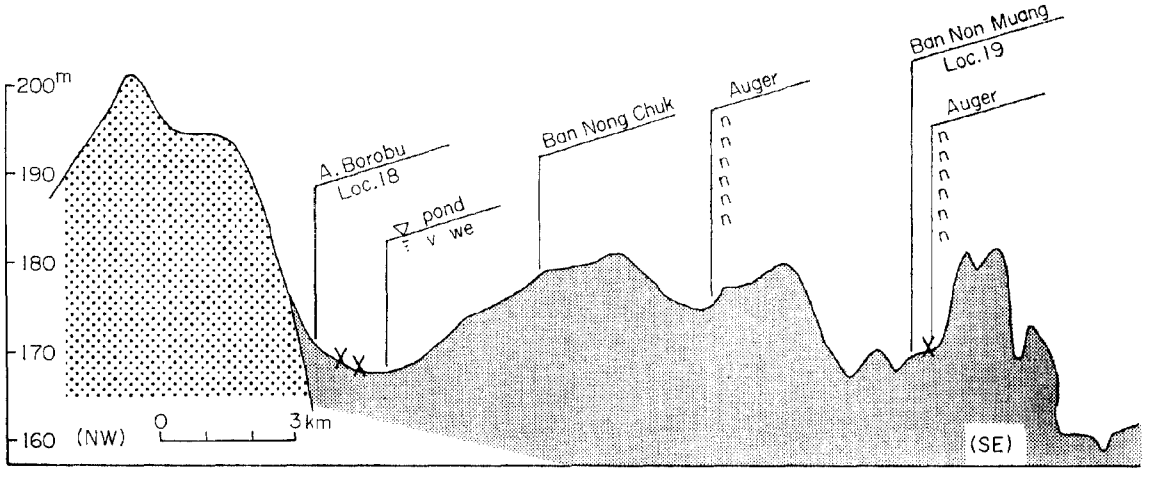


Fig. 14 Cross section ⑱-⑲

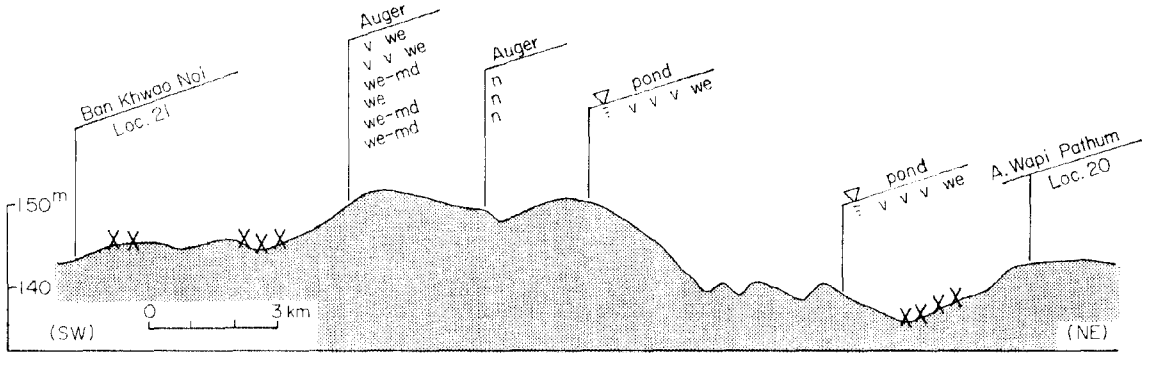
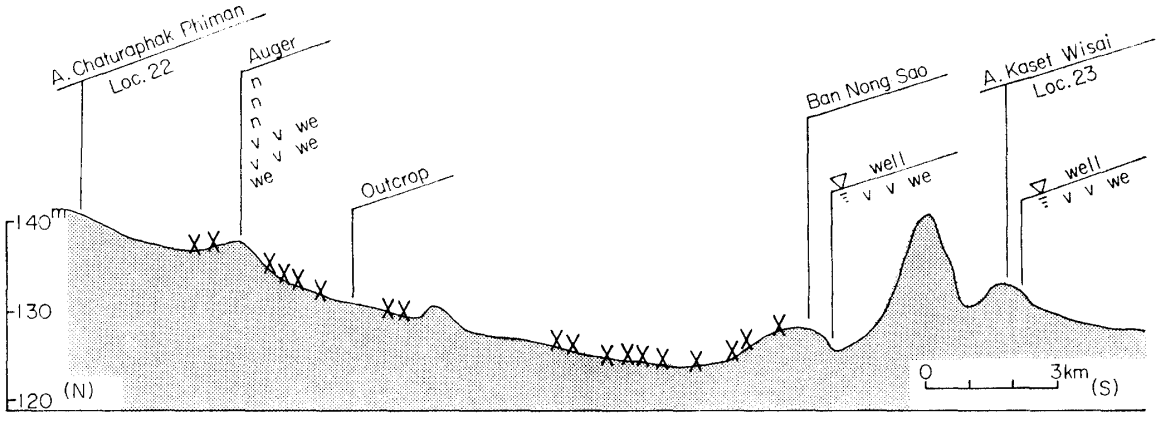


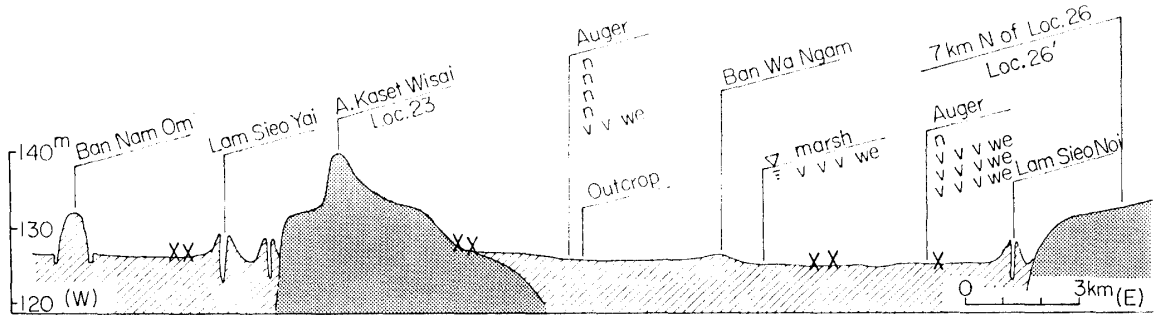
Fig. 15 Cross section ⑳ ㉑



Outcrop

0.0–0.1 m: gr L with profuse Mn-pisoliths; v v we R
–0.7 m: white to br gr S; v v we R
–0.75 m: Mn-pisolith accumulation; v v we R
–1.2 m: yl, gr, pink and white mixed S; v we R
–2.3 m: blue and gr mixed C; indurated; we to md R

Fig. 16 Cross section ㉒–㉓



Outcrop

0.0–0.3 m: pinkish gr fine S; v v v we R
–0.4 m: br gr compact fine S; v v v we R
–0.7 m: gr fine S; v v v we R
–0.8 m: lateritic pan
–1.3 m: pinkish gr CL; we R
–1.8 m: yl gr S; v v we R

Fig. 17 Cross section ㉓–㉖′

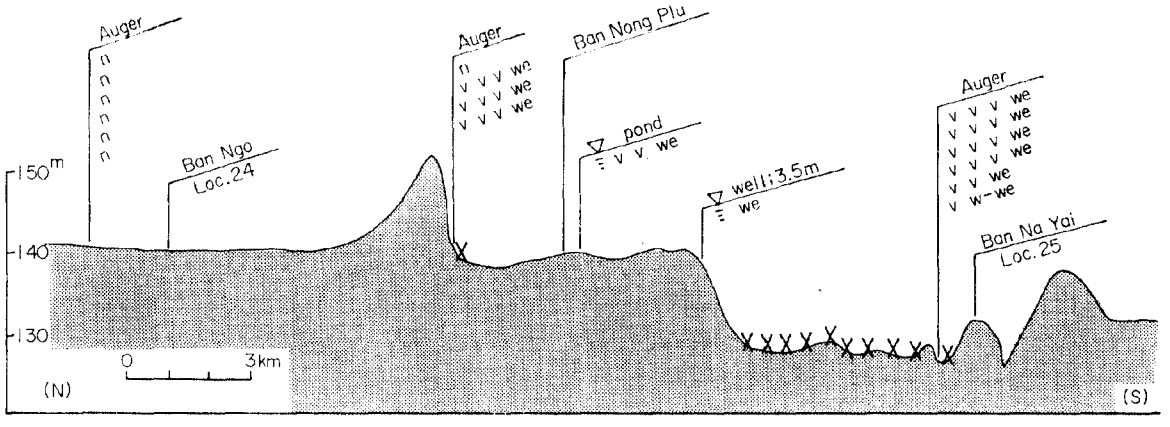
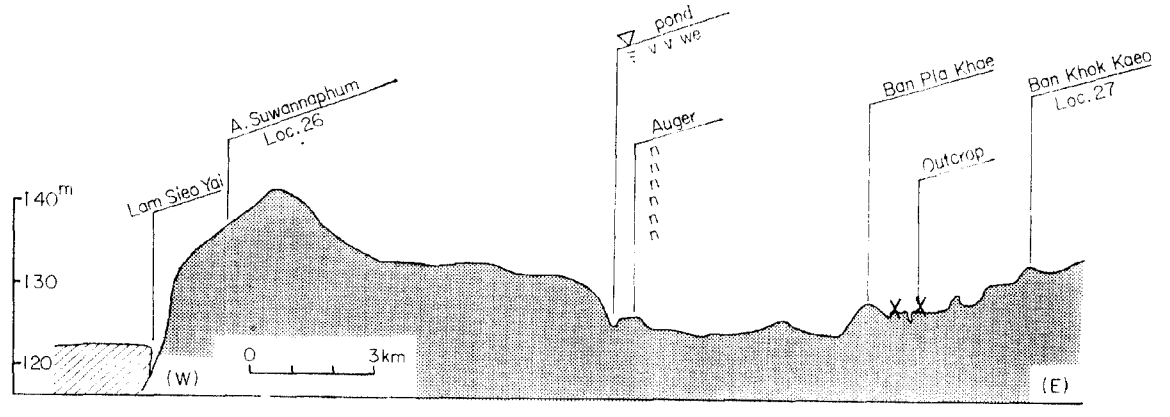


Fig. 18 Cross section ㉔–㉕



Outcrop

0.0–0.2 m: gr br very fine S; v v we R
–0.4 m: gr br L; v we R
–0.5 m: do; we R
–0.7 m: Fe-concreation accumulation; we R

Fig. 19 Cross section ㉖–㉗

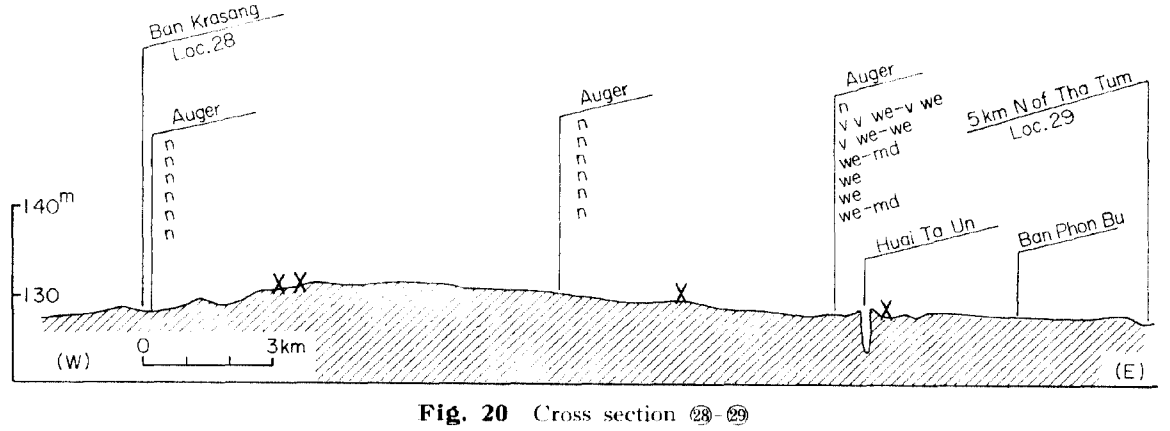
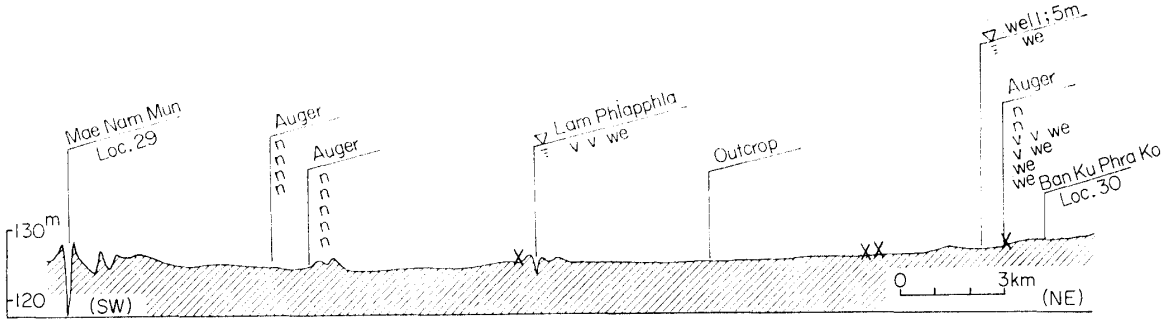


Fig. 20 Cross section ㉘–㉙



Outcrop

0.0–0.15 m: gr and yl mixed L; no R

–0.2 m: Fe- and Mn-pisolith accumulation; no R

–0.8 m: gr LC with few reddish br mottlings; no R

–1.3 m: pink, gr and br mixed SL; v v we R

water; v v we R

Fig. 21 Cross section ㉙–㉚

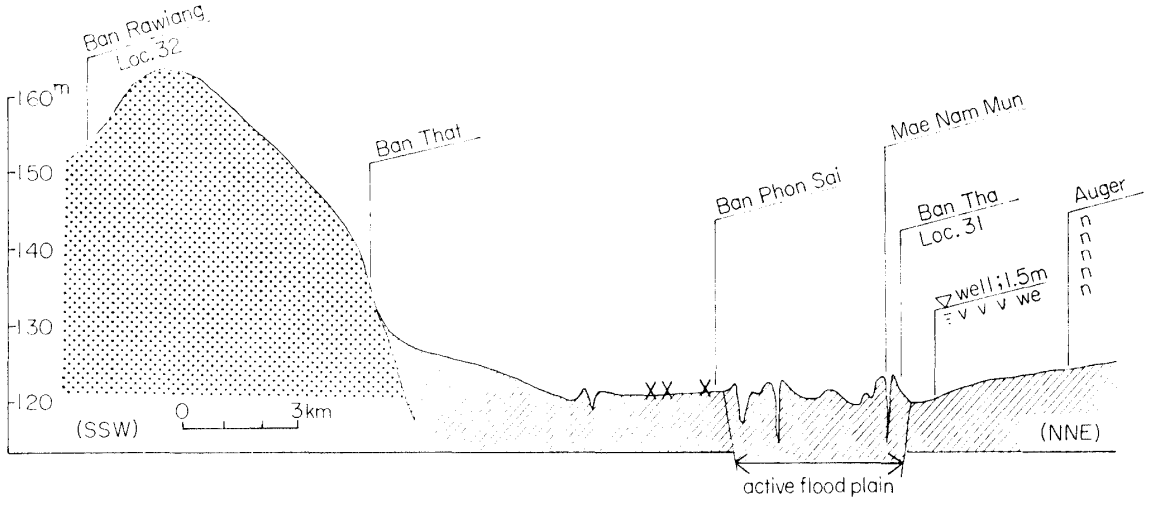


Fig. 22 Cross section ㉛–㉜

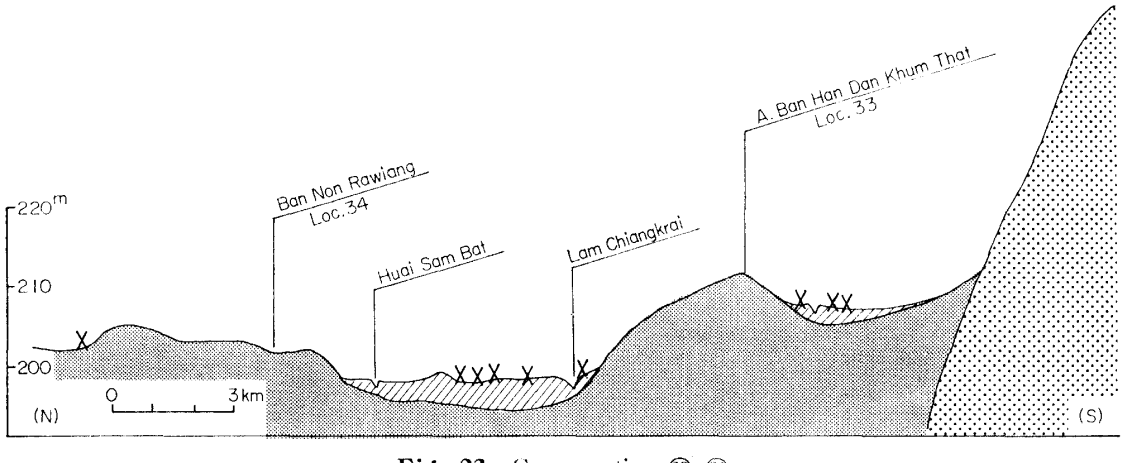
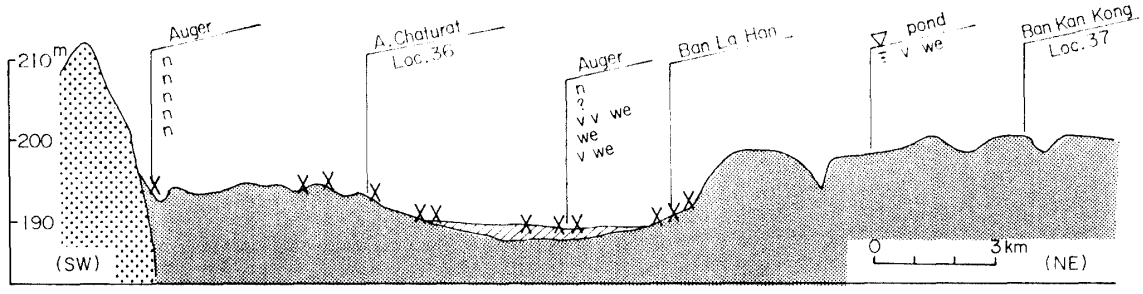


Fig. 23 Cross section ㉝–㉞



Cross sections of 35 38 and N-38–39 have been reported in Somsri and Takaya (1974)

Fig. 24 Cross section ㊱–㊲

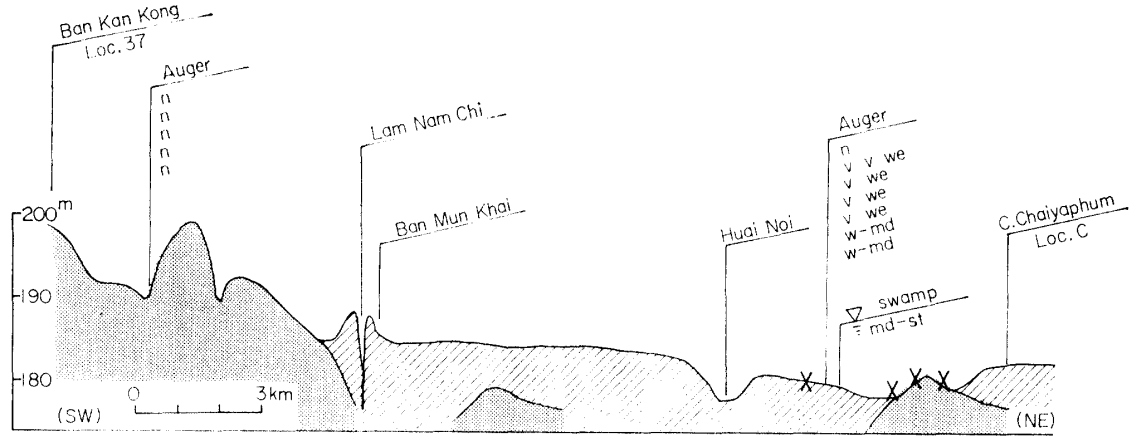
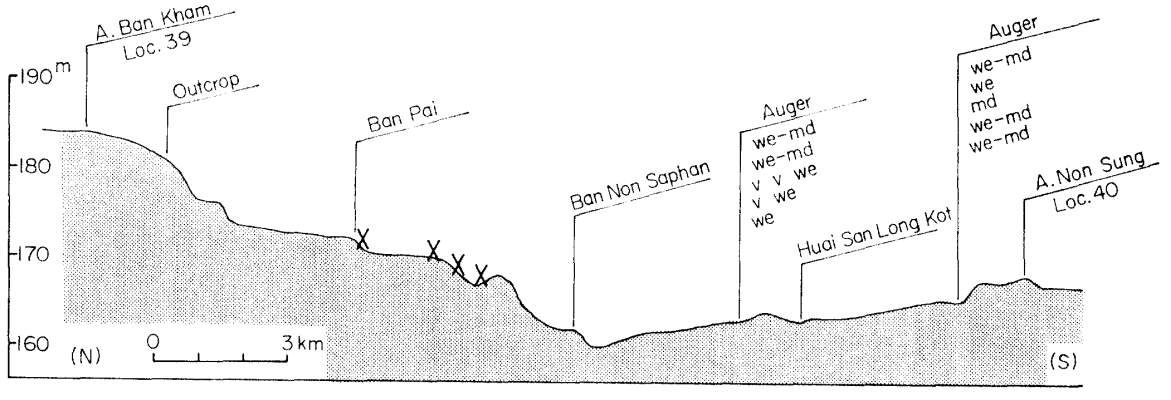


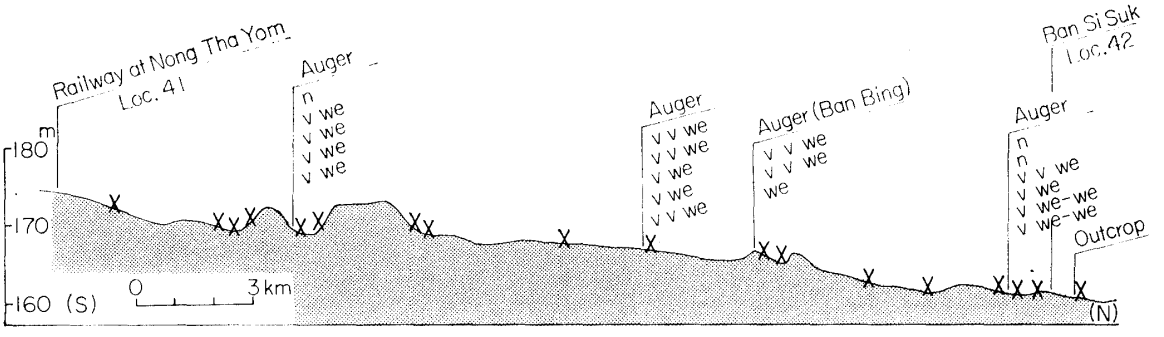
Fig. 25 Cross section ㊲–Ⓒ



Outcrop

0.0–0.3 m: very dark br gr HC; no R
–0.6 m: br gr HC; md R
–0.65 m: Mn-pisolith accumulation; md to st R
–0.95 m: mixture of Ca-nodules and kaoline clay; md to st R
–1.3 m: kaoline clay with Ca-nodules and br red mottlings; md to st R
–1.7 m: red br shale; md to st R

Fig. 26 Cross section ㊴–㊵



Outcrop

0.0–0.1 m: yl br very fine S with few pisolith; no R
–0.2 m: dark gr very fine S; no R
0.5 m: pink quartz sand; no R
–0.6 m: aggregation of Mn-pisolith and rock fragments; no R
–1.6 m: br red shale; v we to md R

Fig. 27 Cross section ㊶–㊷

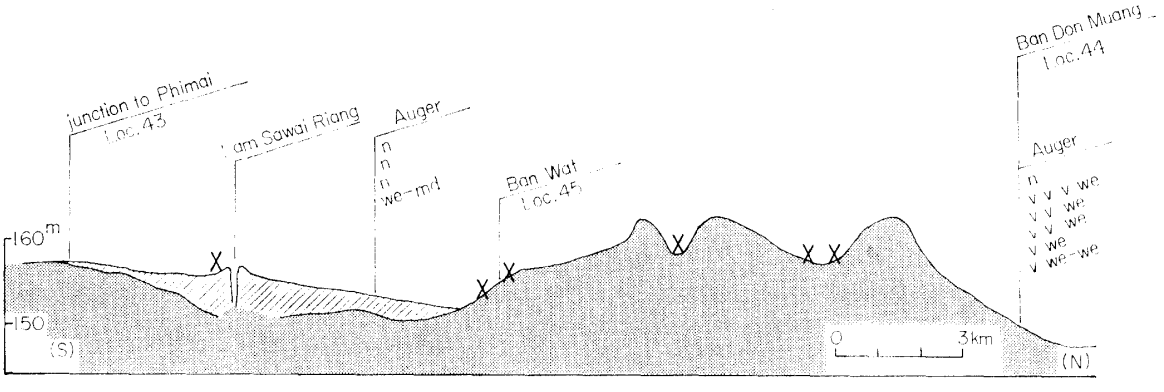


Fig. 28 Cross section ㊸–㊺–㊹

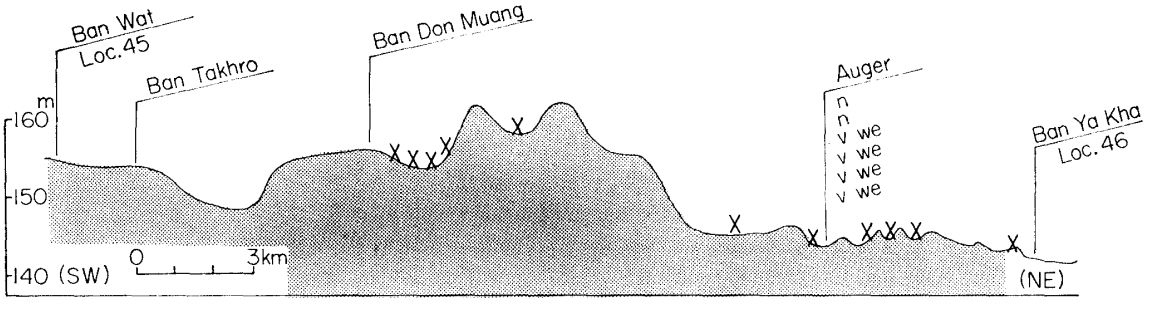


Fig. 29 Cross section ㊺–㊻

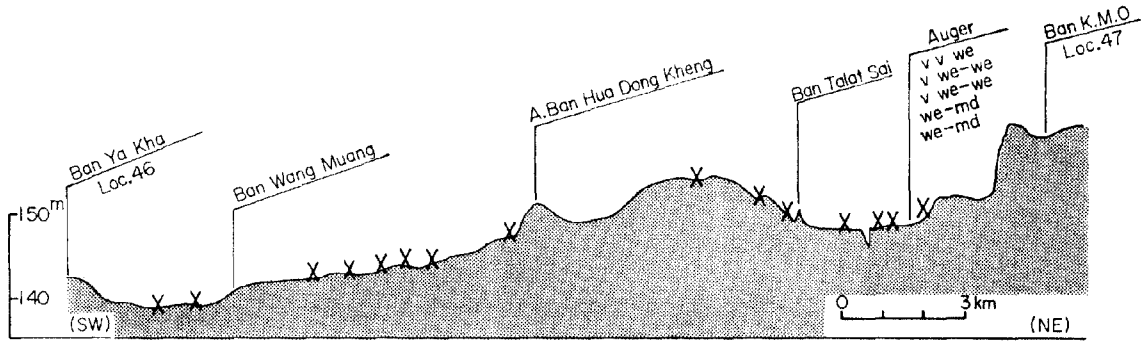
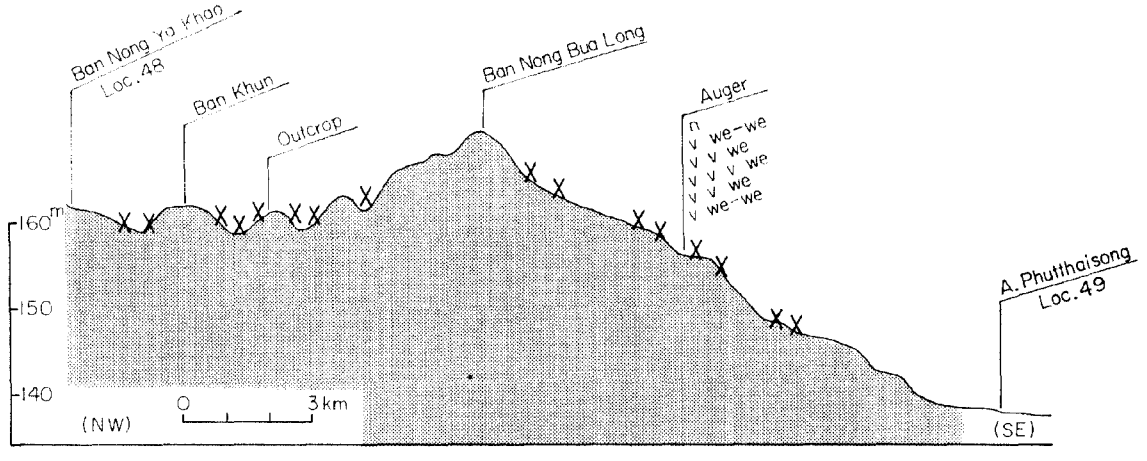


Fig. 30 Cross section ㊻-㊼



Outcrop

0.0–0.2 m: pink quartz; no R

–5.5 m: yl and gr mixed shale with common Ca-nodules; v.v we R

–9.0 m: blue and br red mixed shale; we R

Fig. 31 Cross section ㊽-㊾

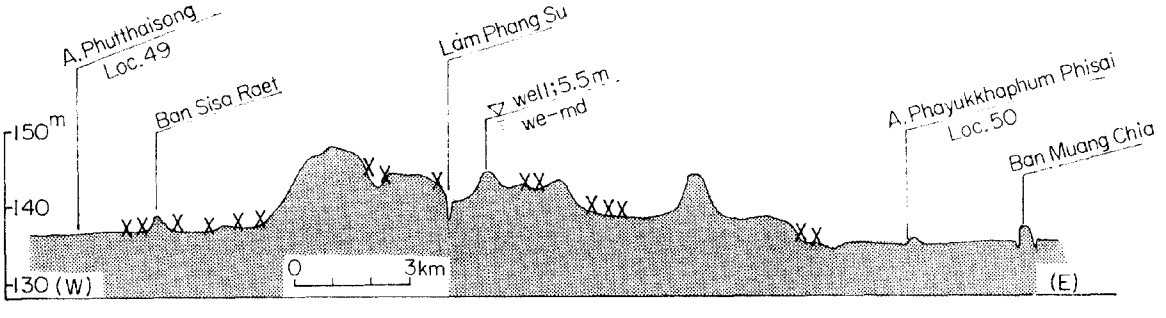


Fig. 32 Cross section ㊾-㊿

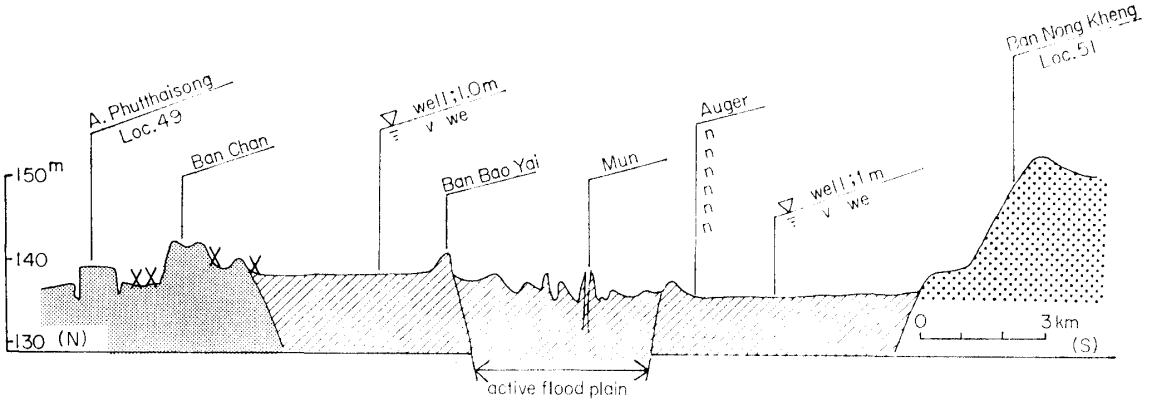


Fig. 33 Cross section ㊾-㊶

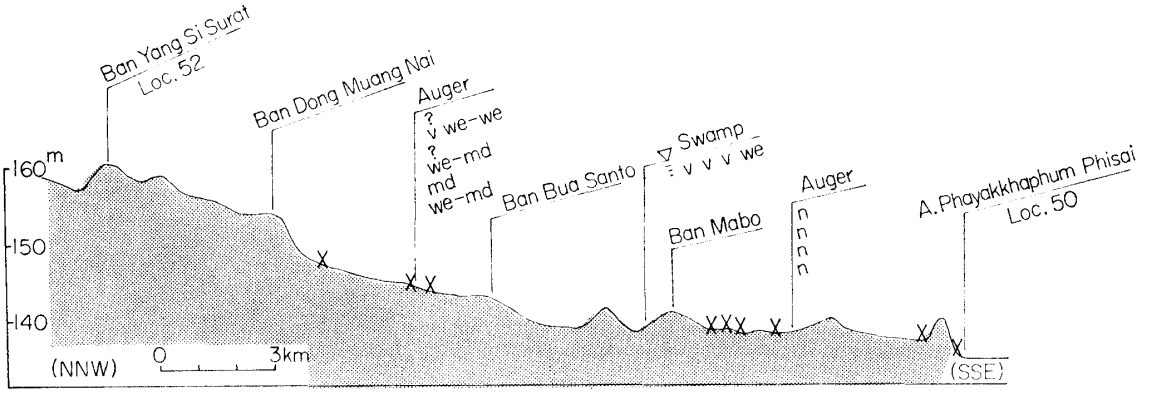


Fig. 34 Cross section ㊿-㊷

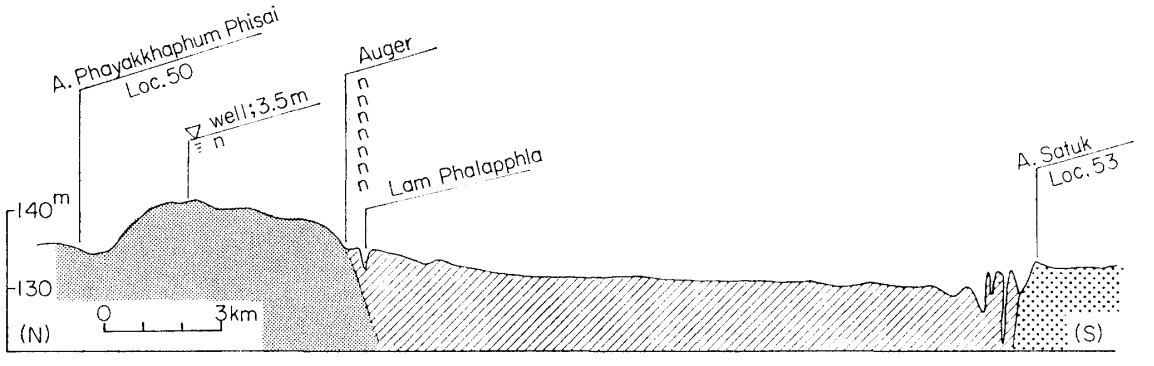


Fig. 35 Cross section ㊿-㊸