CHAPTER III

GEOLOGY OF PHA HOUA XANG

3.1 Physiography

The study area covers approximately 13 square kilometres between latitudes of 17°26' 07" to 17°27' 13"N, and longitudes of 105°00' 32" to 105°03'20"E. The physiography can be simply divided into two topographic terrains as mountainous terrain and flat plain.

The mountainous terrain mainly covers approximately 70 per cent of the study area, particularly in the central and northern parts. It is oriented in the northwest-southeast direction with relief of 160-471 metres above the mean sea level.

The flat plain terrain of mainly paddy field occupies almost all of the southern part of the study area. Its relief varies from 160-180 metres above the mean sea level. This area is suitable for farming and rice cultivation.

Generally, the study area is almost entirely covered by thin, mixed deciduous forest particularly in the mountainous part.

3.2 Stratigraphy and Rock Types

The study area is mainly covered by carbonate rocks and unconsolidate Quaternary sediments.

The carbonate rocks mainly form the karstic topographic feature and mountain ranges with steep cliffs, caves , stalagmite, stalactite in some places. They are exposed in the central, and northern parts of the study area covering about 70 per cent of the area. The carbonate rocks are consisting predominantly of very thick-bedded limestone with subordinate thinly-bedded limestone intercalated by thinly-bedded, dark gray chert in the northern limited part of the study area.

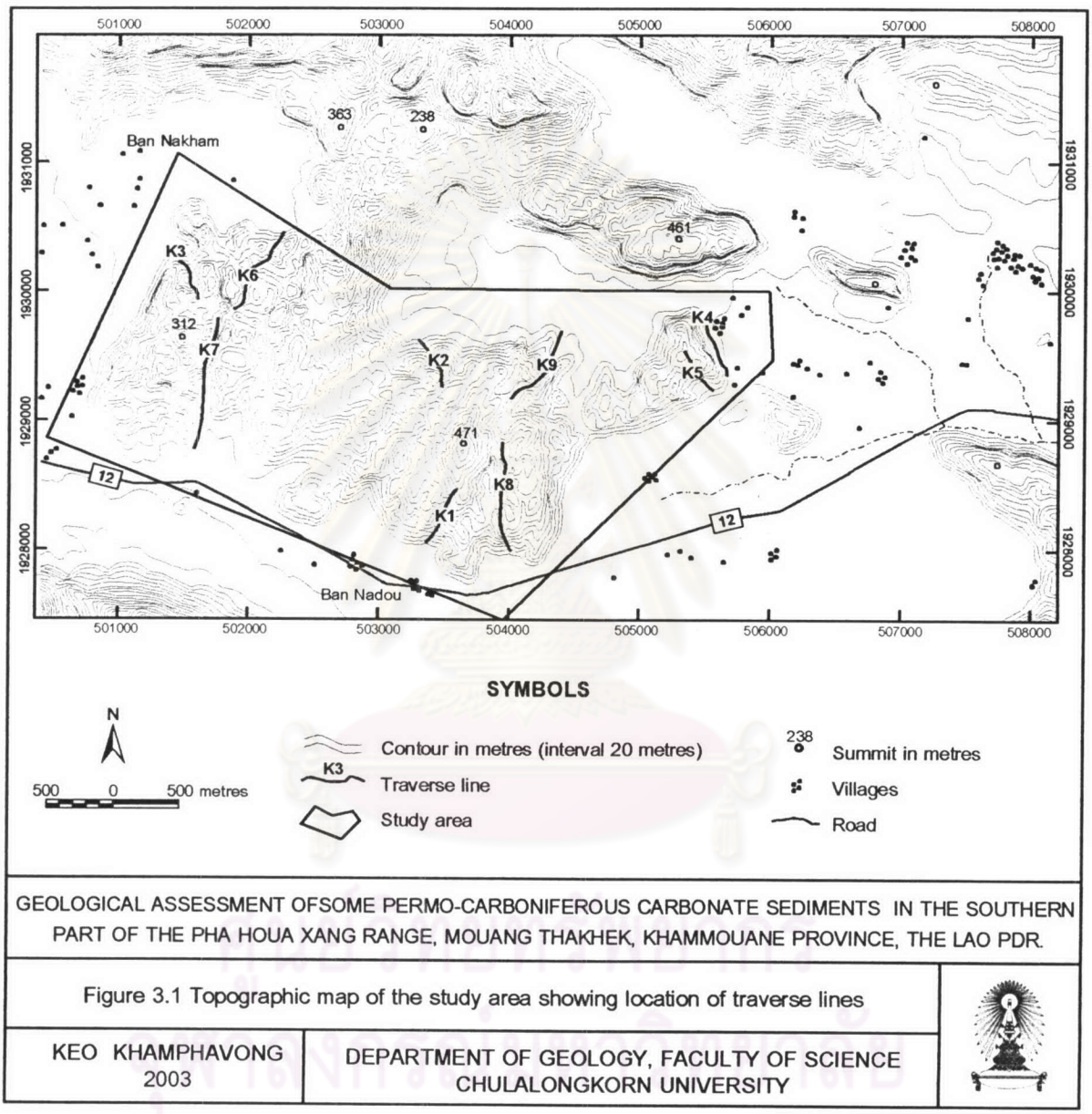
The unconsolidated Quaternary sediments are composed of gravel, sand, silty, clay, lateritic soil, and laterites. They are found in flat plains surrounding mountainous terrains.

During the present field investigation, totally nine traverse lines of measured rock-section are carried out in order to determine the lithostratigraphic characteristics of the study area. The locations of these traverse lines are illustrated in Fig. 3.1. 4 the traverse lines are oriented approximately in the northeast-southwest direction and the less are oriented in approximately northwest-southeast across the regional strike direction. They are about 3,000 metres long, totally. Altogether, 67 rock samples have been collected from all traverse-line sections. The samples are taken where there is a change in lithological characteristics, but for the homogenous lithology, the samples are collected every approximate 50-metre interval.

From the results of field investigation, lithology of the carbonate rocks of the study area are classified into three units, namely, unit A, unit B, and unit C (Fig. 3.2) in ascending order, respectively.

Unit A:

The rock of unit A is composed of dark-gray very thickly-bedded dolomitic limestone . This rock unit is present at the bottommost stratigraphic position in the study area. Its lower boundary is not exposed in the area. Its upper boundary is underlain conformably by the rock unit B. This rock unit is locally exposed in the northern part of the study area, in traverse lines K_2, K_9 which cover approximately 1 square kilometre. The rock mainly consists of dark-gray to gray, medium-grained, dolomitic limestone with calcite veinlets of 1-3 millimetres in width. The thickness is about 20 metres. The stained slab of representative sample K2-1 of this rock unit is shown in Fig.3.3.

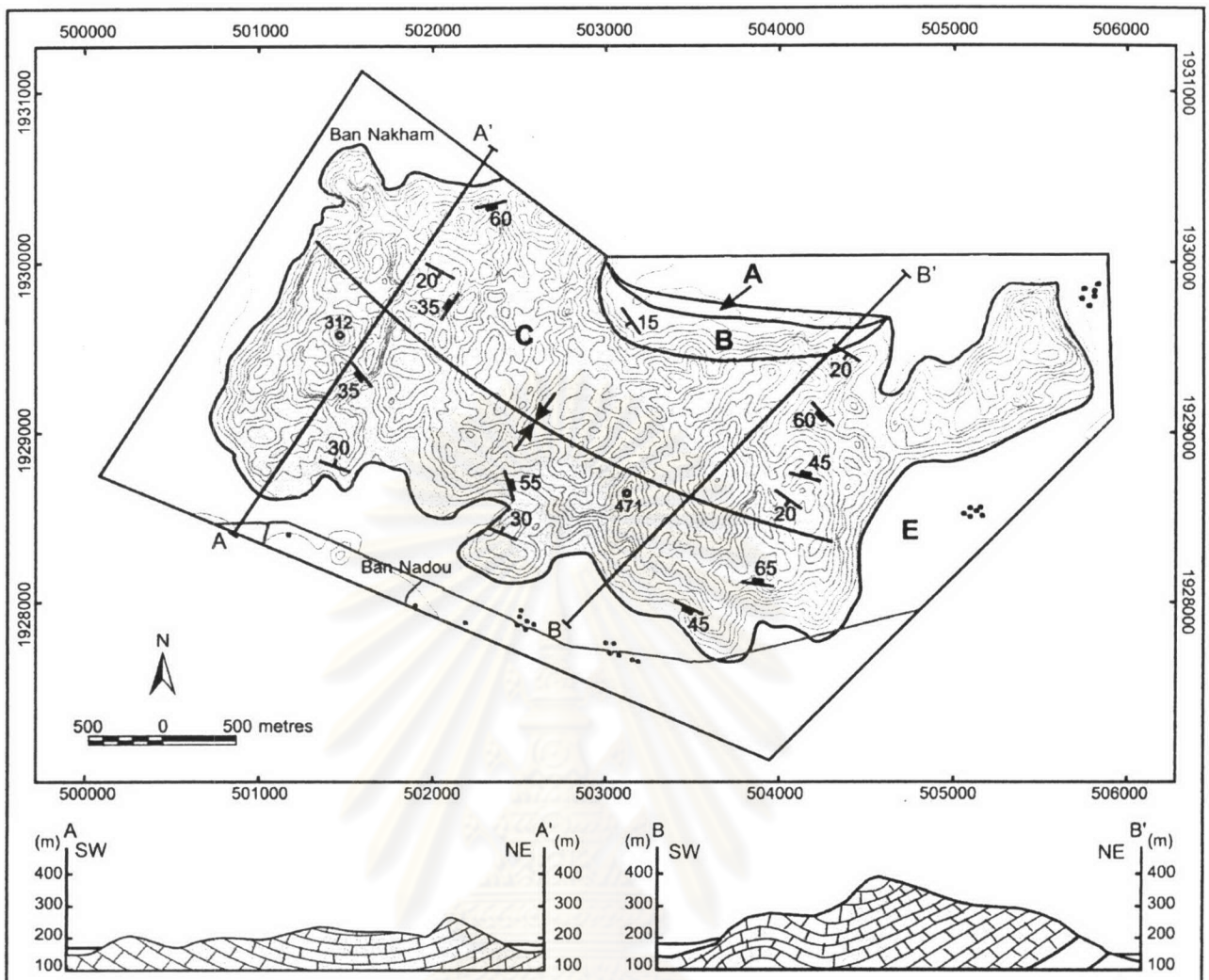


GEOLOGICAL ASSESSMENT OFSOME PERMO-CARBONIFEROUS CARBONATE SEDIMENTS IN THE SOUTHERN PART OF THE PHA HOUA XANG RANGE, MOUANG THAKHEK, KHAMMOUANE PROVINCE, THE LAO PDR.

Figure 3.1 Topographic map of the study area showing location of traverse lines

KEO KHAMPHAVONG
2003

DEPARTMENT OF GEOLOGY, FACULTY OF SCIENCE
CHULALONGKORN UNIVERSITY



EXPLANATION

E Unconsolidated sediments (gravel, sand, silty clay, laterite).

C Light-gray to brownish gray, fine grained thick to very thick-bedded limestone with calcite vein/veinlets, abundant joints.

B Gray to dark gray bedded limestone intercalated with thin bedded brownish gray to dark gray chert and dolomitic limestone as a minority.

A Gray to dark fine to medium-grained, very thick-bedded dolomitic limestone.

SYMBOLS

- 471 Summit in metres
- 30 Attitude of bedding with dip angle
- 65 Attitude of fracture with dip angle
- Syncline
- Contour in metre (interval 20 metres)
- A—A' cross section line
- village
- Road
- Study area

GEOLOGICAL ASSESSMENT OFSOME PERMO-CARBONIFEROUS CARBONATE SEDIMENTS IN THE SOUTHERN PART OF THE PHA HOUA XANG RANGE, MOUANG THAKHEK, KHAMMOUANE PROVINCE, THE LAO PDR.

Figure 3.2 Geological map of the study area.

KEO KHAMPHAVONG 2003	DEPARTMENT OF GEOLOGY, FACULTY OF SCIENCE CHULALONGKORN UNIVERSITY

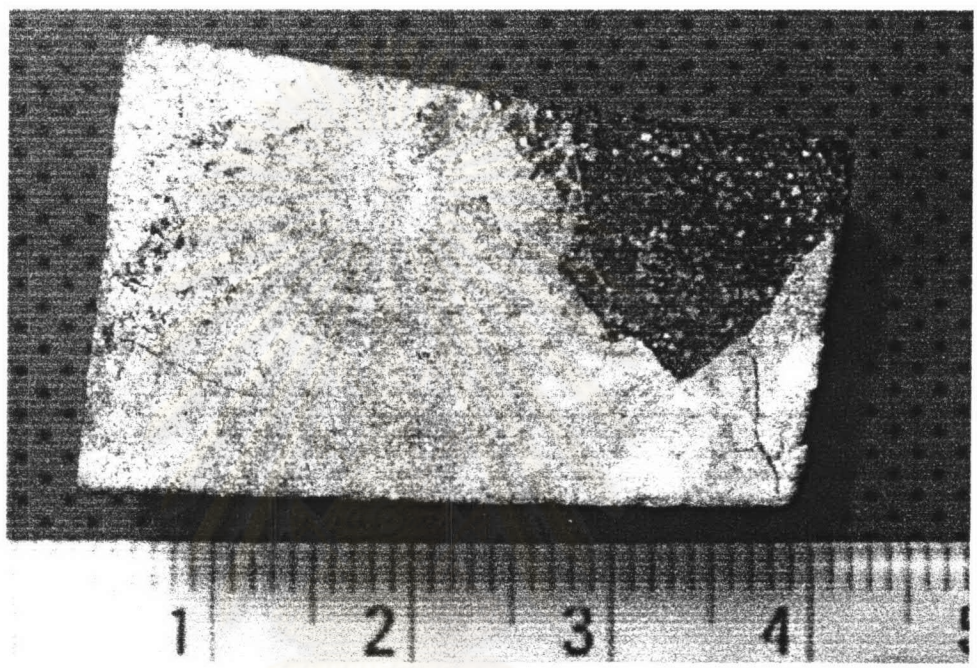


Fig. 3.3 Calcitic dolomite (stained slab with a mixture of arizarin red-S in acid media and potassium ferricyanide in acid media, sample N° K2-1, rock unit A), (see Appendix B). Dolomite displays in gray, calcite in red.

Unit B:

The rock unit B is composed of gray to dark-gray, bedded limestone intercalated with thinly-bedded brownish-gray to dark-gray chert (Figs.3.4,3.5,3.6,3.7). The thickness of limestone bed varies from 3-15 centimetres, whereas the thickness of bedded chert varies from 0.5-10 centimetres. This rock unit is oriented in the northwest-southeast direction and commonly dip 10-20°to SW. This unit is very well exposed in a limited area of the northern part of the study area in the traverse lines K_2, K_9 and in some localities of at traverse line K_4. This rock unit is stratigraphically present between the units A and C. The total thickness of this rock unit is more than 80 metres. It covers about 2 square kilometres.

Unit C:

The rock unit C is composed of light-gray to brownish-gray, fine-grained thickly- to very thickly-bedded limestone, with calcite veinlets (1-3 millimetres thick), showing abundant joints (with dominant orientations in the northwest-southeast and northsouth direction, sharp peaks, and strongly fractured (Figs.3.8,3.9,3.10,3.11,3.12,3.13).

The very thickly-bedded limestone is well exposed mostly in all part of the study area covering about 8 square kilometres. In some lower parts of them, stylolites are present especially in traverse line K_7 (Fig.3.12).

Moreover, the thickly-bedded limestone is also exposed locally in traverse line K_7, the southern part of the study area (Fig. 3.8). The attitude of bed is trending northwest-southeast direction dipping towards the 25-30°NE.

This rock unit is clearly exposed in traverse lines K_8, K_7, K_6. Its lower boundary conformably overlies the rock unit B, and its upper boundary conformably underlies the rock unit E. The total thickness of this unit is more than 140 metres.

Fig. 3.4 Thinly-bedded, dark gray, limestone interbedded with dark gray thinly elongated chert nodules (rocks unit B, traverse line K9)- grid reference: 044295

Fig. 3.5. Thin-to medium-bedded, dark gray limestone interbedded with Nodular, black chert (rock unit B, traverse line K9)- grid reference: 043294

Fig. 3.6 Natural outcrop of well thinly-bedded, dark gray limestone interbedded with thinly-bedded chert (rock unit B, traverse line K9)- grid reference: 043293

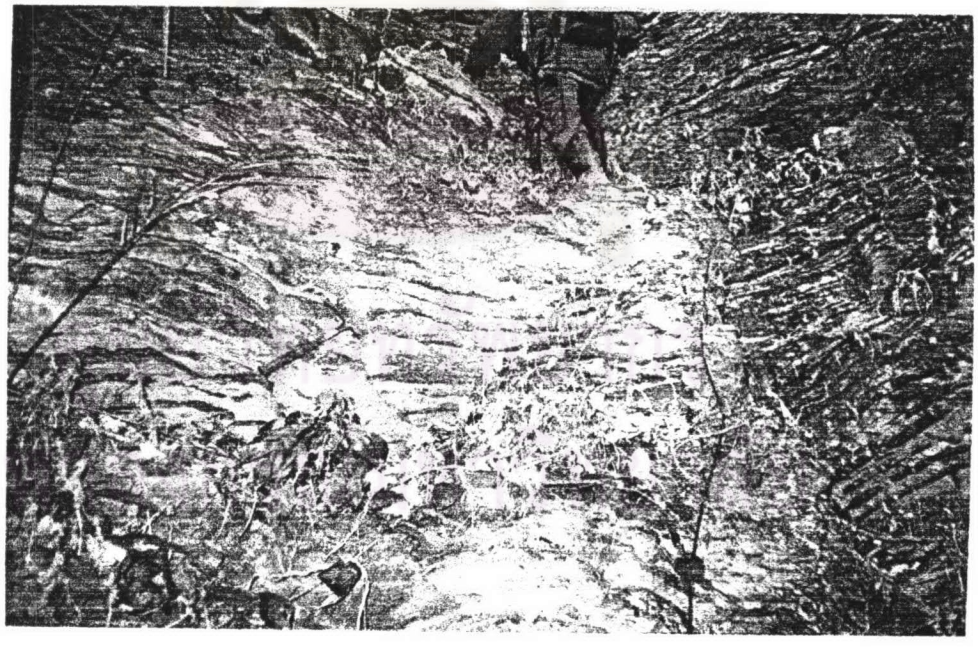


Fig. 3.7 Very thinly-to thinly-bedded, dark gray limestone interbedded with very thinly - bedded black chert (rock unit B, traverse line K9)- grid reference: 043292

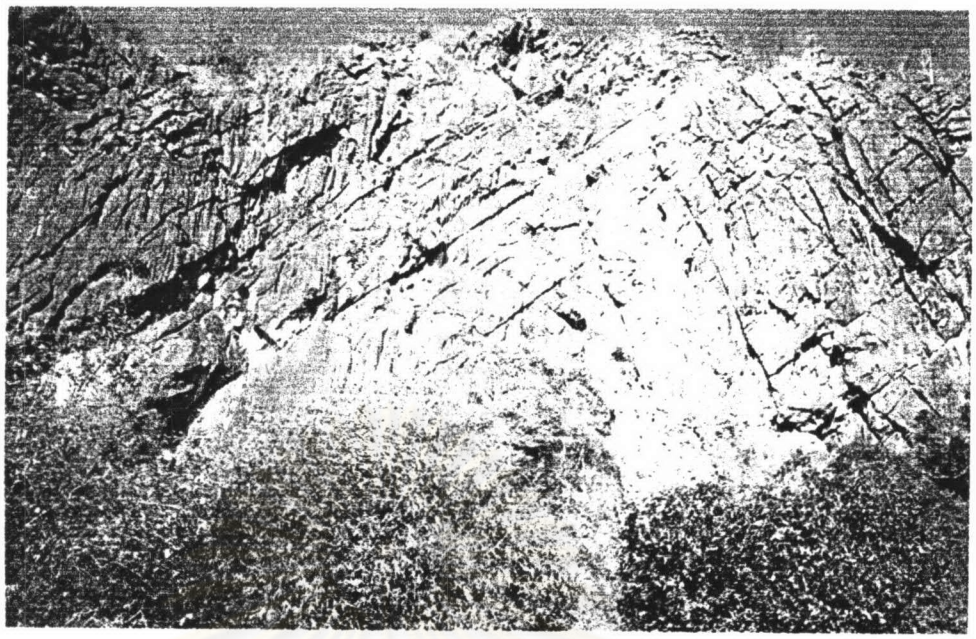


Fig. 3.8 Natural exposure of fine-grained, light-gray to brownish gray, very thickly-bedded limestone with abundant joints (rock unit C, traverse line K8)- grid reference: 041278

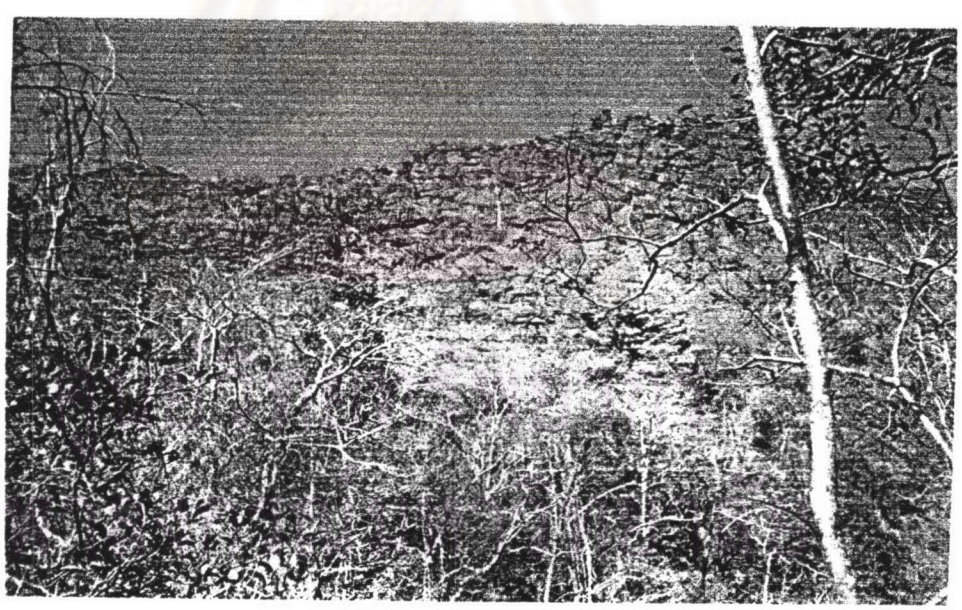


Fig. 3.9 Natural exposure of light gray fine-grained, very thickly-bedded limestone with abundant fructures,(rock unit C,traverse line K7)- grid reference: 017296

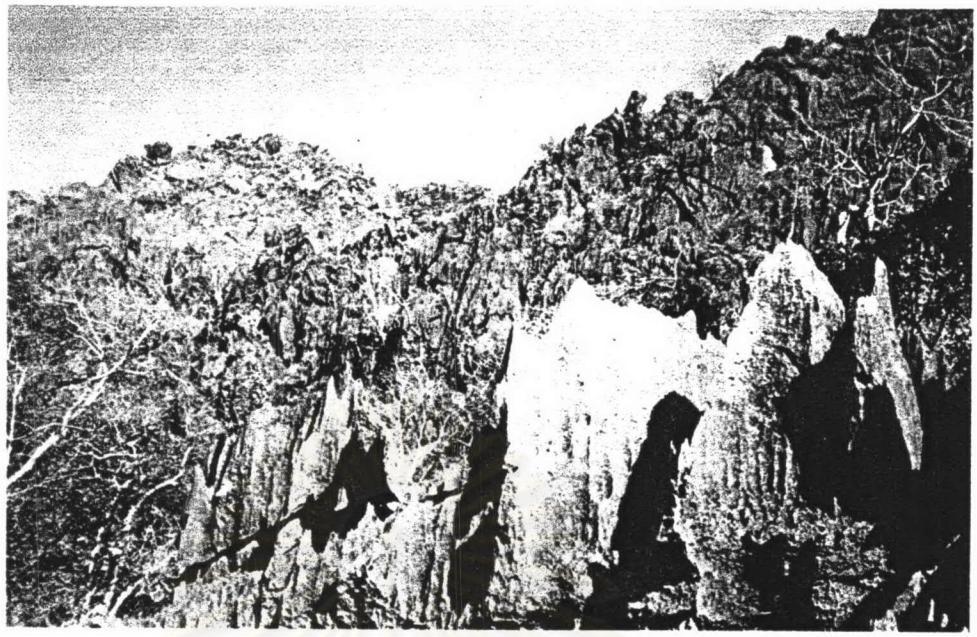


Fig. 3.10 Brownish gray fine-grained limestone,very thickly-bedded (rock unit C, traverse line K8)- grid reference: 040285

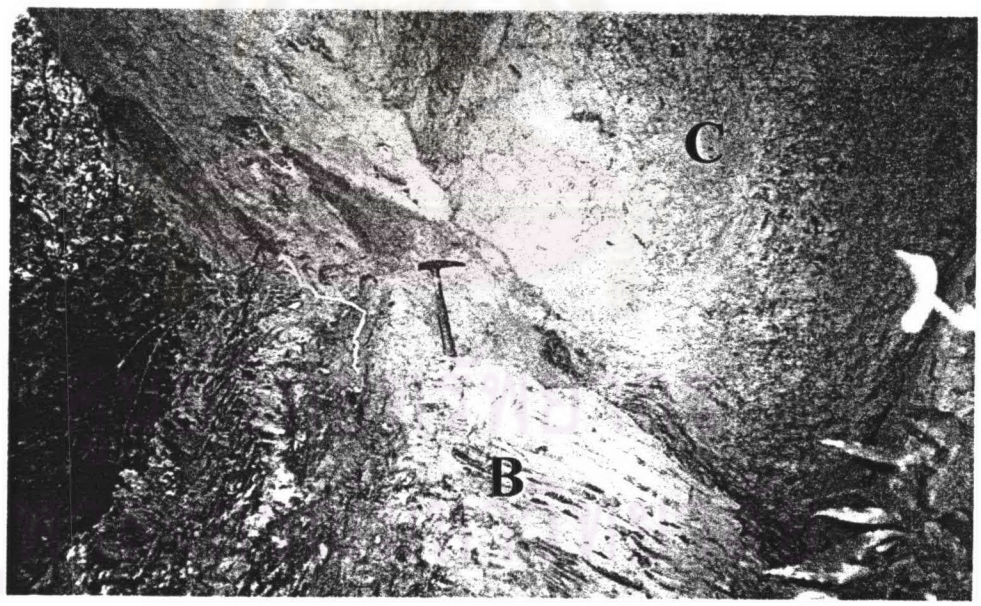


Fig. 3.11 Photograph showing the contact between rock units B and C, traverse line K6- grid reference: 021303

Fig. 3.12 Photograph of natural exposure showing medium to thick interconnected net work stylolites (rock unit C, traverse line K7)- grid reference: 016293

Fig. 3.13 Photograph of natural exposure showing cave with stalagmites and stalactites (rock unit C, traverse line K7)- grid reference: 017295

Unit E:

The rock unit E is composed of gravel, sand, silty clay, lateritic soil, laterite. This rock unit is present at the top most stratigraphic position in the study area. This rock unit is exposed in alluvial plain along the mountain ranges covering approximately 3 square kilometres. The thickness of this rock unit is about 15 metres.

3.2.1 Traverse line Sections

Due to many rugged topography of the study area which is generally characterized by high mountains, the maximum elevation of 471 metres (MSL), with steep cliff, sharp peak, deep sinkholes, the traverse line sections are therefore measured by approximation. They are illustrated in Fig. 3.14. (see also Fig. 3.1).

Section K_1

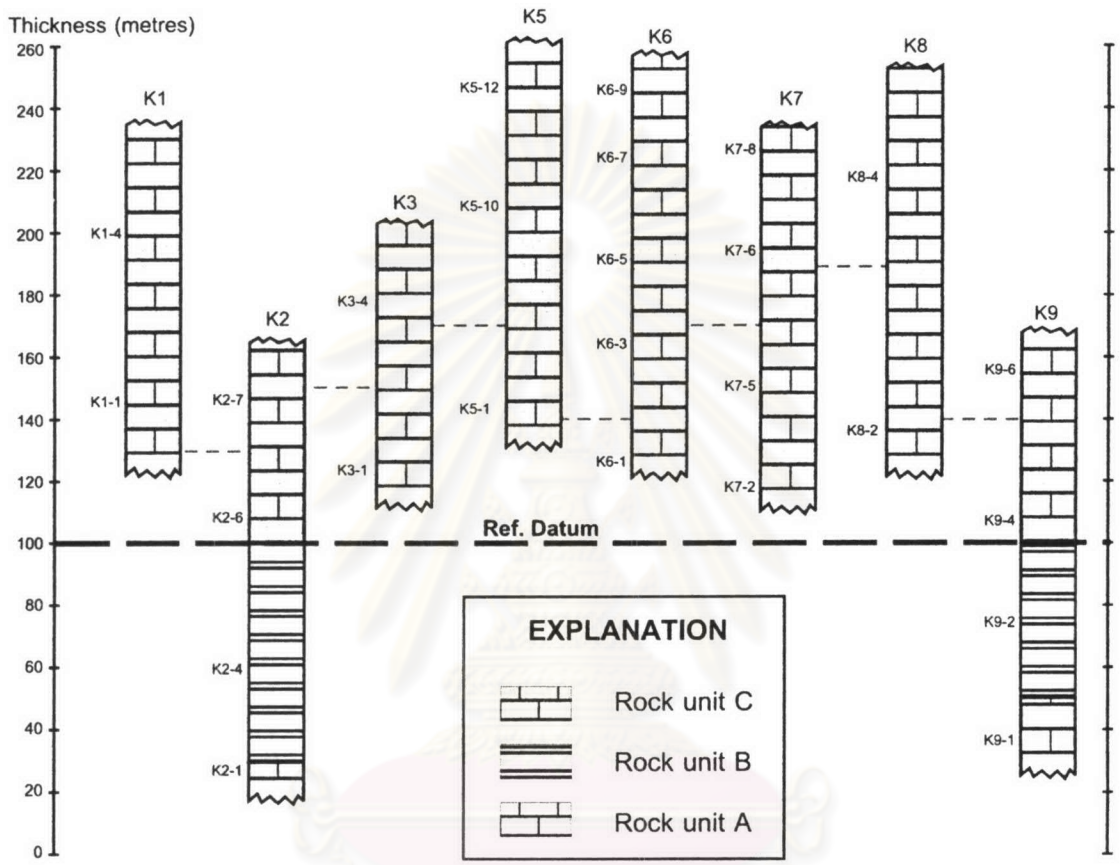
Section K_1 is located in the southern part of the study area, about 400 metres north of Ban Nadou with the grid reference 033279. The total thickness is approximately 140 metres and 4 representative rock samples have been collected from this section.

One rock sample (K_{1-1}) has been taken from the brownish-gray, fine-to medium – grained, very thickly-bedded limestone containing oolites at lower part of the section.

The other three rock samples (K_{1-2}, K_{1-3}, K_{1-4}) have been collected from the light-gray, fine-grained limestone with calcite veinllets at the upper part of this measured section.

Section K_2

Section K_2 is located in the northern part of study area with the grid reference 032296. The total thickness is approximately 180 metres, and 5 representative rock samples are collected from this section.



GEOLOGICAL ASSESSMENT OFSOME PERMO-CARBONIFEROUS CARBONATE SEDIMENTS IN THE SOUTHERN PART OF THE PHA HOUA XANG RANGE, MOUANG THAKHEK, KHAMMOUANE PROVINCE, THE LAO PDR.

Figure 3.14 Sedimentary sequences of eight measured-sections of the study area.

KEO KHAMPHAVONG
2003

DEPARTMENT OF GEOLOGY, FACULTY OF SCIENCE
CHULALONGKORN UNIVERSITY

One rock sample (K_{2-1}) has been collected from the small very thick-bedded dark gray medium-to coarse-grained dolomitic limestone with coarse crystal of calcite in the lower part of this section. The thickness of this unit is about 6 metres.

Two rock samples (K_{2-3}, K_{2-4}) have been collected from dark gray fine-grained bedded limestone 3-5 centimetres thick intercalated with thin-bedded brownish-gray to dark-gray chert 0.5-10 centimetres thick at the middle part of the section. Attitude of bedding is generally northwest-southeast direction (160/20,135/15,110/10,). Its thickness is more than 80 metres.

One rock sample (K_{2-6}) has been collected from gray fine-to medium-grained thick bedded or very thick-bedded limestone with thick stylolites (3-5 metres) in the upper part of this section. Its thickness is approximately 20 metres.

One rock sample (K_{2-7}) has been collected from the lower part of the cliff of light-gray fine-grained limestone in the uppermost part of the section. Its thickness is approximately 65 metres.

Section K_3

Section K_3 is located in the northwestern part of the study area, about 500 metres east of Ban Nakham. The total thickness is approximately 110 metres and 11 rock samples have been taken from this traverse line, but only 2 representative rock samples have been collected from the measured section.

Two representative rock samples (K_{3-1}, K_{3-2}) have been collected from light-gray fine-grained limestone. Its thickness is approximately 110 metres.

Nine rock samples (K_{3-3}, K_{3-4}, K_{3-5}, K_{3-6}, K_{3-7}, K_{3-8}, K_{3-9}, K_{3-10}, K_{3-11}) are collected from light-gray fine-grained limestone at the lower part of the mountain in the southern direction of study area.

Section K_4

Section K_4 is not measured only 5 rock samples have been collected from two points of the study area.

One representative rock sample (K_{4-1}) has been collected from the light-gray fine-grained limestone in the northeastern part of the study area, grid reference 057293.

Another four rock samples ($K_{4-2ab,}K_{4-3ab}$) have been collected from loose blocks of dark gray fine-grained limestone in the northern part of the study area, grid reference 055297.

Section K_5

Section K_5 is located in the eastern part of the study area, about 300 metres south of Ban Kouankhay. The total thickness is approximately 160 metres, and 12 representative rock samples have been collected from this section.

One rock sample (K_{5-1}) has been collected from the dark-gray, fractured fine-grained limestone with abundant calcite veins in the lower part of this section. Its thickness is approximately 20 metres.

Nine rock samples (K_{5-2}, K_{5-3}, K_{5-4}, K_{5-5}, K_{5-6}, k_{5-7}, K_{5-8}, K_{5-9},K_{5-10}) have been collected from dark-gray fine-grained limestone (3-5 centimetres thick) with minor dark-gray to brownish-gray chert nodules at the middle part of the section. Its thickness is about 85 metres.

Two rock samples (K_{5-11}, K_{5-12}) have been taken from light-gray to brownish-gray fine-grained limestone with calcite veins (1-3 millimetres width) at upper part of this section. Its thickness is approximately 40 metres.

Section K6

The section K6 is located in the northern part of the study area, grid reference 024303. The total thickness is approximately 170 metres and 9 representative rock samples have been collected from this section.

Two rock samples (K_{6-1},K_{6-2}) have been collected from dark-gray fine-to medium-grained limestone at the lower part of this section. Its thickness is approximately 18 metres.

Two rock samples (K_{6-3}, K_{6-4}) have been collected from dark-gray fine-grained very thin-bedded limestone (3-5centimetres thick) intercalated with very thin-bedded chert (0.5-5 centimetres thick) at the middle part of the section. Attitude of bedding is mostly in the northwest-southeast direction (145/20,135/15). Its thickness is approximately 22 metres.

Three rock samples (K_{6-5}, K_{6-6}, K_{6-7}) have been collected from gray, fine-grained limestone with some stylolitic beds (0.3-3 metres thick) at the upper part of this section. Its thickness is about 25 metres.

Two rock samples (K_{6-8}, K_{6-9}) have been collected from light-gray fine-grained limestone with abundant calcite veinlets and joints which are mainly oriented in the northwest-southeast and north-south directions. Its thickness is about 30 metres.

Section K_7

Section K_7 is located in the southern part of the study area , grid reference 017288. The total thickness is approximately 150 metres and 11 representative rock samples has been collected from this measured section.

Five rock samples (K_{7-1}, K_{7-2}, K_{7-3}, K_{7-4}, K_{7-5}) have been collected from light-gray fine-grained limestone with stylolites, thick-to very thick-beds (3 ->10 metres) at the

lower part of the section. The attitude of beds is in the northwest-southeast direction and dipping to the northeast (150/30). Its thickness is approximately 20 metres.

Six rock samples ($K_{7\text{-}6ab}$, $K_{7\text{-}7ab}$, $K_{7\text{-}8}$, $K_{7\text{-}9}$) have been collected from light-gray to brownish-gray fine-grained limestone with calcite veins. Its thickness is about 105 metres.

Section K_8

Section K_8 is located in the southeastern part of the study area , about 1 kilometre northeastern of Ban Nadou. The total thickness is approximately 160 metres, and 4 representative rock samples have been collected from this measured section.

Two rock samples ($K_{8\text{-}1}$, $K_{8\text{-}2}$) have been taken from brownish-gray fine-grained limestone (3-5metres thick) with some stylolites at the lower part of this section. Its thickness is approximately 25 metres.

Another two rock samples ($K_{8\text{-}3}$, $K_{8\text{-}4}$) have been collected from light-gray fine-grained limestone with calcite veinllets and abundant joints with dominant northwest-southeast; north-south directions. Its thickness is about 105 metres.

Section K_9

Section K_9 is located in the northern part of the study area, grid reference 044296. The thickness of the measured section is about 180 metres, and 6 representative rock samples have been collected from this section.

One rock sample ($K_{9\text{-}1}$) has been collected from dark-gray fine-grained limestone with abundant calcite veins at the lower part of the section. Its thickness is about 20 metres.

Another two rock samples ($K_{9\text{-}2}$, $K_{9\text{-}3}$) have been collected from dark-gray stratified limestone (1-10 centimetres thick) intercalated with thin brownish-gray bedded

chert (0.5-3 centimetres thick) at the middle medium part of the section. Its thickness is about 65 metres.

The other two rock samples (K_{9-4}, k_{9-5}) have been collected from dark-gray fine-grained limestone (0.3-4 metres thick) with some stylolites. Its thickness is approximately 15 metres.

The last rock sample (K_{9-6}) has been collected from light-gray fine-grained limestone with abundant calcite veinlets (1-3 millimetres). It is at the cliff in the uppermost of this section. Its thickness is approximately 30 metres.

From the field investigation, the stratigraphic units of limestones in the study area are classified into 3 rock units based on lithological characteristics as shown in Fig. 3.15.

The thickness of all rock units based on 9 measured sections, vary from 6 to 170 metres, while the total thickness of the composite section (Unit A to Unit C) is approximately 240 metres.

3.3 Geological structures.

The geological structures of study area is discussed under the main headings, namely, folding, bedding plane, joints.

With respect to the folding, this area lies in a syncline with fold axis oriented in the northwest-southeast direction, plunging northwestwardly.

Bedding plane is best observed in the northeastern part of the study area at traverse line No9. The attitude of the bedding plane is oriented in the northwest-southeast direction, with the dip angle varies from 10°-30°to southwest.

Peroid	Rock Units	Thickness (m)	Lithology	Descriptions
Q	E	15		Unconsolidated sediments (gravel, sand, silty clay, laterite).
Permo-Carboniferous	C	~ 140		Light-gray to brownish gray, fine-grained, thick to very thick-bedded limestone with calcite veinlets of 1-3 millimetres, abundant joint with dominant direction in the northwest-southeast and north-south
	B	> 80		Gray to dark gray bedded limestone, interbedded with brownish gray to dark gray thin-bedded chert with some minor dolomitic limestone.
	A	~ 20		Gray to dark gray very thick-bedded dolomitic limestone with sparite texture and abundant calcite veins/veinlets.

GEOLOGICAL ASSESSMENT OFSOME PERMO-CARBONIFEROUS CARBONATE SEDIMENTS IN THE SOUTHERN PART OF THE PHA HOUA XANG RANGE, MOUANG THAKHEK, KHAMMOUANE PROVINCE, THE LAO PDR.

Figure 3.15 Composite stratigraphic section of the study area.

KEO KHAMPHAVONG
2003

DEPARTMENT OF GEOLOGY, FACULTY OF SCIENCE
CHULALONGKORN UNIVERSITY

Joints are commonly associated with the rock unit C in almost all traverse lines. The only two dominant directions of joint planes are observed. They are northwest-southeast and north-south. In some parts of this area, particularly at traverse line No 8 the attitude of joints is conformable with the bedding planes.

3.4 Petrography

Petrographic examination of representative carbonate rock samples collected from traverse line-sections under the present investigation aims at identifying of three principal aspects, notably, the mineralogical composition; texture; and characteristics of allochems, matrix as well as cement.

The mineralogical compositions are identified by both the X-ray diffractrometry (XRD) of limestone powders, and the optical investigations of their thin-sections, whereas the examination of texture and characteristics of allochems, matrix, and cement are carried out by thin-section methods.

The classification of carbonate rocks employed in the present study follows of Folk's classification (1959 and 1962) which is based on composition (Fig. 3.16).

Detailed mineralogical composition and petrographic study of each rock unit is described as folows:

Unit A:

Petrographic studies show that the rock unit A is composed chiefly of dolomite, and micrite.

Dolomite (Fig.3.17) essentially comprises euhedral to subhedral rhombs of dolomite with size of 0.1-0.8 millimetre, with subordinate micritic calcite.

Micrite (Fig. 3.18) is composed of organic matter-rich, fine-grained calcite with calcite veinlets and probably brown microstylolites.

				>10% Allochems ALLOCHEMICAL ROCKS (I AND II)		<10% Allochems MICROCRYSTALLINE ROCKS		UNDISTURBED BIOHERM ROCKS (IV)
				Sparry calcite cement> Microcrystalline ooze Matrix	Microcrystalline Ooze Matrix>Sparry Calcite Cement	1-10% Allochems	<1% Allo-chems	
				SPARRY ALLOCHEMICAL ROCKS (I)	MICROCRYSTALLINE ALLOCHEMICAL ROCKS (II)			
VOLUMETRIC ALLOCHEM COMPOSITION	>25% Intraclasts (I)			Intrasparrudite (Ii:Lr) Intrasparite (Ii:La)	Intramicrudite (IIi:Lr) intramicrite (IIi:La)	Most Abundant Allochem: Intraclasts: Introclast-bearing Micrite (IIIi:Lr or La)	Micrite (IIIm:L); if disturbed, Dismicrite (IIImX:L); If primary dolomite, Dolmicrite (IIIm:D)	Biolithite (IV :L)
	< 25% Intraclasts	>25% Oolites (0)		Oosparrudite (Io:Lr) Oosparite (Io:La)	Oomicrudite (IIo:Lr) Oomicrite (IIo:La)	Oomicrudite (IIo:Lr) Oomicrite (IIo:La)		
		<25% Oolites Volume Ratio of Fossils to Pellets	>3:1 (b)	Biosparrudite (Ib:Lr) Biosparite (Ib:La)	Biomicrudite (IIb:Lr) Biomicrite (IIb:La)	Fossils: Fossiliferous Micrite(IIIb: Lr,La,orL1)		
			3:1-1:3 (bp)	Biopelsparite (IIbp:La)	Biopelmicrite (IIbp:La)	Pellets: Pelletiferous Micrite (IIIp:La)		
			<1:3 (p)	Pelsparite (Ip:La)	Pelmicrite (IIp:La)			

Fig. 3.16 Carbonate rock classification (after Folk, 1959 and 1962).

Fig. 3.17 The photomicrograph showing euhedral to subhedral rhombs of dolomite embedded in fine-grained calcite (unit A, sample no K2-1.section K2).(crossed nicols).

Fig. 3.18 The photomicrograph of micrite cut across by calcite veinlets and microstylolites.(rock unit A, sample no K9-1,section K9). (crossed nicols).

From X-ray diffractrogram of rock unit A, It indicates that the rocks are composed mainly of dolomite and calcite, as shown in Fig. 3.19.

Unit B:

Petrographic studies reveal that the rocks from unit B are composed of laminated micrite, and pelmicrite .

Laminated micrite (Figs. 3.20,3.21) comprises of irregular layering fabrics which are defined by the alteration of very-thin layers of dark laminated micrite rich in organic matter and very-thin layers of light-colour micrite. Calcite veinlets cut across throughout the rock texture.

Pelmicrite (Fig. 3.22) consists dominantly of peloids (0.01-0.03 millimetre) of about 15 per cent by volume. Micrite is more abundant than sparry calcite. The cross-cut calcite veins also occur throughout the rock.

Generally, the rock unit B is mainly composed of laminated micrite rich in organic matter. From X-ray diffractrogram of rock unit B, It is composed mainly of calcite and subordinate quartz, as shown in Fig. 3.23.

Unit C:

Petrographic studies of the rock unit C reveal many rock type, namely, oosparite, pelsparite, oomicrite, oopelmicrite and biopelsparite.

Oosparite (Figs.3.24,3.25,3.26,3.27) is composed mostly of rounded ooids (o.4-1.5 millimetres) with well-developed concentric structure, but somes ooids are broken,fractured probably due to post-depositional compaction. Some peloids are also present. Pore space between ooids are filled with sparry calcite. It is noted that calcite veinlets across some ooids.

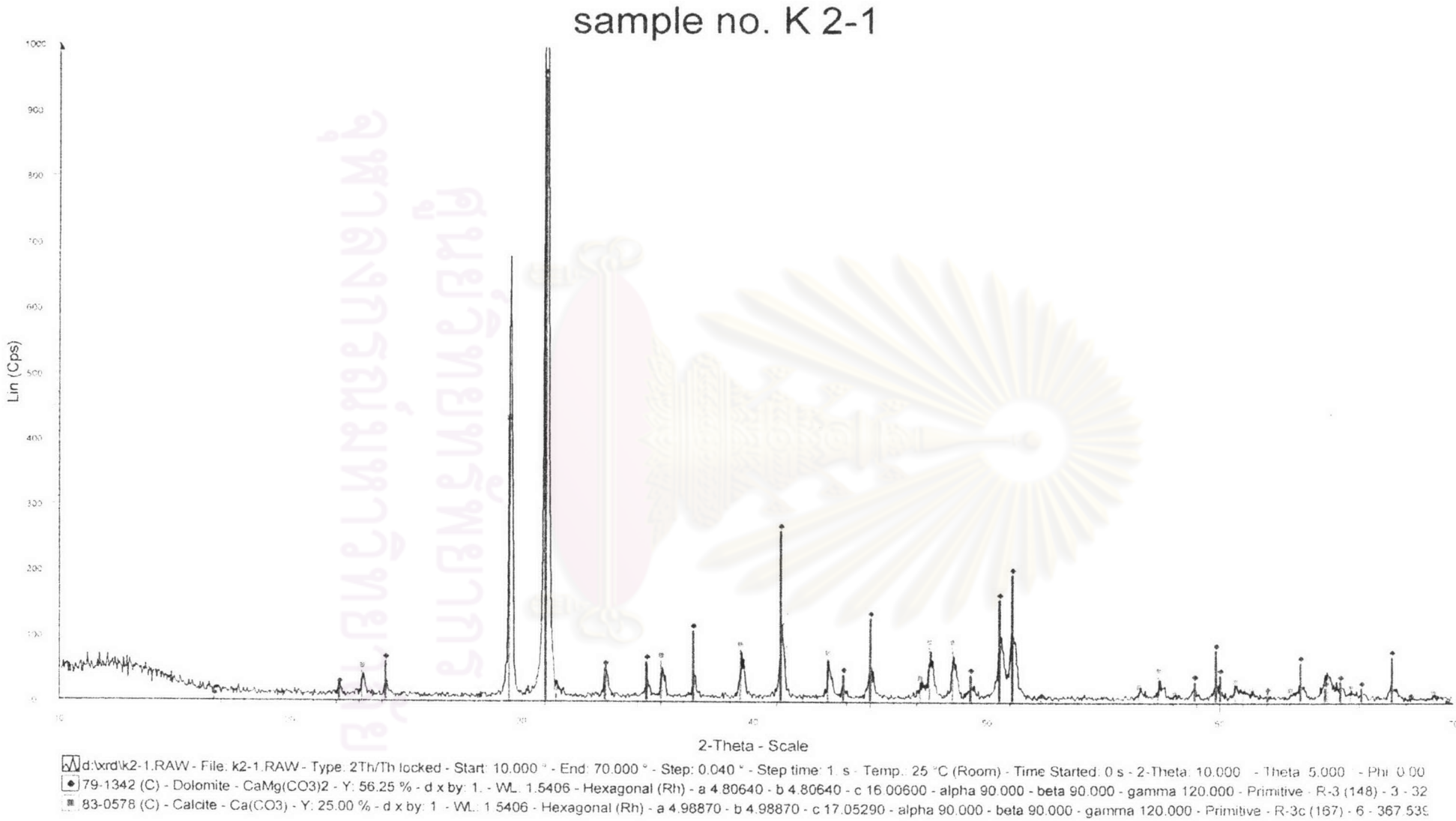


Fig.3.19 X-ray diffractogram of the sample K2-1 showing prominent dolomite peak (blue colour) and subordinate calcite peak (red colour)

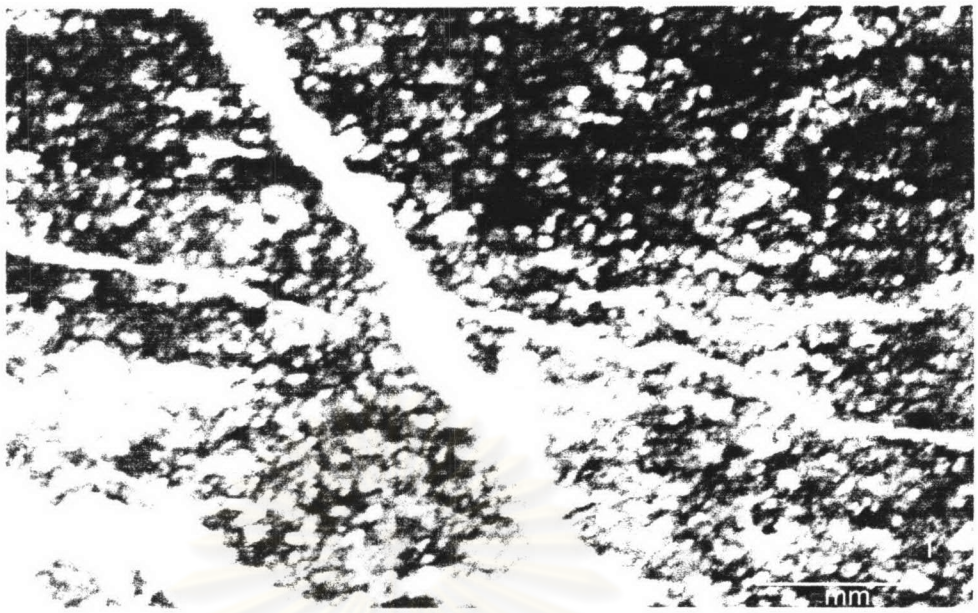


Fig. 3.20 The photomicrograph of laminited micrite rich in organic matter being cut across throughout by calcite veinlets.(rock unit B, sample no K4-3, section-K4). (uncrossed nicols).

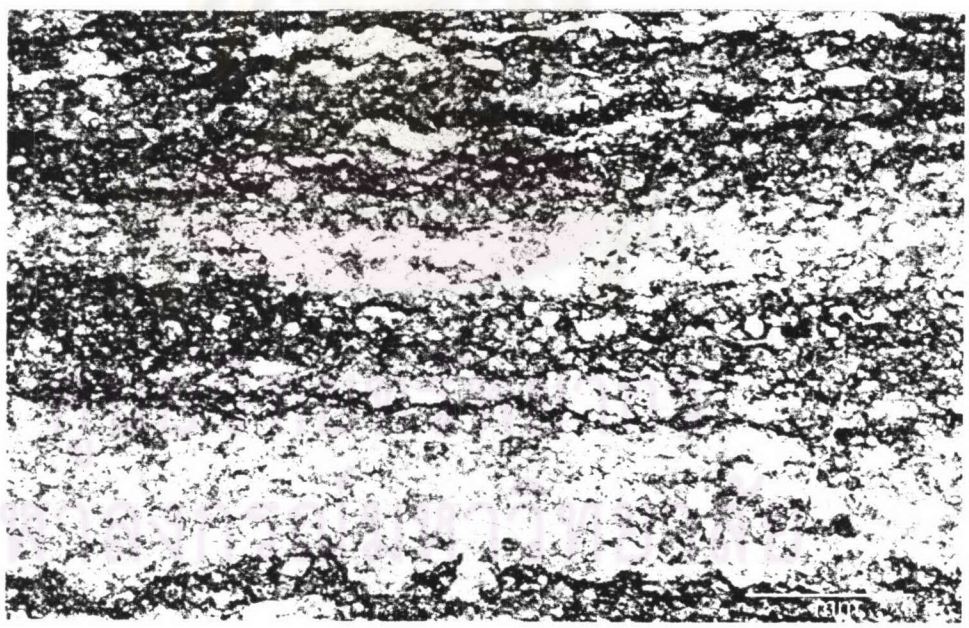


Fig. 3.21 The photomicrograph of laminated micrite showing calcisiltite lamina rich in organic matter.(rock unit B, sample no K9-2, section-K9). (crossed nicols).

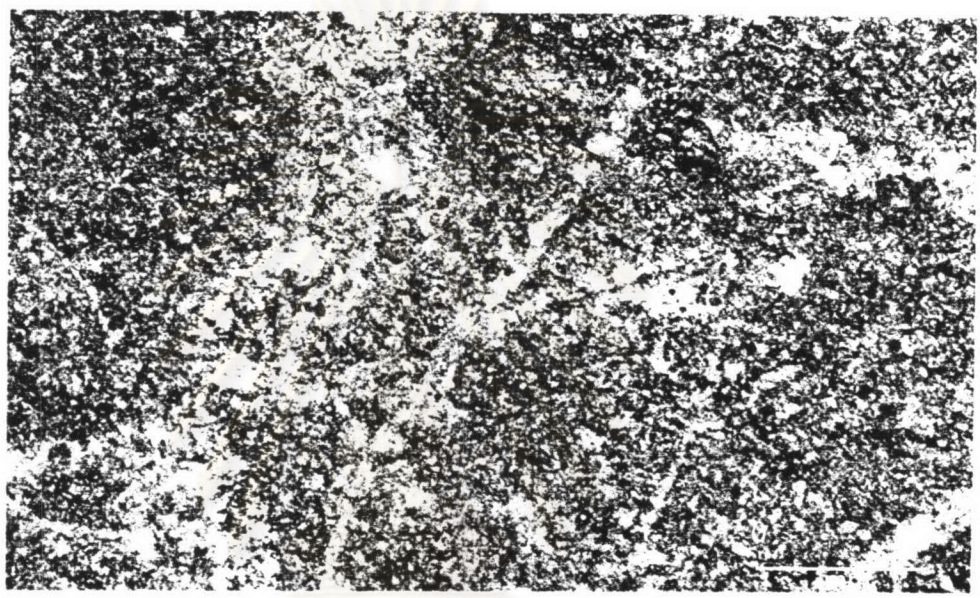


Fig. 3.22 The photomicrograph showing pelmicrite that is cut across throughout by calcite veinlets (rock unit B, sample no K2-4, section K2). (crossed nicols).

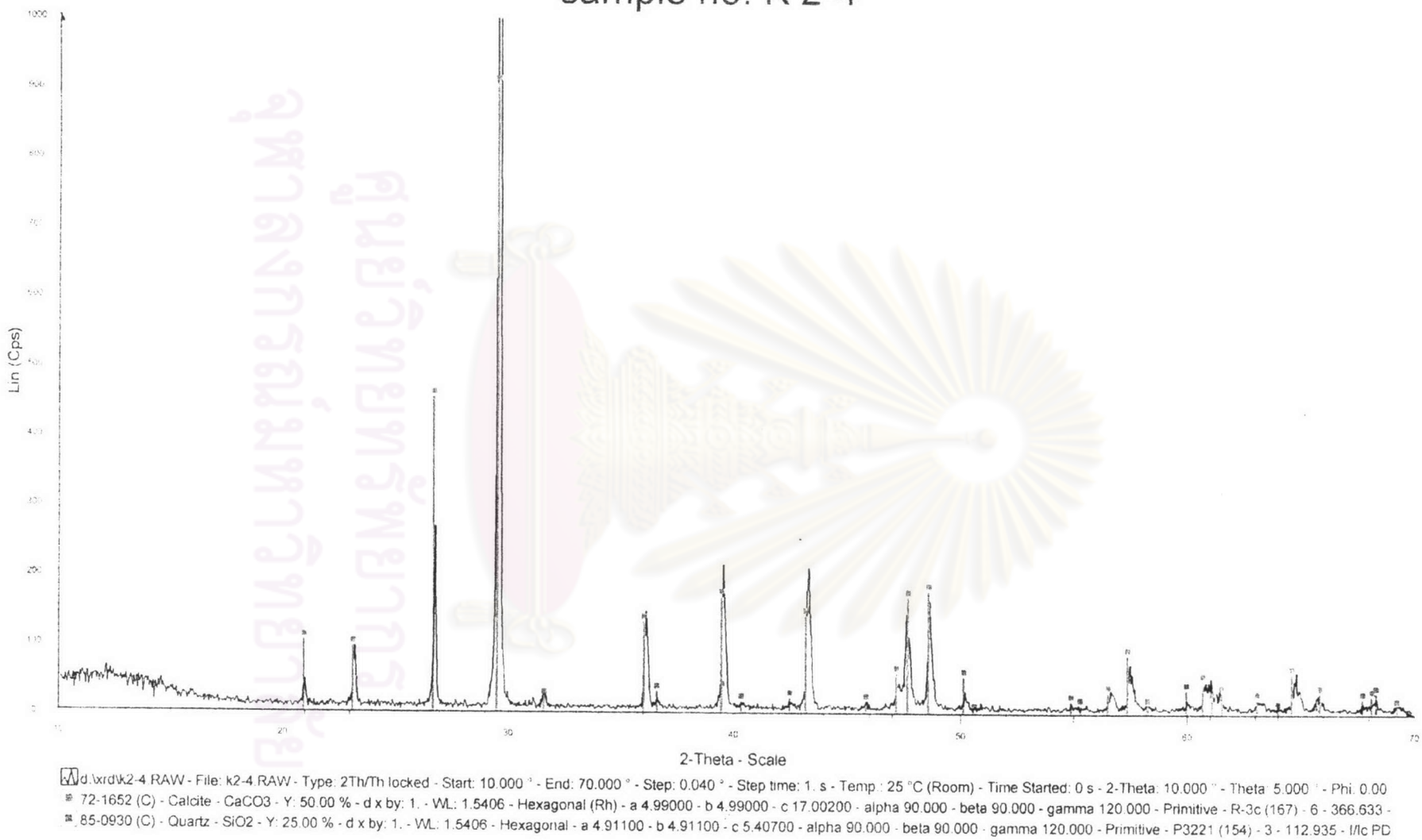


Fig. 3.23. X-ray diffractogram of the sample K2-4 (rock unit B) showing major calcite peak (red colour) and quartz peak (green colour)

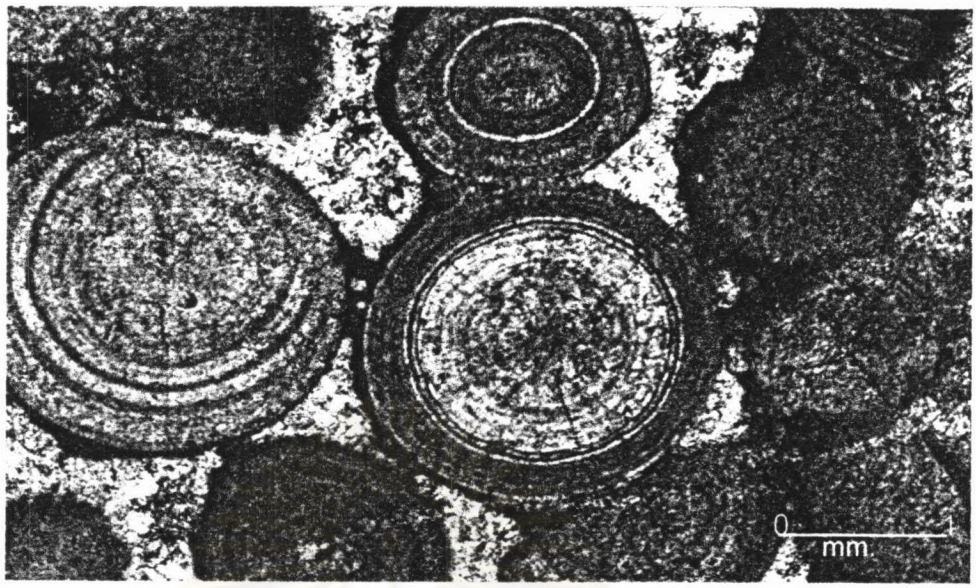


Fig. 3.24 The photomicrograph of ooids with very well preserved concentric layers, some ooids are undergone grain-to-grain pressure solution, and broken probably due to post-deposional compaction (rock unit C, sample no K1-1, section -K1).(crossed nicols).

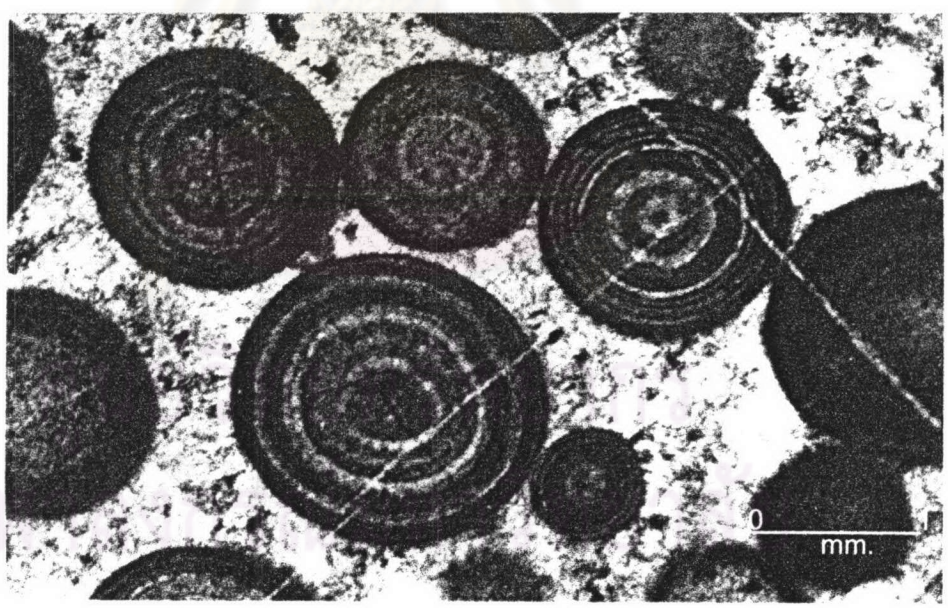


Fig. 3.25 The photomicrograph of oosparite illustrating ooids that have very well developed concentric structures. Intergranular pores are filled with micro-sparry cement. Both ooids and cement are fractured and the fructures are heated by calcite veinlets (rock unit C, sample no K3-9, section-K3. (crossed-nicols)

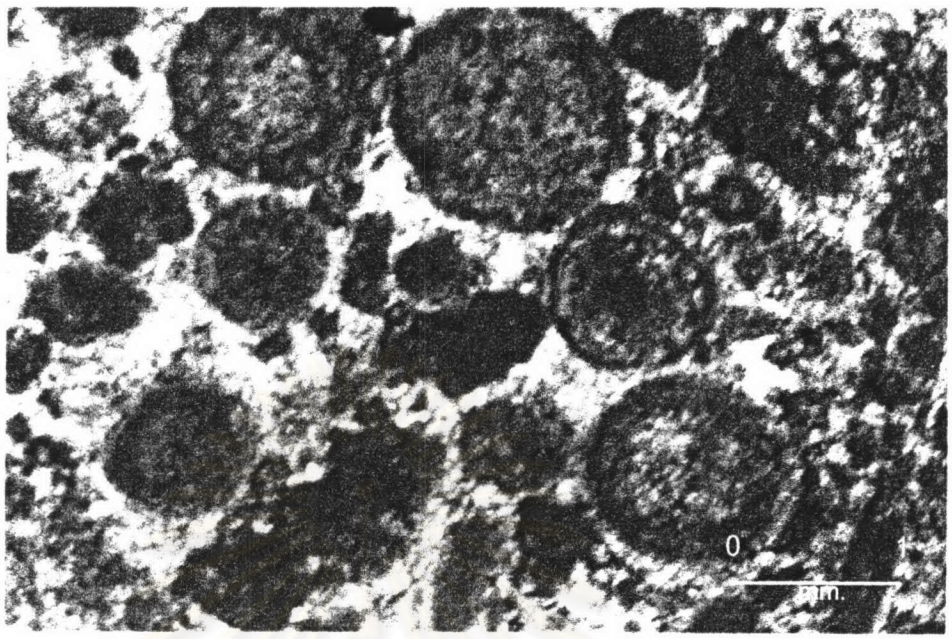


Fig. 3.26 The photomicrograph of oosparite illustrating concentric structures of ooids are not well developed and poorly preserved probably due to micritization process. Some peloids are also present (rock unit C, sample no K5-11,section-K5).(crossed nicols).

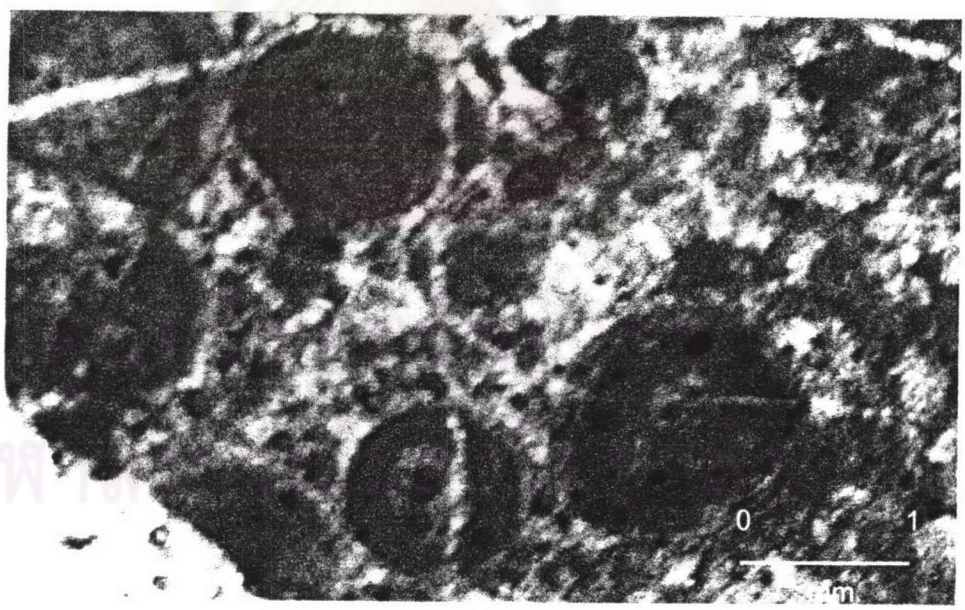


Fig. 3.27 The photomicrograph of oosparite showing ooids poorly developed and poorly preserved concentric layers probably due to micritization. The texture is cut across by calcite veinlets (rock unit C,sample no K7-5, section K7). (crossed nicols).

Pelsparite (Fig.3.28) is composed of large crystals of sparry calcite and poorly preserved ghost of peloids and ooids. In some parts, it contains subeuhedral to euhedral (sand size) dolomite.

Oopelmicrite (Figs.3.29,3.30) consists mainly of micrite calcite with peloids (0.01-0.02 millimetre) of about 30 per cent and some ooids with relatively poorly-preserved concentric structure enclosing fractured nuclei.

Oopelsparite (Fig.3.31) commonly comprises peloids (0.01-0.04 millimetre) ,(25 per cent by volume), and some ooids (~ 0.8 millimetre) with poorly developed concentric layers. All allochems are micritized. Intergranular pores between allochems are filled with sparry calcite.

Biopelsparite (Figs.3.32,3.33) is dominantly composed of peloids (0.01-0.03 millimetre) of approximately 40 per cent by volume, and some filament algae rods of less than 0.3 millimetre long. Other skeletal fragments are also present. The intergranular pore space is filled with sparry calcite.

Generally, the rock unit C comprises mainly of rounded oosparite with well-developed concentric structure, but some are broken probably due to post-depositional pressure. Calcite veinlets commonly crosscut ooids.

From X-ray diffractogram, the rock unit C is composed mostly of calcite, as shown in Fig. 3.34.

Fig. 3.28 The photomicrograph of dolomitic pelsparite? showing large sparry calcite which has been partially dolomitized in the right side, and partially dolomitized peloids in the lower lelf of the photograph (rock unit C, sample no K2-7, section K2). (crossed nicols).

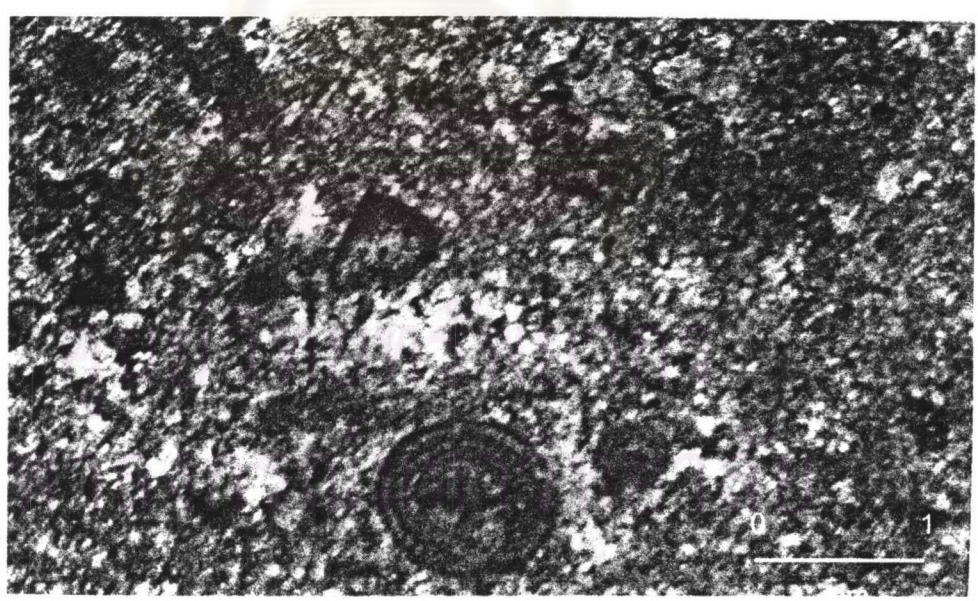


Fig. 3.29 The photomicrograph of oopelmicrite with some ooids (rock unit C, sample no K3-1, section K3). (crossed nicols,).

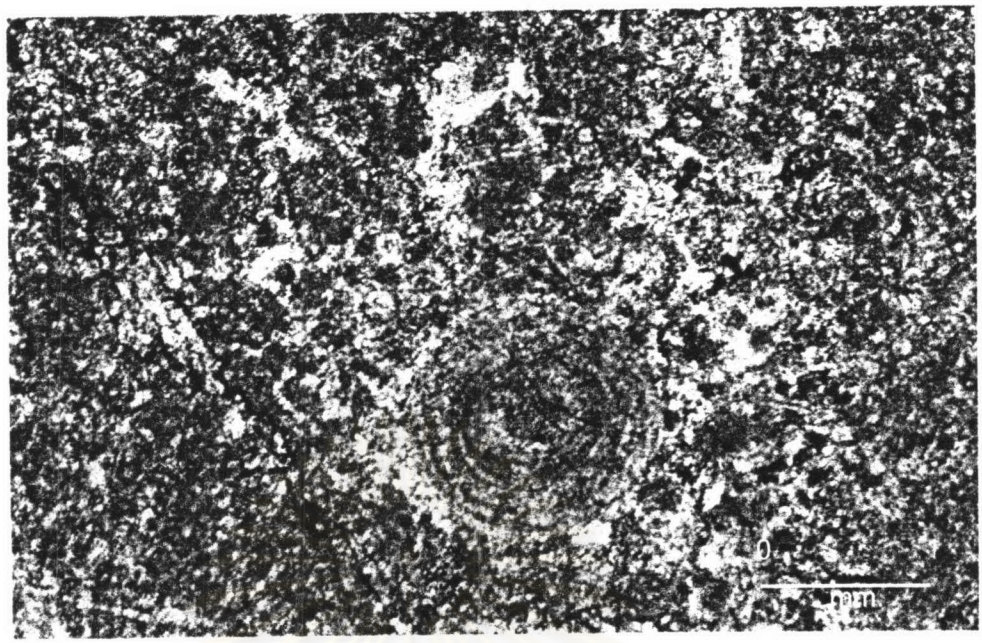


Fig. 3.30 The photomicrograph of oopelmicrite showing abundant peloids, some ooids and cut across by microstylolites (rock unit C, sample no K3-3, section K3). (crossed nicols).

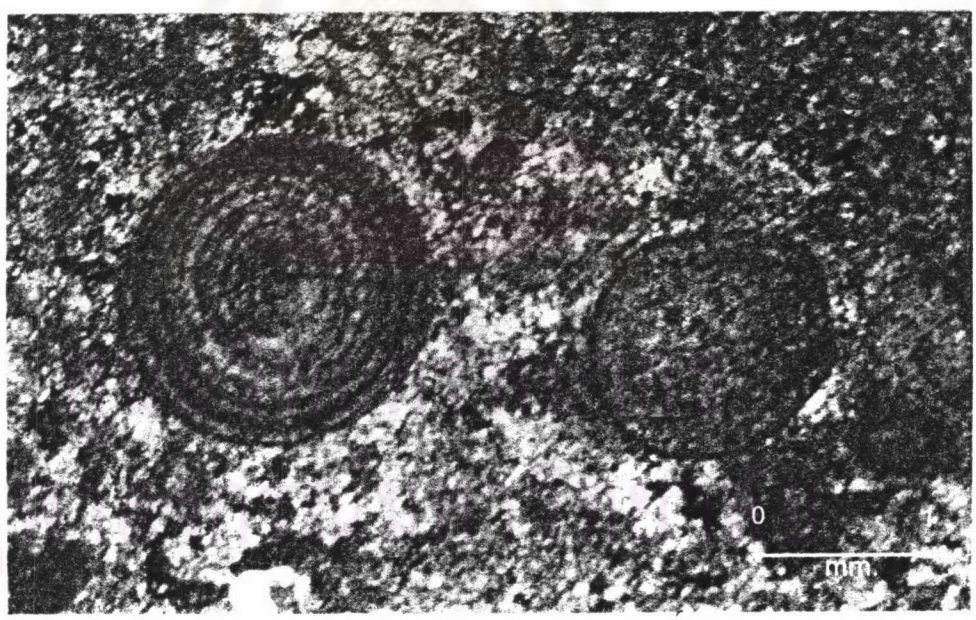


Fig. 3.31 The photomicrograph of oopelsparite showing peloids, and ooid with well preserved concentric layers (rock unit C, sample no K6-9, section K6).(crossed nicols).

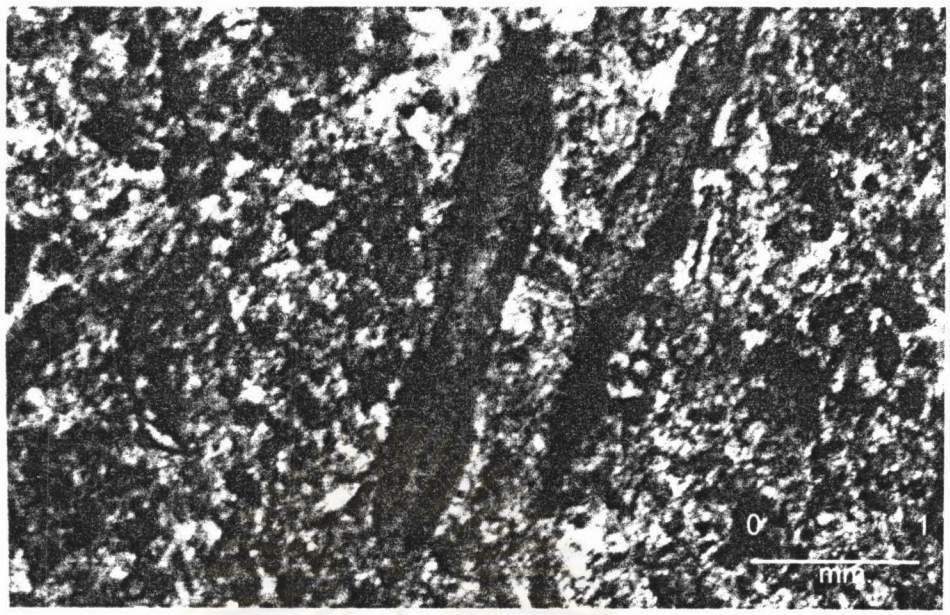


Fig. 3.32 The photomicrograph of biopelsparite showing filaments of possible algae rods and abundant peloids (rock unit C, sample no K3-10, section K3). (crossed nicols).

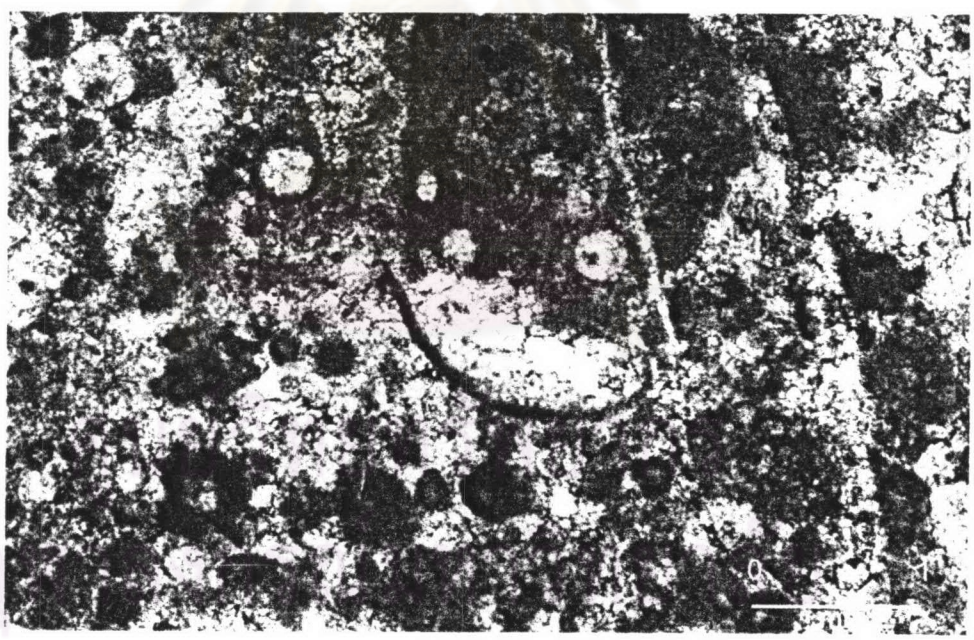


Fig. 3.33 The photomicrograph of biopelsparite with relicts of unidentified bioclasts (rock unit C, sample no K3-6, section K3). (crossed nicols).

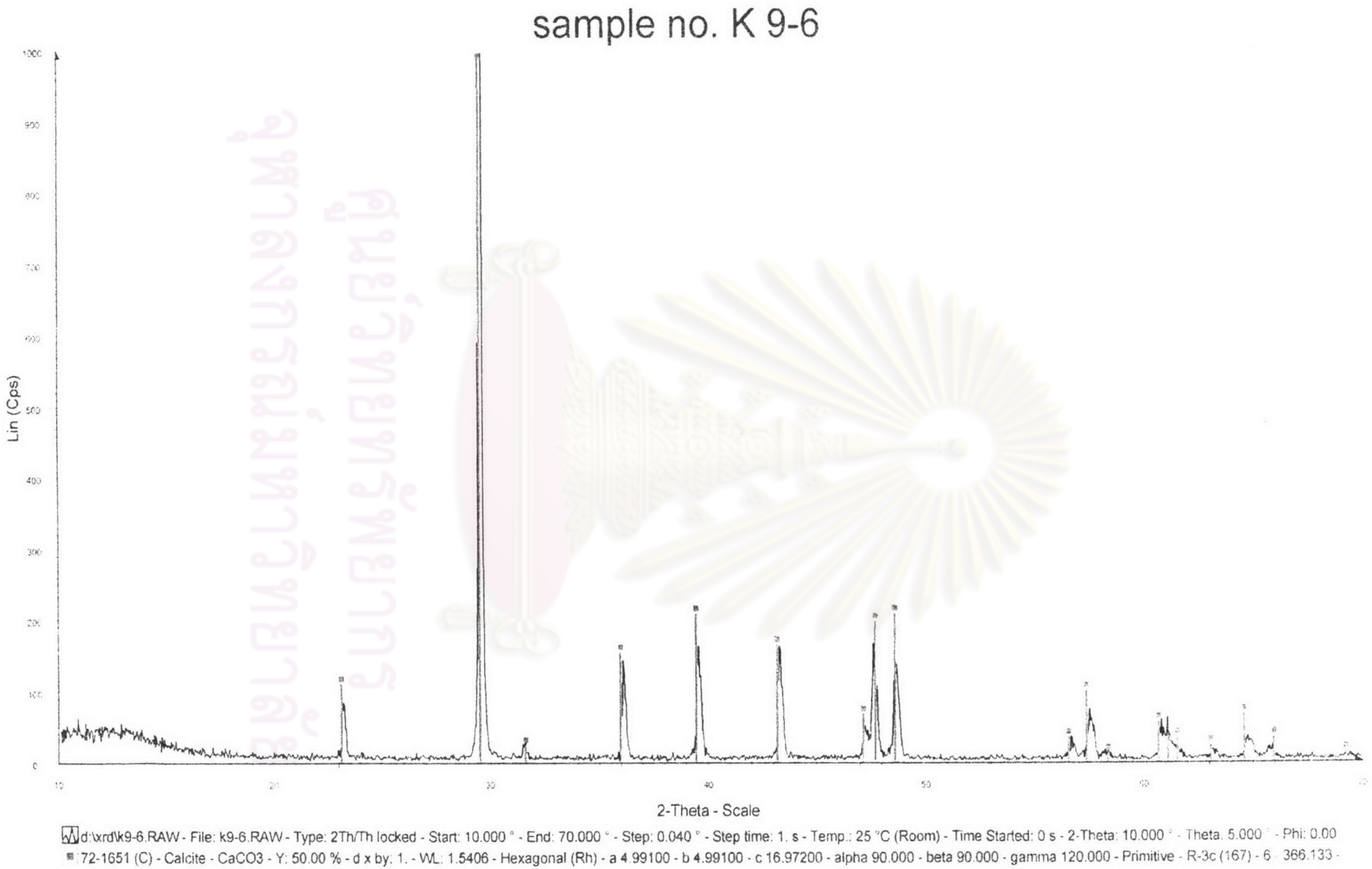


Fig.3.34 X-ray diffractogram of the sample K9-6 (rock unit C) showing only calcite peak(red colour)