สภาพแวดล้อมบรรพกาลของอุทยานแห่งชาติเขาสามร้อยยอด จังหวัดประจวบคีรีขันธ์: หลักฐานจาก บรรพชีวินวิทยา การลำดับชั้นหินและการหาอายุในยุคควอเทอร์นารี

นายพีรสิทธิ์ สุรเกียรติชัย

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรดุษฎีบัณฑิต
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PALEOENVIRONMENTS OF KHAO SAM ROI YOT NATIONAL PARK, CHANGWAT PRACHUAP KHIRI KHAN: EVIDENCE FROM PALEONTOLOGY, STRATIGRAPHY AND QUATERNARY DATING

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Thesis Title	PALEOENVIRONMENTS OF KHAO SAM ROI YOT NATIONAL PARK,CHANGWAT PRACHUAP KHIRI KHAN: EVIDENCE FROMPALEONTOLOGY, STRATIGRAPHY AND QUATERNARY DATING
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Field of Study	Geology
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พีรสิทธิ์ สุรเกียรติชัย : สภาพแวดล้อมบรรพกาลของอุทยานแห่งชาติเขาสามร้อยยอด จังหวัดประจวบคีรีขันธ์:หลักฐานจาก บรรพชีวินวิทยา การลำดับชั้นหินและการหาอายุในยุคควอเทอร์นารี (PALEOENVIRONMENTS OF KHAO SAM ROI YOT NATIONAL PARK,CHANGWAT PRACHUAP KHIRI KHAN: EVIDENCE FROMPALEONTOLOGY, STRATIGRAPHY AND QUATERNARY DATING) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รศ. ดร.ปัญญา จารุศิริ, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: ศ. ดร.มนตรี ชูวงษ์, 222 หน้า.

บริเวณเขาสามร้อยยอด และพื้นที่ใกล้เคียง มีแนวสันทรายและร่องทอดตัวยาวตั้งแต่ปราณบุรี สามร้อยยอด จนถึงกุยบุรี ซึ่งผลการศึกษาโดยการหาอายุตะกอนสันทรายด้วยการวิเคราะห์อายุด้วยเทคนิคการวัดการเรืองแสงเชิงแสง จากแนวเก็บตัวอย่าง 12 แนว จำนวน 48 ตัวอย่าง ไกลจากชายฝั่งทะเลปัจจุบันมากที่สุด 3.8 กิโลเมตร และการหาอายุด้วยวิธีคาร์บอน-14 จากเปลือกหอยนางรมเก็บจากเว้าทะเลใน 6 พื้นที่ จำนวน 10 ตัวอย่าง ที่ระดับเว้าทะเลที่สูงสุดประมาณ 2.6 เมตร ได้ทำแท่งลำดับชั้นตะกอน ทั้งหมด 9 แนว 25 แท่ง และเก็บเปลือกหอยมาจำแนกชนิดจากทั้งหมด 11 พื้นที่ ผลการศึกษาพบว่าอายุตะกอนที่ได้บริเวณกุยบุรีมีอายุตั้งแต่ 880-7,940 ปี สามร้อยยอดมีอายุตั้งแต่ 1,940-6,260 ปี และปราณบุรีมีอายุตั้งแต่ 1,850-10,200 ปี เปลือกหอยนางรมมีอายุตั้งแต่ 366-5,476 ปี ซึ่งทั้งหมดอยู่ในสมัยโฮโลซีน จากแท่งลำดับชั้นพบว่าตะกอนส่วนใหญ่เป็นตะกอนทรายที่ความลึก 1 เมตร ลงไปพบเศษเปลือกหอยหรือเปลือกหอยที่สมบูรณ์ และเปลือกหอยสามารถจำแนกได้ทั้งหมด 57 ชนิด แบ่งเป็นหอยฝาเดียว 12 ชนิด และหอยสองฝา 45 ชนิด เปลือกหอยส่วนใหญ่ที่ได้สามารถระบุสภาพแวดล้อมว่าเป็นป่าชายเลนบริเวณน้ำขึ้น-ลง ผลทั้งหมดสรุปได้ว่าแนวชายฝั่งทะเลโบราณในพื้นที่ศึกษาเกิดในสมัยโฮโลซีน โดยอยู่ลึกเข้าไป 3.8 กิโลเมตรจากชายฝั่งทะเลปัจจุบัน และสูงประมาณ 2.6 เมตร จากระดับทะเลปัจจุบัน โดยเคยเป็นป่าชายเลนจนถึงชายฝั่งทะเลบริเวณน้ำขึ้น-ลง มีการสะสมตัวเป็นสันทรายสลับกับร่องเป็นช่วงเรื่อยมาจนถึงแนวชายฝั่งปัจจุบัน ภูมิประเทศโบราณมีหลากหลาย คือเป็นชายฝั่งที่เป็นอ่าว แนวสันทราย สันดอนเชื่อมเกาะ และเว้าทะเลในช่วงตอนกลางสมัยโฮโลซีน และเป็นที่ราบน้ำขึ้นถึงเกิดหลังจากสันดอนเชื่อมเกาะ และเว้าทะเลสมัยตอนปลายโฮโลซีน

ภาควิชา ธรณีวิทยา	ลายมือชื่อนิสิต ....
สาขาวิชา ธรณีวิทยา	ลายมือชื่อ อ.ที่ปรึกษาหลัก ....
ปีการศึกษา 2559	ลายมือชื่อ อ.ที่ปรึกษาร่วม ....

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KEYWORDS: PALEOENVIRONMENTS / PALEONTOLOGY / STRATIGRAPHY / QUATERNARY DATING / PRACHUAP KHIRI KHAN

PEERASIT SURAKIATCHAI: PALEOENVIRONMENTS OF KHAO SAM ROI YOT NATIONAL PARK,CHANGWAT PRACHUAP KHIRI KHAN: EVIDENCE FROMPALEONTOLOGY, STRATIGRAPHY AND QUATERNARY DATING. ADVISOR: ASSOC. PROF. PUNYA CHARUSIRI, Ph.D., CO-ADVISOR: PROF. MONTRI CHOOWONG, Ph.D., 222 pp.

Khao Sam Roi Yot area and nearby consists of beach ridges and swales extending from Pran Buri, Sam Roi Yot to Kui Buri. Dating of sediment was carried out in this study by optically stimulated luminescence dating (OSL). Sediment samples were collected from 12 transects, including 48 samples at 3.8 km from the present shoreline. Total 10 samples of oyster shells collected from sea notch with the height 2.6 m from mean sea level were dated by carbon-14. Additional 25 stratigraphic columns from 9 transects were also carried out. As a result, the age of sediments around Kui Buri was between 880-7,940 years ago, at Sam Roi Yot of 1,940-6,260 years ago, and at Pran Buri, the age was at 1,850-10,200 years ago. Oyster shells from sea notch provide the age between 366-5,476 years ago. More than 57 species of molluscan, gastropods 12 species and bivalve 45 species were identified. They indicate mangrove environment to intertidal zone. The inner part of paleo-shoreline is located at 3.8 km from recent shoreline and about 2.6 m above men sea level. Environment has changed from mangroves to intertidal zone and then gradually to accumulate the ridges and swales periodically continues to recent shoreline. Paleo-landforms include coastal bay, a beach ridge plain and tombolos. The semi-circle paleo-coastal bay was also found. These new results suggest that the progradation of the SRY coastal plain came to a stillstand twice, between the middle and late Holocene. In addition, the beach ridge plain gradually advanced toward the sea in the east direction.

Department:	Geology	Student's Signature	....
Field of Study:	Geology	Advisor's Signature	....
Academic Year:	2016	Co-Advisor's Signature	....

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CHAPTER 1
INTRODUCTION

1.1 Theme and Backgrounds

Khao Sam Roi Yot National Park is the first coastal National Park of Thailand established in 1996, covers approximately 98.8 km^2 in Changwat Prachuap Khiri Khan. This area owns high biological diversity and interesting ecosystem with very high steep limestone. The geological characteristic of Khao Sam Roi Yot National Park is characterized by very high steep limestone mountain that becomes the high steep cliffs as well as the deep abyss or caves include Tam Phraya Nakhon, Tam Sai, Tam Kaeo. The highest peak of the mountain is 605 m above the mean sea level. The most attraction locations in Khao Sam Roi Yot include Khao Yai, Khao Tham Prathun, Khao Daeng and Khao Khan Ban Dai. This area preserved evidence of sea level change such as sea notch and marine fossils (Choowong et al., 2004). Mollusca fossils were found at the former tidal flat (now become shrimp farm). These fossils together with sea notch were dated to represent the history of sea level change in this area during the Holocene Epoch (Choowong et al., 2004, Surakiatchai, 2005, Chucha-Em, 2007).

Geomorphological landforms around Khao Sam Roi Yot National Park include beach ridges and swales which lie down from the north at Amphoe Pran Buri, Amphoe Sam Roi Yot and Amphoe Kui Buri to the south of Changwat Prachuap Khiri Khan. Tidal flat is found on the eastern side of Khao Sam Roi Yot from the central (at Ban Bung Pu) down to the south (at Ban Thung Noi). Alluvium is recognized in the north of Khao Sam Roi Yot, another section is the floodplain at the south and cluster around Sam Roi Yot Field. Colluvium is located along north east and south of foothills of Khao Sam Roi Yot. Floodplain areas are found at the western side of the park where Thung Sam Roi Yot or Sam Roi Yot Field, the largest wetland in Thailand is located. This wetland provides an important environment for a large number of birds, amphibians, reptiles and small mammals. International Union for Conservation of Nature and Natural Resources or World Conservative Union (IUCN) has recognized these fragile wetlands as a site of global importance. Other areas of habitat include scrub, salt pan, cultivated areas, mudflats, brackish water, mangroves, sand beaches, offshore inlets and open sea (Choowong et al., 2004).

Surakiatchai (2005) reported that sea notches around Sam Roi Yot were created by marine erosion. Result from dating and classification of marine mollusca fossils at Ban Don Makham (former tidal flat), the south of Khao Sam Roi Yot, one of the study areas, far from the recent coastline around 4 km suggested that this area was flooded by sea water during the transgression and formed as intertidal or mangrove in 7,360 ± 420 years ago. After that the regression occurred continuously until reaching the mean sea level at present.

Based on the above mentioned data, Khao Sam Roi Yot owns its significant site that preserves geological records in particular Holocene history of sea level change. Thus, in order to understand such an episodic record of sea level change, the well-defined paleogeography is of significant need to better understand first.

1.2 Objectives

The major aim of this thesis was to the paleoenvironment model and paleogeography at Khao Sam Roi Yot National Park area, Changwat Prachuap Khiri Khan based on the precise identification of paleontology, stratigraphy and quaternary dating. In order to accomplish the major aim, there minor objectives of this study were set up, including.

1. to determine taxonomy of coastal and brackish mollusca fossils deposited within the former and modern coastal deposits,
2. to determine the absolute ages of coastal sediments and mollusca fossils and
3. to model the paleoenvironment and the evolution of shoreline.

1.3 Scopes of Study

1. Geomorphology of the area is based on remote sensing interpretation with field survey checking.
2. Interpretation was done based on the field survey included sediment sampling and stratigraphic analysis and collecting mollusca fossils, mainly to the western part of Sam Roi Yot area.

3. Systematic classification of mollusca fossils was done to interpret only index fossils adequate for paleoenvironment analysis.
4. Ages of both sediment and mollusca fossils were done by OSL and C14 method, respectively.

1.4 Study Area

In this study, the study area covers the Sam Roi Yot National Park (SRY) of Amphoe Pran Buri, Sam Roi Yot and Kui Buri, Changwat Prachuap Khiri Khan in the west of the Gulf of Thailand is about 240 km south of Bangkok. The area can be accessed easily via cars, using the road no. 4. There routes to the study area can be reached. So the study area was subdivided into 3 parts (the south, the central and the north part of SRY) (as shown in Figure 1.1). The southern part covers the Kui Buri area (A, 131 km^2) of Amphoe Kui Buri, Changwat Prachuap Khiri Khan. It is bounded by 12° 4′ 58″ N, 99° 51′ 15″ E. The central part covers the Sam Roi Yot area (B, 60 km^2) in Amphoe Sam Roi Yot, Changwat Prachuap Khiri Khan. It is bounded by 12° 16′ 14″ N, 99° 52′ 19″ E. The northern part covers the Pran Buri area (C, about 27 km^2) in Amphoe Pran Buri, Changwat Prachuap Khiri Khan. It is bounded by 12° 23′ 42″ N, 99° 55′ 0″ E.

These three study areas are located in topographic map of the Royal Thai Survey Department, of sheet 4933 I (Amphoe Pran Buri) and 4933 II (Amphoe Kui Buri) series L7017 with scale 1:50,000 (as shown in Figure 1.2) and geologic map Sheet ND47-15 (Amphoe Hua Hin) with scale 1:250,000 (as shown in Figure 1.3).

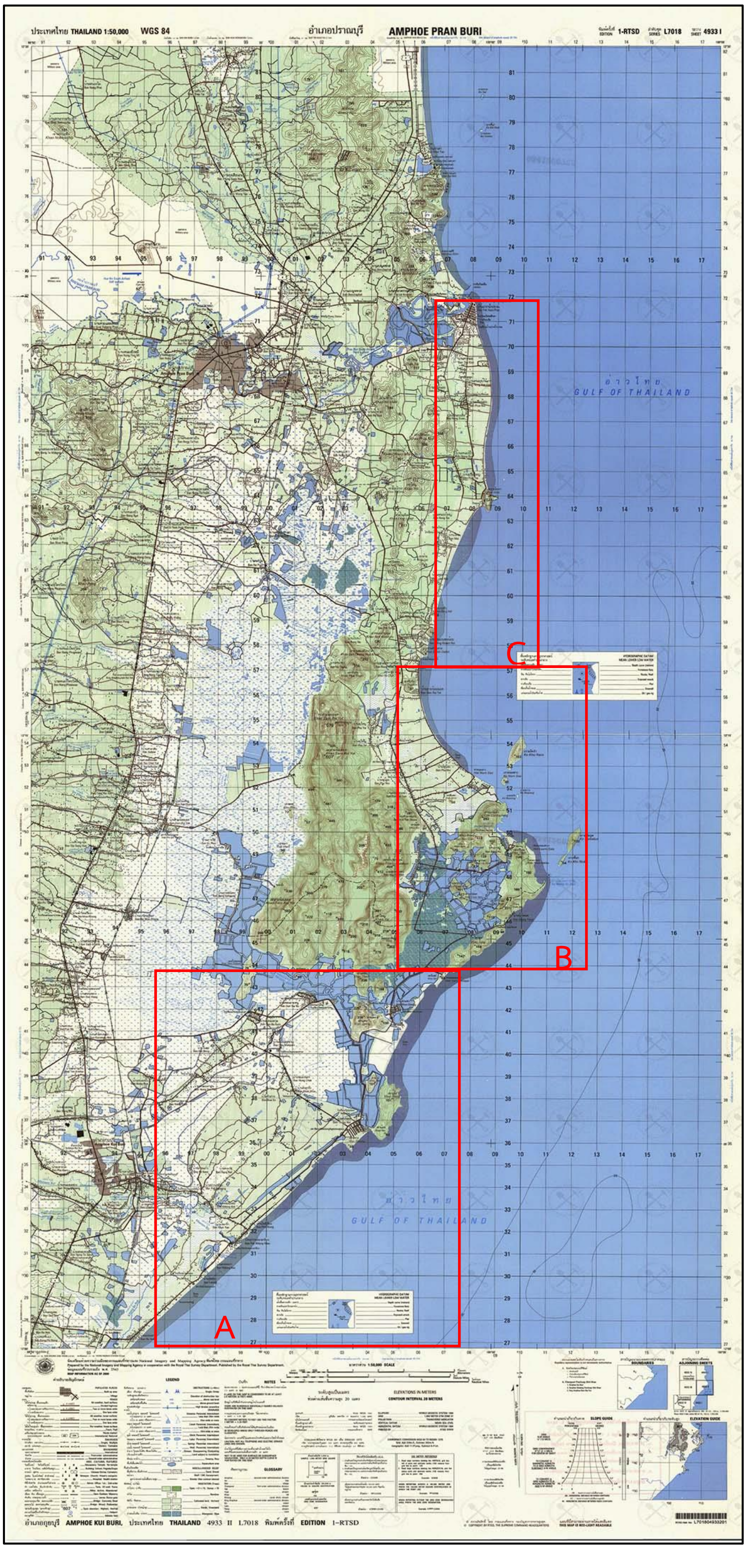


Figure 1.1 Topographic maps of Amphoe Pran Buri and Kui Buri, Map sheet 4933 I and 4933 II (Royal Thai Survey Department, 2000), showing the study areas: A, B and C.

Figure 1.2 Map from Google Earth showing the locations of the study area at Kui Buri (A), Sam Roi Yot (B) and Pran Buri (C) areas of Changwat Prachuap Khiri Khan.

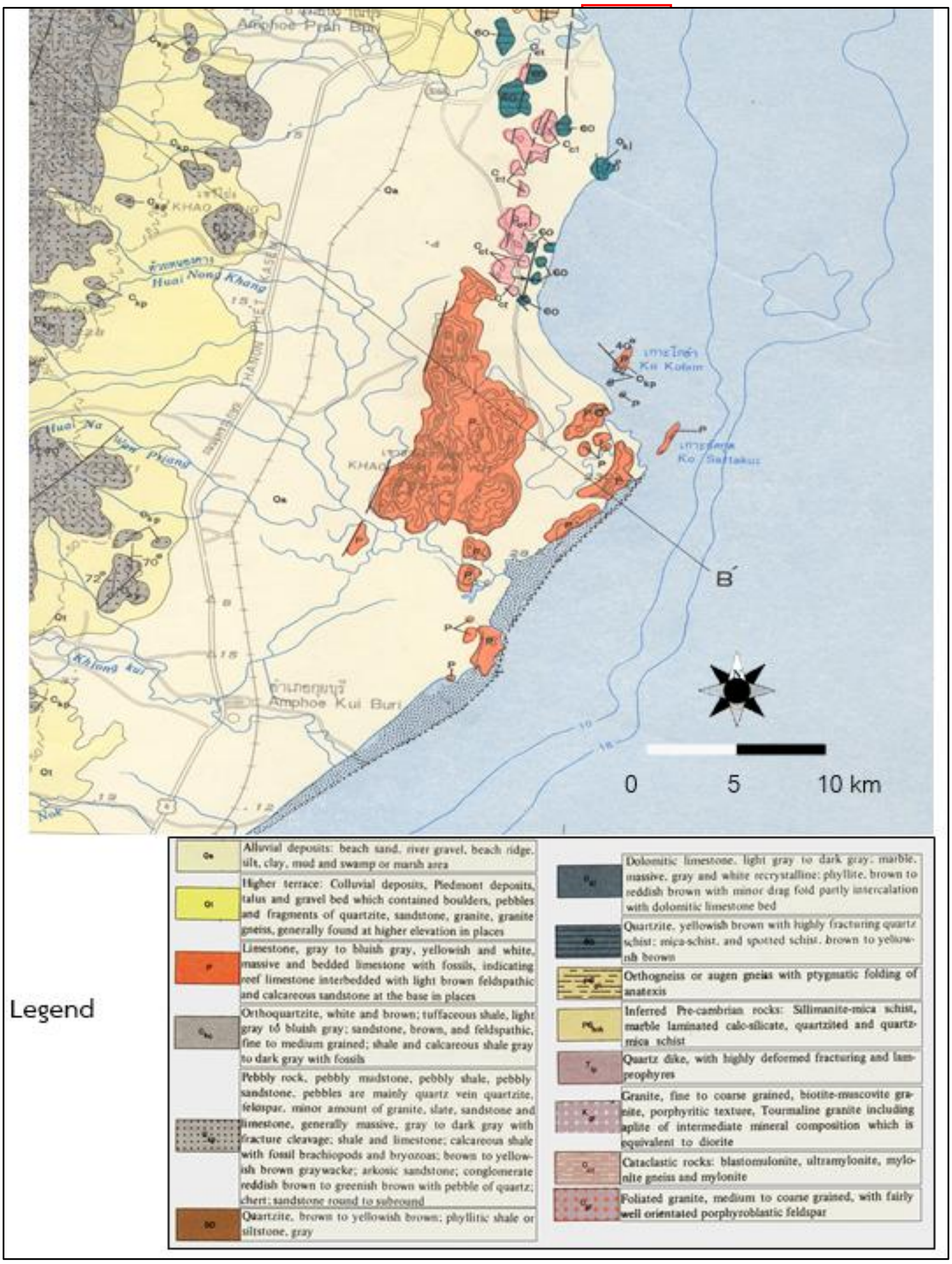


Figure 1.3 Geologic map of the study area at Kui Buri (A), Sam Roi Yot (B) and Pran Buri (C) based on Department of Mineral Resources (1976).

1.5 Literature Reviews

1.5.1 Geomorphology

Based on Chalermlarp (1990) the geomorphic units within this area were classified into 3 units. Unit A is called an old land (marine alluvium, brackish alluvium and river alluvium), whereas Unit B represents the mountain area (the quartzite, dolomitic limestone hill, the quartzite and meta-shale hill, the limestone mountains and hill and metamorphosed igneous rock hill), foot slope deposit, deltaic deposition. Unit C represents old lagoon (Sam Roi Yot field), coastal deposits (beach and sand barrier, former and active tidal flats). Coastal landforms along the study area have been studied in more detail by Choowong et al. (2004) in order to find the relationship of coastal evolution and history of sea level change. However from previous studies, general geomorphological units were based on geological mapping of the Department of Mineral Resources, Thailand. Geomorphological units of Sam Roi Yot National Park, which covers the central part of study area, were classified into 10 units including, Silurian-Devonian, Permian limestone, Holocene barrier, inter-barrier depression, former tidal flat, tidal flat, alluvium, colluvium, back-barrier lagoon and Sam Roi Yot Field as shown in Figure 1.4. The geological map of Sam Roi Yot National Park was created by Department of mineral resources in 2008 (Figure 1.5).

1.5.2 Paleontology

There are many fossils found in coastal deposits at Khao Sam Roi Yot area in various landforms (e.g. beach ridge, swale, former tidal flat, tidal flat and tidal channel). Swennen et al. (2001) studied and introduced mollusca with their environments in southern part of the Gulf of Thailand. Choowong et al. (2004) found 3 species of gastropod and 13 species of bivalve from the former tidal flat. Surakiatchai (2005) discovered more than 75 mollusca species. There are 31 species of gastropod and 44 species of bivalves from 5 localities. The pioneer paleontological studies in this study area suggested that it is the possibility to conduct more paleontological investigation and the results can be useful for paleoenvironment interpretation.

1.5.3 Quaternary dating

Marine and brackish shells in Khao Sam Roi Yot area have been dated. Choowong et al. (2004) reported the absolute age dated by AMS of Genus *Circe* collected from beach deposit. They provided the age of 4,010 ± 40 and 2,180 ± 40 BP. Surakiatchai (2005) reported the age of shells collected from former tidal flat and dated by C14. Results are 1,520 ± 250, 2,200 ± 270 and 7,360 ± 420 BP, respectively. Chucha-Em (2007) used Electron Spin Resonance (ESR) for dating of oyster shells collected from sea notch from SRY area. Ages are 5,545, 5,887 and 7,822 BP, respectively. All these dating results were among the pioneer reports. Through, they provides some absolute ages related to deposition, but the more dating is necessary in order to clarify the precise history of paleoenvironment and paleogeography.

1.5.4 Sea-level changes

The pioneer work related to sea level changes in the Gulf of Thailand was carried out by Sinsakul et al. (1985) and Sinsakul (1992). They concluded that sea-level changes in the Gulf of Thailand were attributed only to glacio-eustatic cycle during the Post Glacial Marine Transgression (PGMT) without isostatic adjustment (Thiramongkol, 1983) suggested that isostasy has played an additional role in controlling sea-level changes around the Central Plain of Thailand extending to the south reaching this study area. Choowong (2002) provided lines of evidence of sea-level changes in explaining the evolution of the coastal plain from the Gulf of Thailand. Locations of the mid-Holocene barriers and the presence of indicators of sea-level changes are also helped in positioning the paleo-shoreline. The mid-Holocene sea rose as far as 40 km inland on the southern peninsula and 7 km on the western part of the Gulf. At the northeastern coast, estuarine deposits, prograded barriers and relict barriers are indicators of Holocene paleo-shoreline that was located as far as 15 km inland to the north of present coast. At the Lower Central Plain, marine and brackish deposits are the record of the incursion of the sea as far as 70 km inland to the north of present coast.

Close up to Sam Roi Yot area, some studies of sea-level changes in Sam Roi Yot and adjacent areas have been reported in the past decade (Choowong et al., 2004, Nimnate et al., 2015). Evidence of sea level change included both physical and biological indicators. The dominant physical clue coupled with biological indicator in this area is the solution sea notch with oyster attached to notch's walls that were found extensively at the base of Limestone. Marine and brackish shells were classified as biological indicators of sea level changes as well.

Latest radiocarbon dating of marine fossils from SRY area was carried out by Surakiatchai (2005). C14 dating was performed from fossils found at Khao Rap area that provided the age of 1,520 ± 250 BP, 2,200 ± 270 BP at Wat Thung Noi School and 7,360 ± 420 BP from Ban Don Makham. All of dating results indicated the Holocene history of their depositions. The results from C14 dating were related to the height of sea notch in order to confirm the Holocene sea level envelope (curve) for Thailand constructed earlier by Choowong et al. (2004). At Khao Rap, the elevation is equal the present mean sea level whereas the level at Wat Thung Noi School is 0.5 m and Ban Don Makham is 2.2 m above the present mean sea level Surakiatchai (2005). These levels are related well with history of sea level change records in this area and provided as basic background for further study.

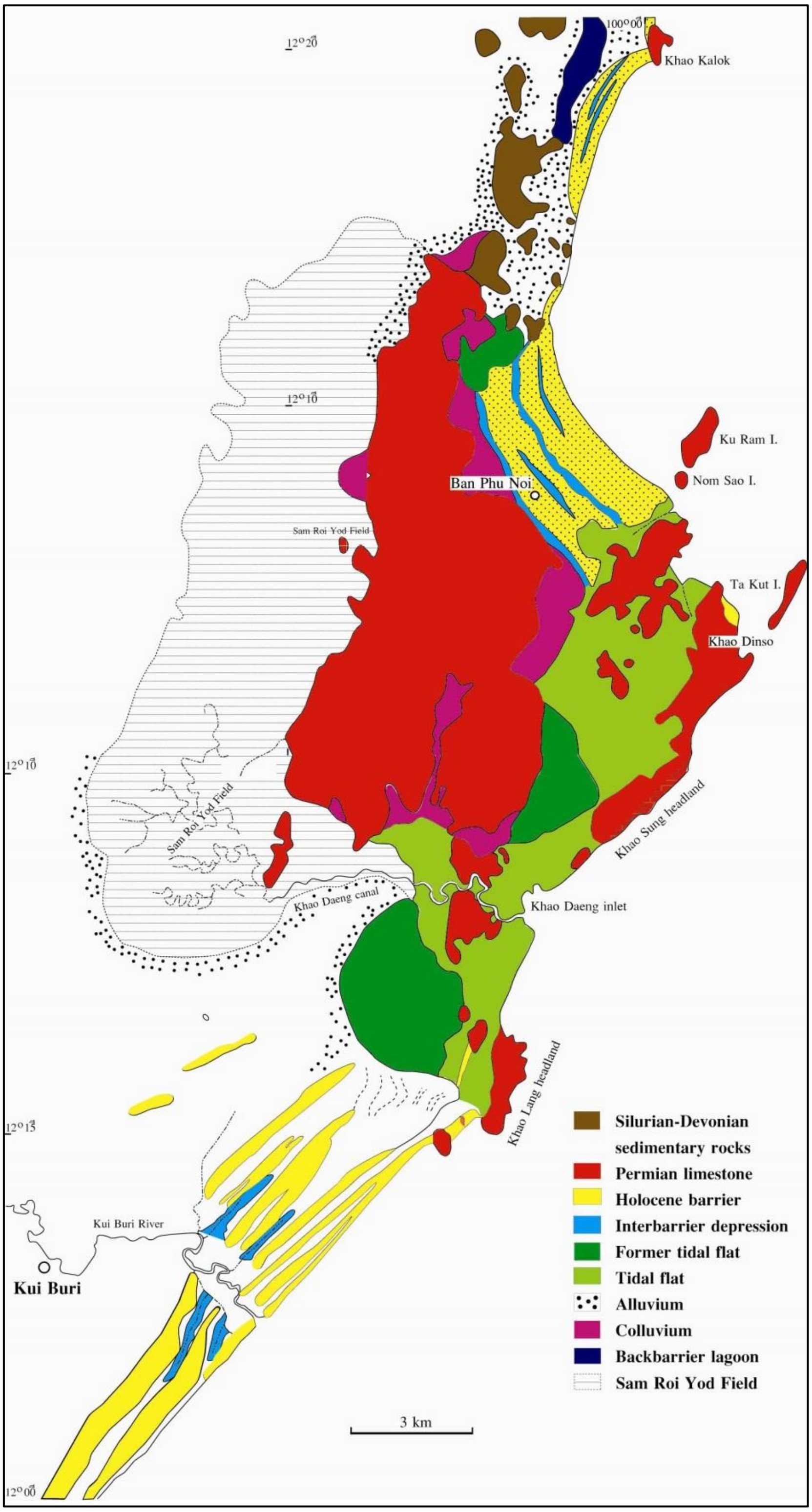


Figure 1.4 Geomorphological map of Khao Sam Roi Yot National Park (Choowong et al., 2004).

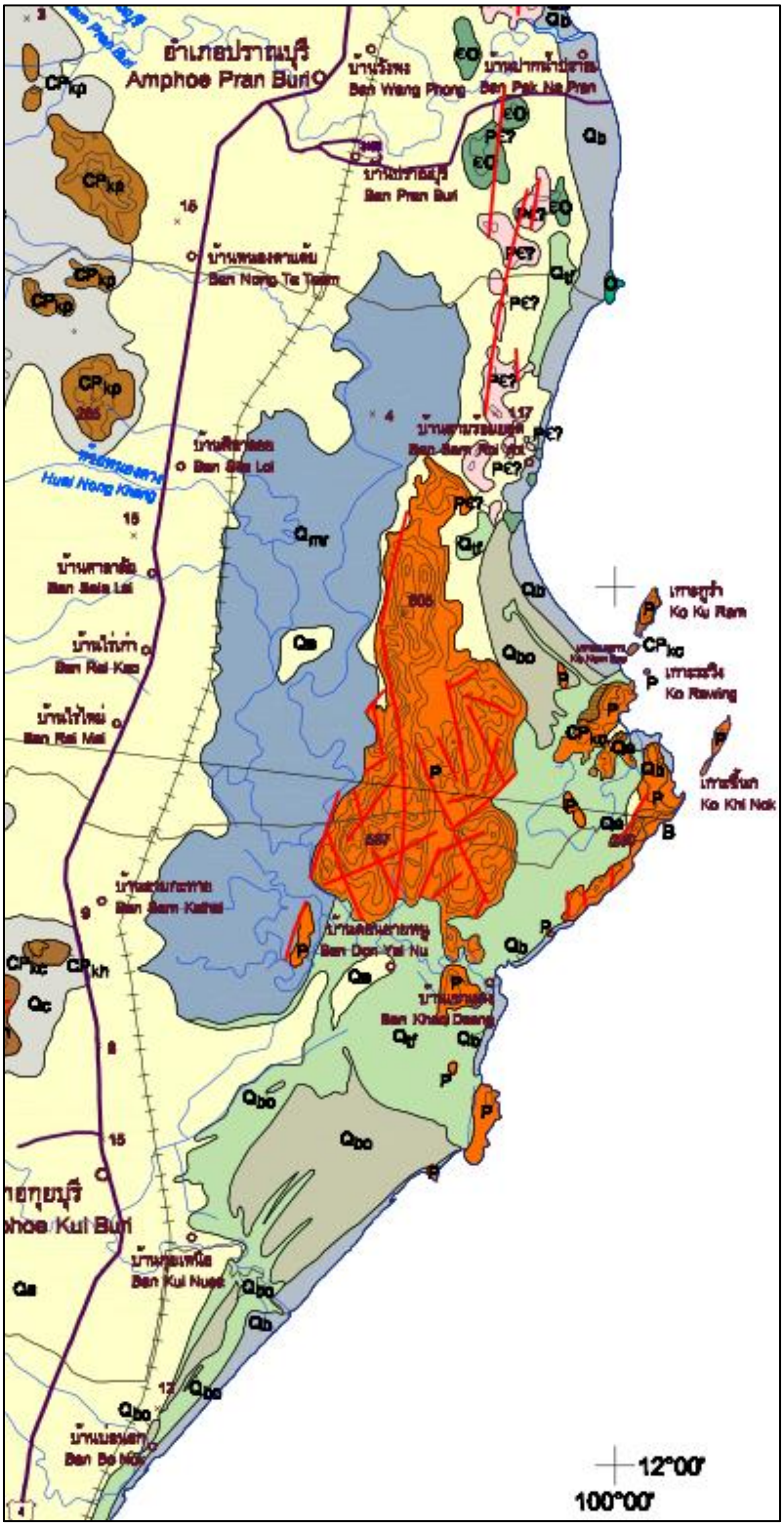


Figure 1.5 Geologic map of the Sam Roi Yot areas at Kui Buri (A), Sam Roi Yot (B) and Pran Buri (C) base on Department of Mineral Resources (2008).

คำอธิบาย
EXPLANATION

ตะกอน หินชั้น และหินแปร SEDIMENT, SEDIMENTARY AND METAMORPHIC ROCKS	ชื่อหมวด/กลุ่มหิน FORMATION/GROUP	ยุค PERIOD	อายุ (ล้านปี) AGE (my.)
Qb ตะกอนชายหาด : ทราย กรวด ทรายแป้ง มีเปลือกหอย เศษปะการัง และเศษซากพืช Beach deposits: sand, gravel, silt, with mollusc, coral and plant remains.		ควอเทอร์นารี QUATERNARY	0.01-1.6
Qtf ตะกอนที่ลุ่มราบน้ำขึ้นถึง : ดินเคลย์สีเทา หรือสีเทาปนเขียว เนื้ออ่อนนิ่ม ชั้นหนา มีชั้นทรายละเอียด และชั้นพีตแทรกสลับ พบเปลือกหอยบ้าง Tidal flat deposits : clay, gray or greenish gray, soft, thick bedded, intercalated with fined sand, peat layers shell fragments.			
Qmr ตะกอนที่ลุ่มชุ่มน้ำ : ดินเคลย์ เนื้อนิ่ม สีดำ มีเศษพืชพวกหญ้า หรือพืชน้ำปะปนมาก มีน้ำขังตลอด Marsh deposits : clay, black, soft, abundant grass and water plants.			
Qa ตะกอนน้ำพา : กรวด ทราย ทรายแป้ง และดินเหนียว Alluvial deposit : gravel, sand, silt and clay.			
Qbb ตะกอนสันทรายเก่า ทราย เนื้อปานกลางถึงหยาบ การคัดขนาดปานกลาง ความกลมมนดี มีเศษเปลือกหอยปน Old beach ridged deposits : sand, medium-to coarse-grained, medium sorted, well rounded, with shell fragments.			
Qt ตะกอนตะพัก : กรวด และทราย Terrace deposits : gravel and sand.			
Qc ตะกอนเศษหินเชิงเขา และตะกอนผุพังอยู่กับที่ : เศษหิน ประกอบด้วยหินควอร์ตไซต์ หินทราย หินทรายแป้ง หินแกรนิต ทราย และทรายแป้ง ดินลูกรัง และดินเทอราโรซ่า Colluvial and residual deposits : rock fragments of quartzite, sandstone, siltstone, granite; sand and silt; lateritic soil and terrarosa soil.			
JKlt หินทราย สีน้ำตาลแกมแดง เนื้อละเอียดถึงปานกลาง เม็ดเป็นเหลี่ยม การคัดขนาดดี เป็นแถบชั้นบางถึงชั้นหนา สลับด้วยชั้นหินกรวดมน กรวดประกอบด้วยหินทราย แร่ควอตซ์ และหินดินดาน เม็ดค่อนข้างกลมถึงกลม เนื้อหินเป็นทรายและทรายแป้ง Sandstone, reddish brown, fine-to-medium-grained, angular shaped, good sorting, laminated to thick bedded, interbedded with conglomerate, pebbles of sandstone, quartz and shale, subround to round shaped, sand and silt matrixes.	หมวดหินลำทับ Lam Thap Fm.	ครีเทเชียสถึงจูแรสซิก CRETACEOUS to JURASSIC	66.4-210
TR หินทราย สีน้ำตาลแกมแดง เนื้อละเอียดถึงปานกลาง เม็ดแร่เหลี่ยม การคัดขนาดดี เป็นแถบชั้นบางถึงชั้นหนา สลับด้วยชั้นหินกรวดมน กรวดประกอบด้วยหินทราย ควอตซ์ และหินดินดาน กรวดกึ่งกลมถึงกลม วัสดุประสานเป็นทราย และทรายแป้ง ตอนล่างเป็นหินกรวดมนฐาน กรวดประกอบด้วยหินปูน รูปร่างเหลี่ยม หินทราย และควอตซ์ รูปร่างกึ่งกลมถึงกลม วัสดุประสานเป็นทรายและทรายแป้ง สีแดง Sandstone, reddish brown, fine-to medium-grained, angular, good sorting, laminated to thick bedded, interbedded with conglomerate, pebbles of sandstone, quartz and shale, subround to round , sand and silt matrixes; basal conglomerate at the lower part, pebbles of limestone, angular shaped, sandstone and quartz, subround to round, red silt and sand matrixes.	หมวดหินแม่ร่ำพึง Mae Ramphung Fm.	ไทรแอสซิก TRIASSIC	210-245
P หินปูน สีเทาถึงสีเทาเข้ม เป็นชั้นถึงไม่แสดงชั้น มีหินเชิร์ตเป็นกระเปาะ หินปูนเนื้อโดโลไมต์ พบซากดึกดำบรรพ์ จำพวก ฟิวซูลินิด แบรคคิโอพอด ปะการัง แอมโมนอยด์ และไครนอยด์ พบหินทรายและหินดินดานบ้าง Limestone, gray, bedded to massive, with chert or siliceous nodules; dolomitic limestone, with fossils of fusulinid, brachiopoda, corals, ammonoids and crinoids; minor sandstone and shale.	กลุ่มหินราชบุรี Ratburi Gp.	เพอร์เมียน PERMIAN	245-286
CPkc หินทรายอาร์โคส สีขาวถึงสีน้ำตาลแกมเหลือง เนื้อละเอียดมากถึงปานกลาง การคัดขนาดปานกลางถึงดี ไม่แสดงชั้น และเป็นแถบชั้นบาง หินโคลน สีขาว สีเทาปานกลาง เนื้อละเอียดมากถึงละเอียด การคัดขนาดดี ชั้นบาง และเป็นแถบชั้นบาง เม็ดแร่เหลี่ยม พบซากดึกดำบรรพ์จำพวกหอยตะเกียง พลับพลึงทะเล และไบรโอซัว Arkosic sandstone, white to light yellowish brown, very fine-to medium-grained, moderate to well sorted, massive and laminated; mudstone, white, medium gray, very fine-to fine-grained, well sorted, thin bedded and laminated, angular shaped, with fossils of brachiopod, crinoid stem and bryozoa.	หมวดหินเขาเจ้า Khao Chao Fm.	เพอร์เมียนถึงคาร์บอนิเฟอรัส PERMIAN to CARBONIFEROUS	245-360
CPkp หินทรายเกรย์แวก สีเทาแกมเขียวถึงสีเทาปานกลาง เนื้อละเอียดมากถึงปานกลาง การคัดขนาดไม่ดี เม็ดแร่เหลี่ยมถึงกลม หินดินดาน สีเทาแกมเขียวถึงสีเทาปานกลาง แตกเป็นแผ่นเรียบ และแถบชั้นบาง หินทรายอาร์โคส สีขาว ถึงสีน้ำตาลแกมเหลืองอ่อน เนื้อละเอียดมากถึงปานกลาง การคัดขนาดปานกลางถึงดี เม็ดแร่ค่อนข้างเหลี่ยมถึงกลม Graywacke, greenish gray to medium gray, very fine-to medium-grained, poor sorted, angular to round shaped; shale, greenish gray to medium gray, fissile and laminated; arkosic sandstone, white to light yellowish brown, very fine-to medium-grained, moderate to well sorted, subangular to round shaped.	หมวดหินเขาพระ Khao Phra Fm.		
CPkp หินควอร์ตไซต์ หินฮอร์นเฟลส และหินชนวน พบบริเวณสัมผัสกับหินอัคนี Quartz ite, hornfel and slate near the contact aureole.			
CPkh หินทราย และหินโคลนเนื้อปนกรวด สีเทาแกมเขียว สีเทา เนื้อละเอียดถึงปานกลาง เนื้อแน่น แข็ง ลักษณะกรวดกึ่งเหลี่ยมถึงกึ่งกลม ความมนน้อยถึงปานกลาง การคัดขนาดไม่ดี ประกอบด้วยแร่ควอตซ์ หินทราย หินปูน และหินแกรนิต มีการเรียงตัวของเม็ดกรวด บริเวณใกล้แนวรอยเลื่อน และพบหินควอร์ตไซต์ หินฮอร์นเฟลส์ และหินทรายแปรสภาพบริเวณสัมผัสกับหินแกรนิต Pebbly sandstone and pebbly mudstone, greenish gray, gray, fine-to medium-grained, dense and hard, composed of quartz, mudstone, sandstone, limestone and granite, subangular to subrounded, low to moderately sphericity, poor sorted, gravel oriented near fault zone; quartzite, hornfels and meta-sandstone at granite contact.	หมวดหินเกาะเฮ Ko He Fm.		
CPlp หินโคลน สีเทา แสดงชั้นบางชัดเจน แทรกสลับชั้นบางกับหินทราย สีขาวขุ่น เนื้อละเอียด เม็ดกึ่งกลม ความมนน้อย บริเวณตอนกลางแทรกด้วยหินทรายเนื้อเฟลด์สปาร์ สีขาว เนื้อปานกลาง กึ่งกลม ความมนน้อย Mudstone, gray, well laminated, interlaminated with sandstone, dull white, fine grained, subrouned, low sphericity; intercalated with felspathic sandstone, white, medium grained, subrouned, low sphericity at the middle part.	หมวดหินแหลมไม้ไผ่ Laem Mai Phai Fm.		
SD หินทรายเนื้อควอตซ์ หินทรายเนื้อดิน สีน้ำตาล เทา และน้ำตาลแกมแดง เนื้อละเอียดถึงหยาบ เม็ดกึ่งกลม การคัดขนาดดี สลับด้วย หินดินดาน และหินทรายแป้ง บางแห่งถูกแปรสภาพเป็นหินควอร์ตไซต์ หินฟิลไลต์และหินชนวน ชั้นหินเชิร์ต พบซากดึกดำบรรพ์จำพวกเทนตะคิวไลต์ Quartzitic sandstone, lithic sandstone, brown, gray, reddish brown, fine-to coarse-grained, subrounded, well sorted, interbedded with shale and siltstone, some metamorphosed to quartzite, phyllite and slate; chert bedded, with fossils of tentaculite.		ดีโวเนียนถึงไซลูเรียน DEVONIAN to SILURIAN	360-438
O หินปูนเนื้อโดโลไมต์ สีเทา หินอ่อน สีเทา ไม่แสดงชั้น หินฟิลไลต์ สีน้ำตาลถึงสีน้ำตาลแกมแดง แสดงรอยคดโค้งแบบแดรก Dolomitic limestone, gray; marble, gray and white, massive; phyllite, brown to redish brown, with minor drag fold.		ออร์โดวิเชียน ORDOVICIAN	438-505
€O หินควอร์ตไซต์ สีน้ำตาลแกมเหลือง มีการแตกหักมาก หินควอตซ์ชิสต์ หินไมกาชิสต์ และหินชิสต์ สีน้ำตาลถึงสีน้ำตาลแกมเหลือง Quartzite, yellowish brown, with highly fracturing; quartz-schist; mica-schist and spotted schist brown to yelowish brown.	หมวดหินเขาทับทิม Khao Taptim fm.	ออร์โดวิเชียนถึงแคมเบรียน ORDOVICIAN to CAMBRIAN	438-570
P€? หินออร์โทไนส์ และหินไนส์รูปตา พบการคดโค้งของหินหลอมละลาย หินที่การแตกหักบดอัด ได้แก่ หินบราสโตไมโลไนต์ หินอัลตราไมโลไนต์ และหินไมโลไนต์ไนส์ หินซิลิมาไนต์ไมกาชิสต์ หินอ่อน แถบชั้นบางของหินแคลก ซิลิเกต หินควอร์ตไซต์ และหินควอตซ์ไมกาชิสต์ Orthogneiss and augen gneiss with pygmatic folding of anatexis; cataclastic rocks, blastomylonite, ultramylonite, mylonite gneiss and mylonite; sillimanite-mica schist; marble; laminated calc-silicate; quartzited and quartz-mica schist.	หมวดหินเขาเต่า Khao Tao fm.	พรีแคมเบรียน PRECAMBRIAN	มากกว่า 570

หินอัคนี IGNEOUS ROCKS	ยุค PERIOD	
Kgr หินแกรนิต สีจาง เนื้อปานกลางถึงหยาบ ส่วนมากเนื้อสม่ำเสมอ และหินแอไพลต์แกรนิต เนื้อละเอียด ถึงเนื้อขนาดปานกลาง Granite, light color, medium-to coarse-grained, mostly granular texture and aplite granite, fine-to medium-grained.	ครีเทเชียส CRETACEOUS	66.4-140
Kv หินไรโอไลต์ สีม่วง เนื้อดอก เฟลด์สปาร์ซึ่งเป็นดอกแสดงลักษณะรูปผลึกกึ่งสมบูรณ์ถึงสมบูรณ์ Rhyolite, maroon porphyritic texture with subhedral to euhedral feldspar phenocrysts.		
Cgr หินแกรนิตที่มีการเรียงตัวของเม็ดแร่ เนื้อปานกลางถึงหยาบ เป็นการเรียงตัวค่อนข้างดีของผลึกแร่เฟลด์สปาร์ขนาดใหญ่ Foliated granite, medium- to coarse-grained, with fairly well oriented porphyroblastic feldspar.	คาร์บอนิเฟอรัส CARBONIFEROUS	286-360

Figure 1.5 Geologic map of the Sam Roi Yot areas at Kui Buri (A), Sam Roi Yot (B) and Pran Buri (C) base on Department of Mineral Resources (2008). (cont)

CHAPTER 2
METHODOLOGY

Generally, the methodology of this research was categorized into four main aspects, including pre-field work, field work, laboratory work and analyzing and concluding data. The flow chart summarized all methods of the study is illustrated in Figure 2.1.

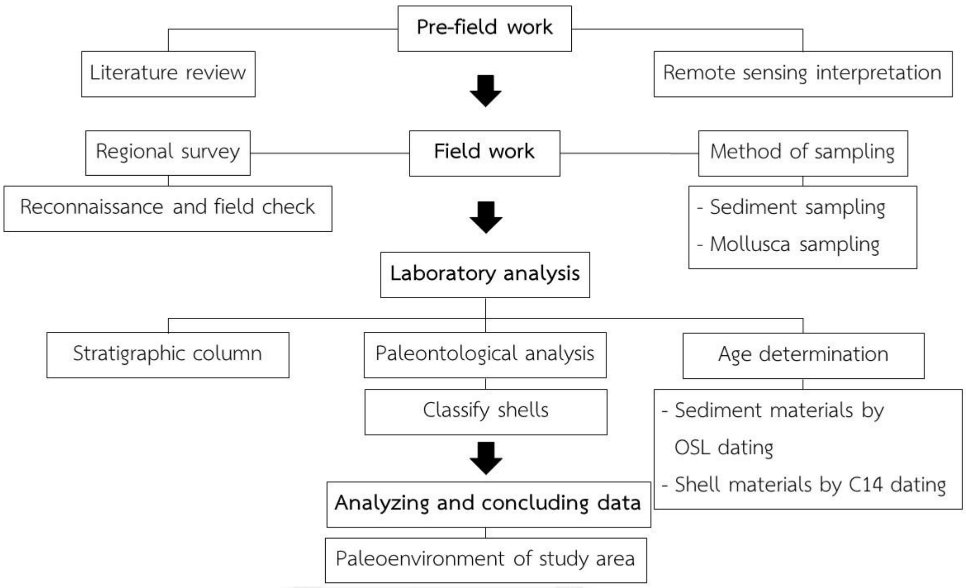


Figure 2.1 Flow chart showing methodology using in this study.

2.1 Remote Sensing Interpretation

In this study, aerial photograph survey during 1955, 1970 and 1994 analysis were used for detailed interpretation of landforms. Topographic map (Royal Thai Survey Department, 2000) (Figure 1.1) and geological map (Department of Mineral Resources, 1976, 2008) (Figures 1.3 and 1.5) were used as base maps. Satellite images data used in this thesis derived from various sources including those of Point Asia, Ortho-photographs, Landsat 7 taken in 2013 and Google Earth taken in 2015 (Figures 2.2 to 2.5). Ancient and present day coastal landforms were identified using stereo-pair aerial photos and a mirror stereoscope (Table 2.1).

Table 2.1 Series of topographic maps and aerial-photographs used for this study.

Material used	Detail (year of air-photo taken; map sheet; series)	Compiled and published year	Publisher
Topographic map	Map sheet 4933 I, L7018 Amphoe Pran Buri	2000	Royal Thai Survey Department
	Map sheet 4933 II; L7018 Amphoe Kui Buri	2000	
Aerial photographs	1955 (ID 23962)	1955	Royal Thai Survey Department
	1968 (ID 0002)	1970	
	1994 (ID 0012)	1994	
Geological map	Amphoe Hua Hin sheet ND 47-15 Scale 1:250,000	1976	Department of Mineral Resources
	Changwat Prachuap Khiri Khan	2008	
Satellite image	Google Earth	2015	Google Inc.
	Point Asia	2013	LOXLEY Public Company Limited and Space Imaging Southeast Asia
	Ortho-photograph	2013	Land Development Department
	Landsat 7	2013	United States Geological Survey

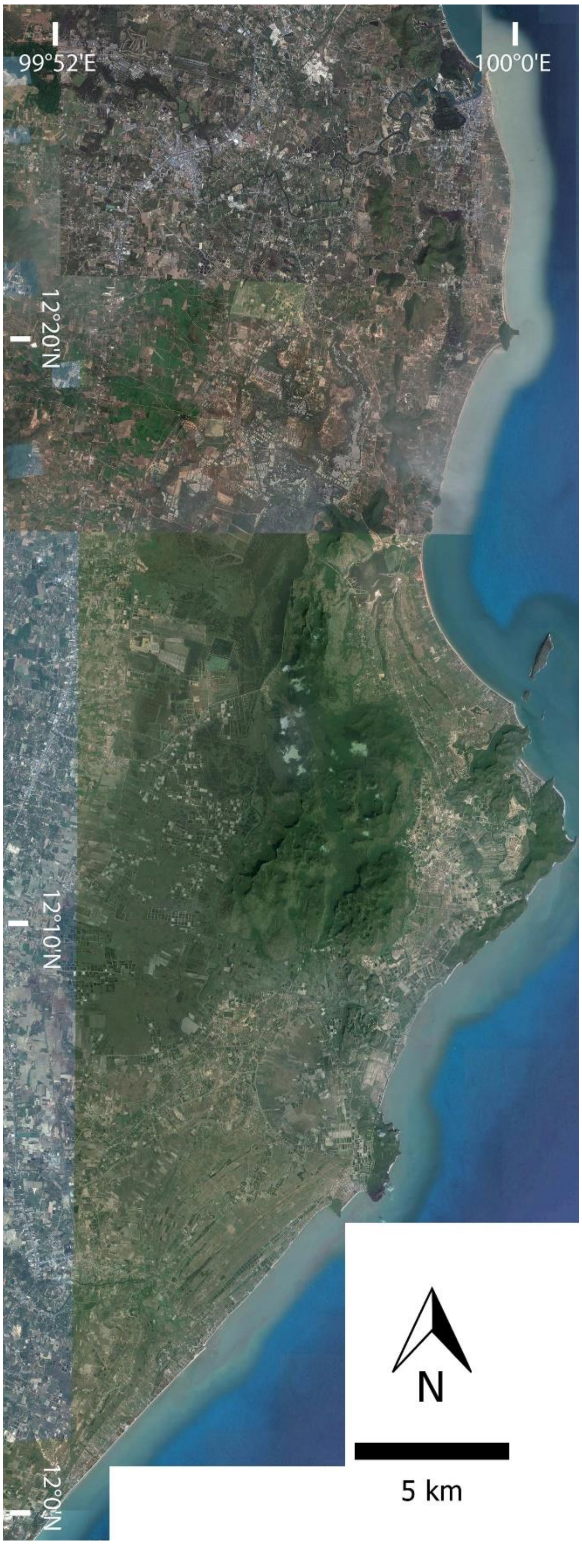


Figure 2.2 Satellite images showing the study area at Kui Buri, Sam Roi Yot and Pran Buri, Changwat Prachuap Khiri Khan. Satellite image from Google Earth; acquisition period: April 2015.

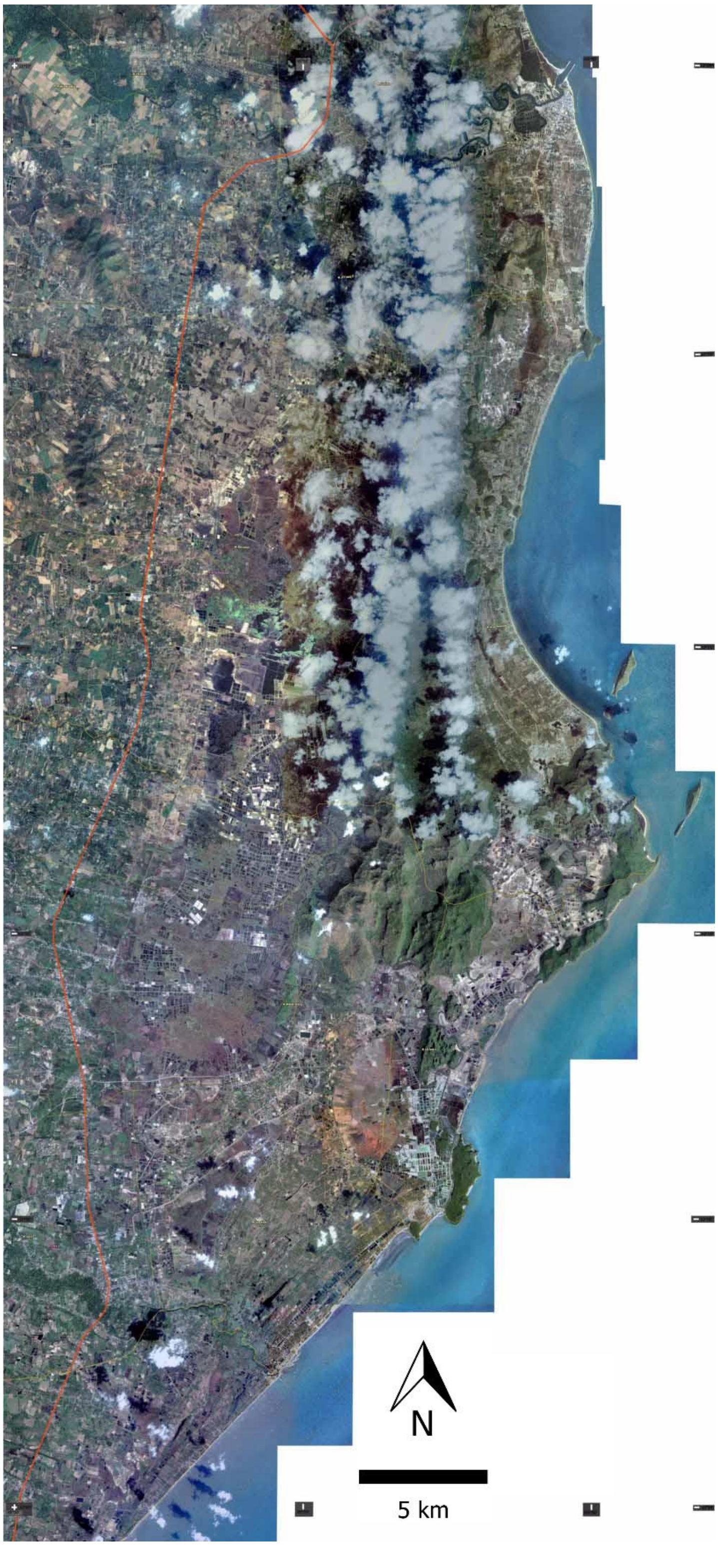


Figure 2.3 Satellite images showing the study area at Kui Buri, Sam Roi Yot and Pran Buri, Changwat Prachuap Khiri Khan. Satellite image from PointAsia; acquisition period: January 2013.

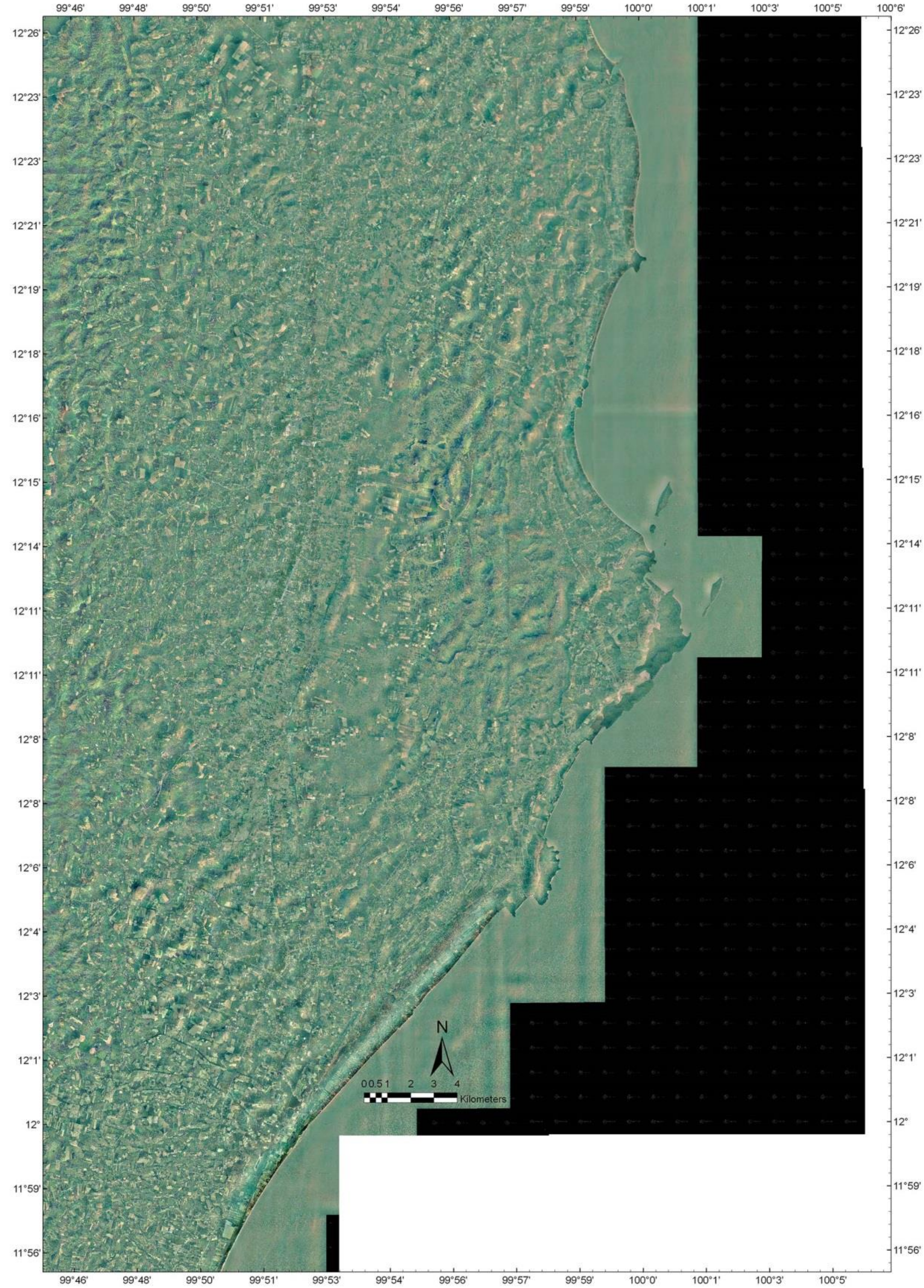


Figure 2.4 Satellite images covering Kui Buri, Sam Roi Yot and Pran Buri, Changwat Prachuap Khiri Khan. Satellite image from Orthophoto; acquisition period: January 2013.

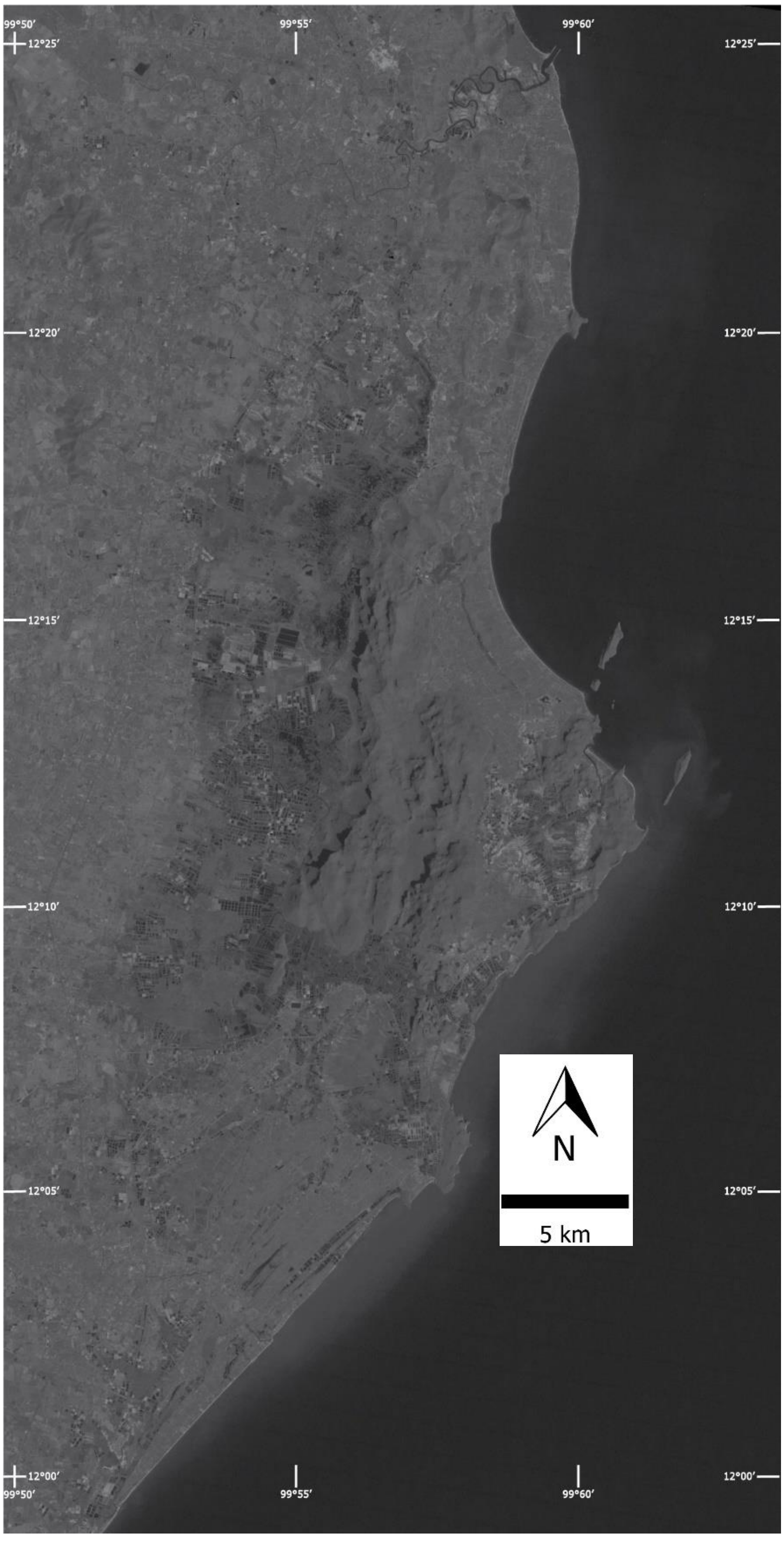


Figure 2.5 Satellite images showing the study locations at Kui Buri, Sam Roi Yot and Pran Buri, Changwat Prachuap Khiri Khan. Satellite image from Landsat 7; acquisition period: January 2013.

2.2 Regional Survey

After literature reviews and remote sensing interpretation were carried out, potential site for samples collection were selected during reconnaissance survey. Basically, hand auger is first tool for stratigraphy coring and then, excavation was done in order to recognize layers of sediments for collected samples (for dating and mollusca classification).

2.3 Method of Sampling

In this study, samples were collected for two purposes. The first purpose is for age dating. Samples were collected from depth 40 cm from surface (Figure 2.6) for optically stimulated luminescence dating (OSL) and collected oyster fossils from sea notch for radiocarbon dating (C14). Second purpose is for collecting shells from pit, core at the rim of shrimp pond for species classification.

Figure 2.6 Pit for collecting sediment samples for OSL dating

2.4 Stratigraphic Columns

Stratigraphic columns were made by cutting off surface at the rims of the shrimp pounds before hand auger or sand bucket were drilled. Hand auger was also used on ridge, swale, tidal channel, tidal flat, former tidal flat and alluvial pain (Figure 2.7) with a number of cores were from Kui Buri area (4 transects, 13 columns), Sam Roi Yot area (3 transects, 7 columns) and Pran Buri area (2 transects, 5 columns).

2.5 Paleontological Analysis

In laboratory, Mollusca were cleaned and classified. After that, they were photographed and the classification catalog was based on the study of Swennen et al. (2001), Surakiatchai (2005) and Robba et al. (2002, 2004 and 2007).

Figure 2.7 Map showing the study locations for stratigraphic investigation (1), OSL (2) and C-14 (3) dating at Kui Buri, Sam Roi Yot and Pran Buri, Changwat Prachuap Khiri Khan.

2.6 Optically Stimulated Luminescence Dating

Sediments were collected basically at depth 40 cm from surface for optically stimulated luminescence dating (OSL). Each sample was divided into 2 parts. Method of analysis was carried our followings that of Takashima and Watanabe (1994) all step of OSL dating see in appendix.

2.7 Carbon14 Dating

A total of 10 oyster fossils from 6 sea notches at different locations were collected (Figures 2.8 to 2.13). Ages of fossils were determined by radiocarbon dating. C-14 radiocarbon dating was analyzed at the Office of Atomic Nuclear for Peace of Thailand (OANP), Nakhon Nayok. C-14 was calibrated with the Calib 7.0 online program using the northern hemisphere terrestrial calibration curve (Reimer et al., 2009).

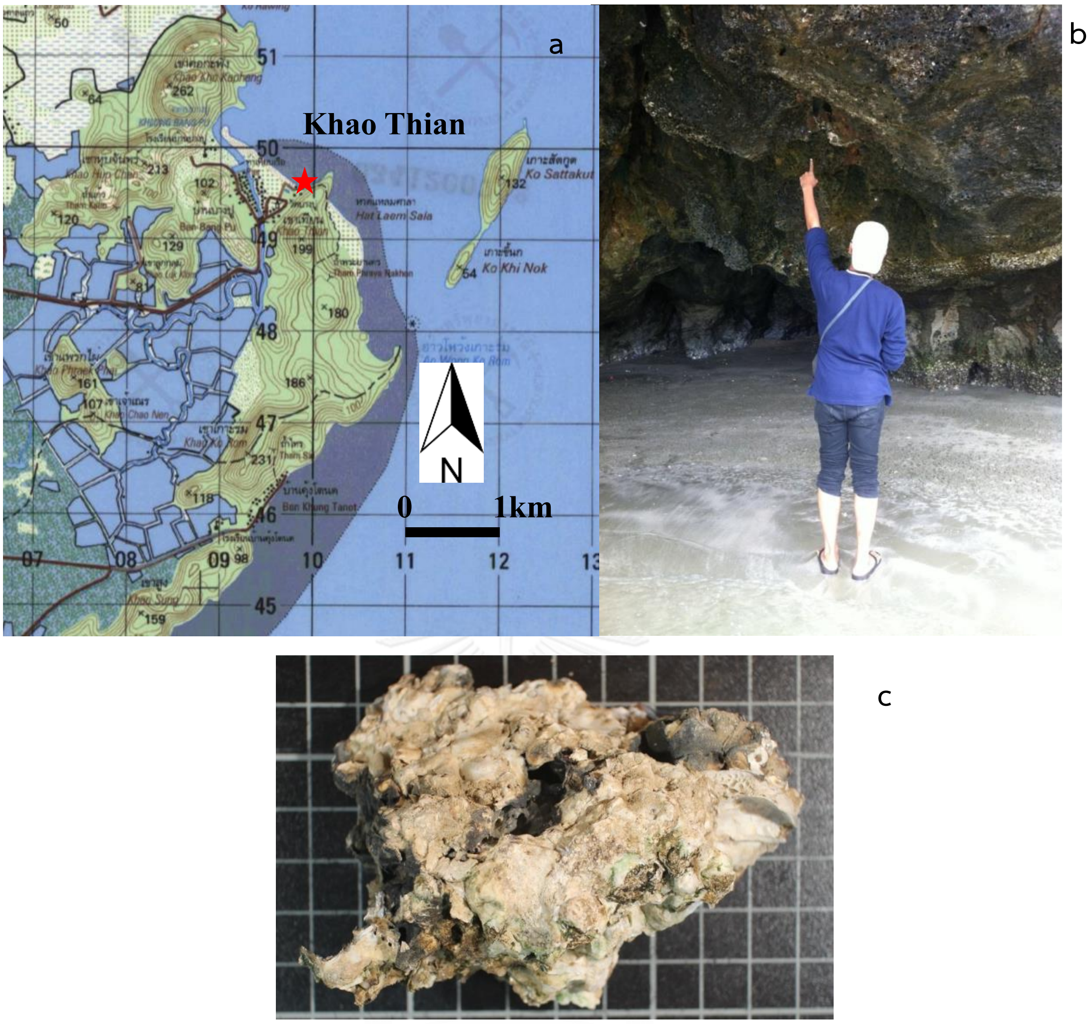


Figure 2.8 (a) Topographic map of Amphoe Kui Buri showing location of sampling point (Khao Thian), (b) level of oysters (about 2 m from sea level) attached sea notch at Khao Thian and (c) An oyster sample from Khao Thian for C14 dating.

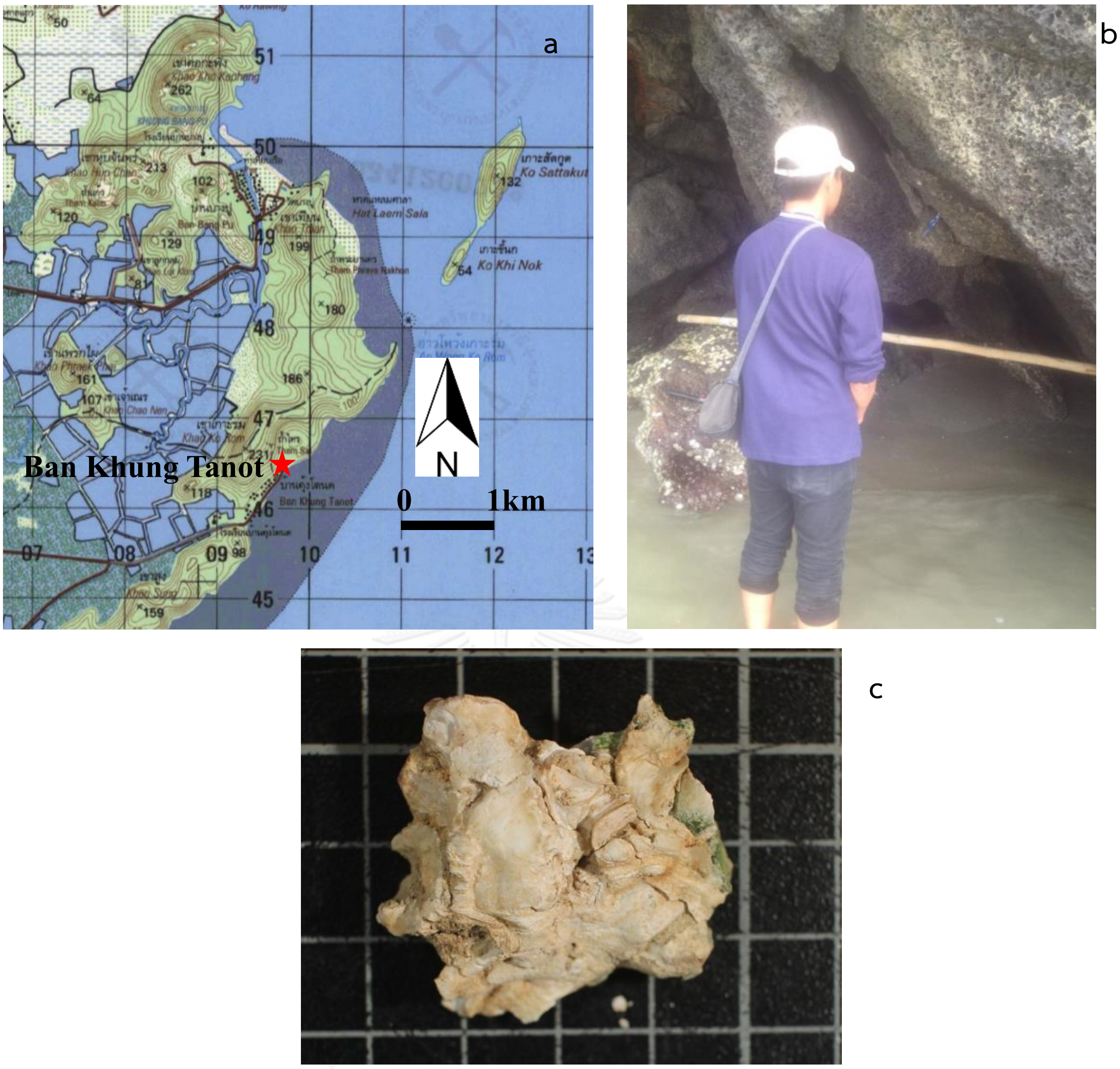


Figure 2.9 (a) Topographic map of Amphoe Kui Buri showing location of sampling point (Ban Khung Tanot), (b) level of oysters (about 1 m from sea level) attached sea notch at Ban Khung Tanot and (c) An oyster sample from Ban Khung Tanot for C14 dating.

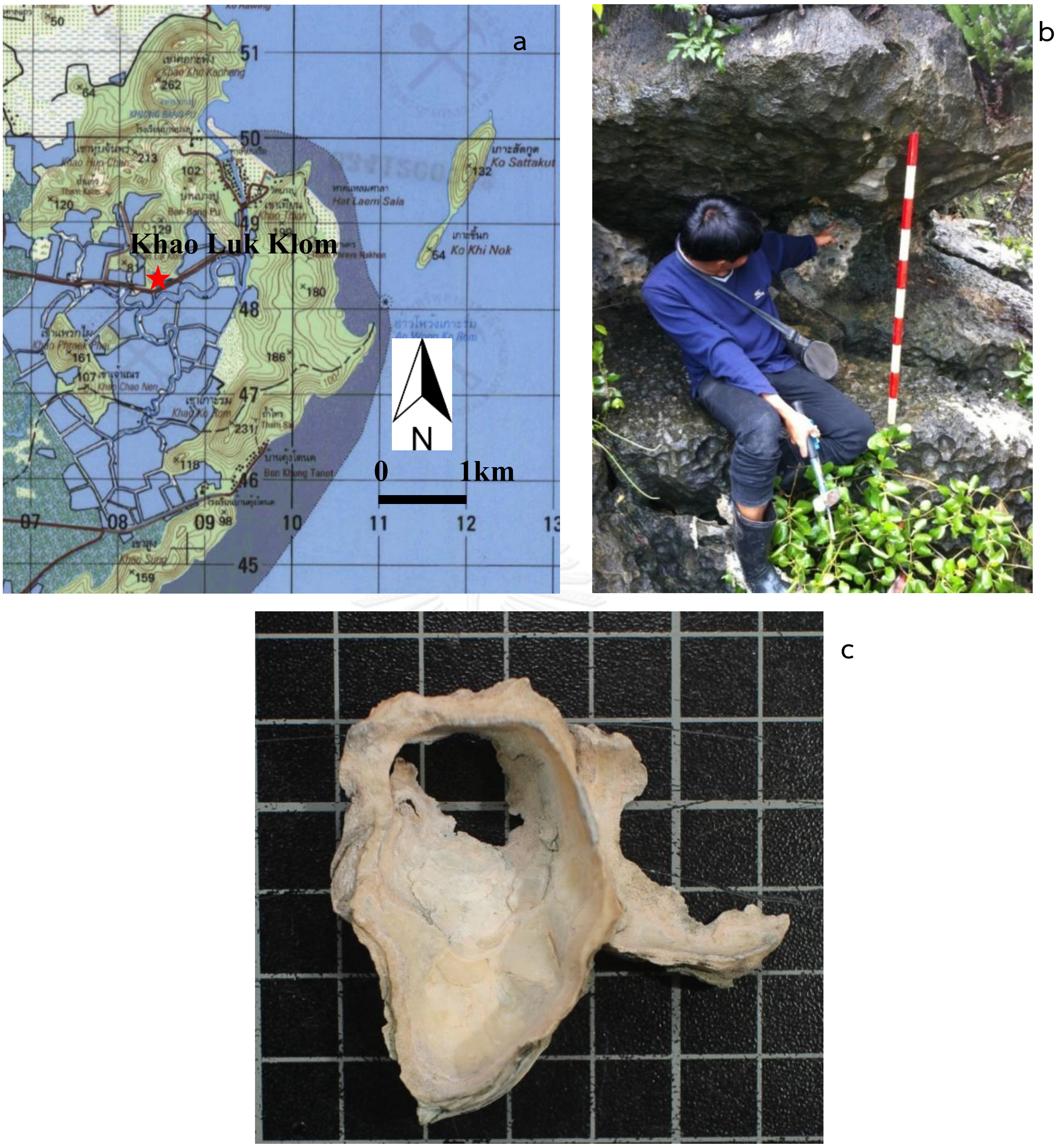


Figure 2.10 (a) Topographic map of Amphoe Kui Buri showing location of sampling point (Khao Luk Klom), (b) level of oysters (about 2.5 m from sea level) attached sea notch at Khao Luk Klom and (c) An oyster sample from Khao Luk Klom for C14 dating.

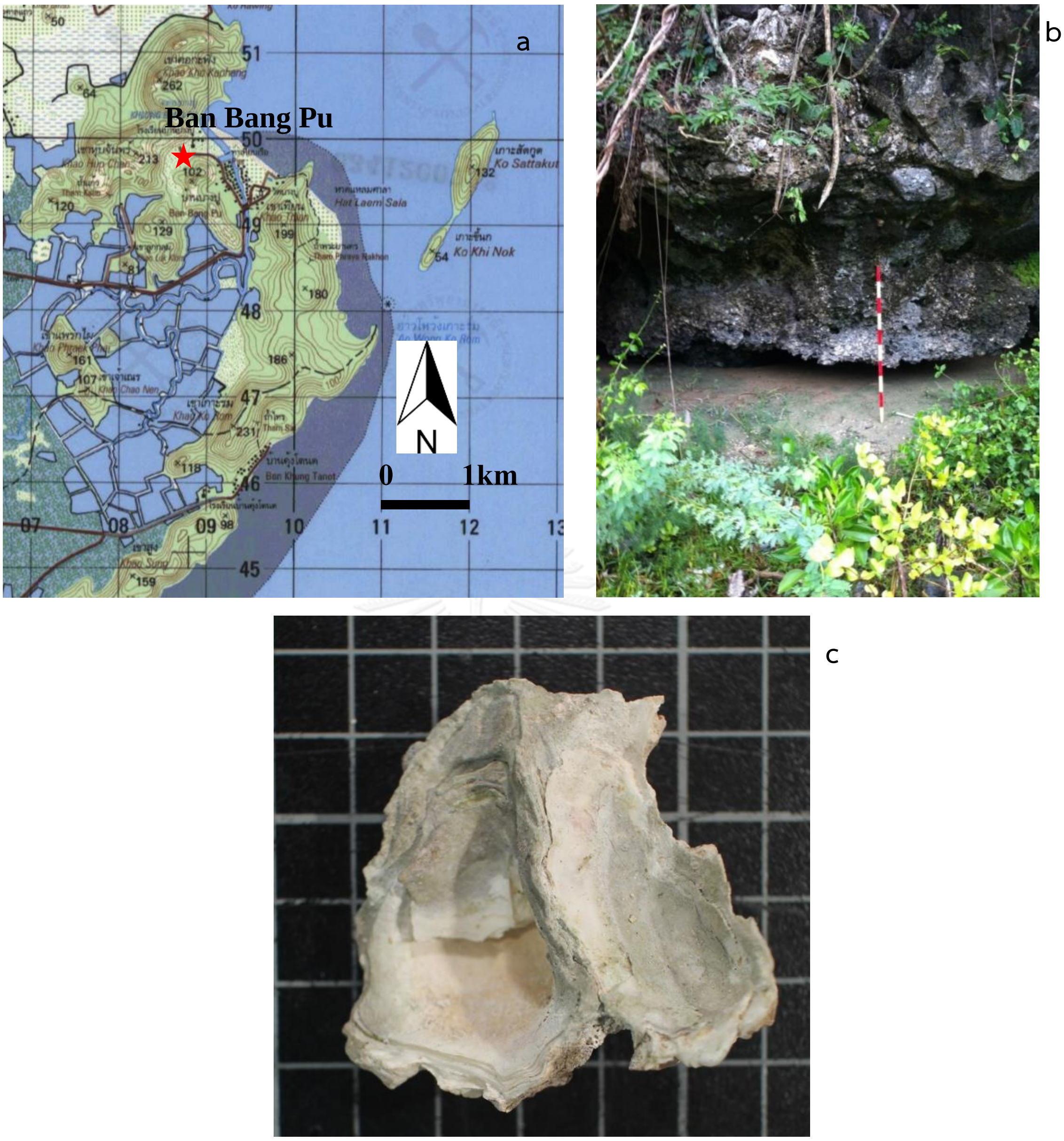


Figure 2.11 (a) Topographic map of Amphoe Kui Buri showing location of sampling point (Ban Bang Pu), (b) level of oysters (about 2, 2.3 and 2.6 m from sea level) attached sea notch at Ban Bang Pu and (c) An oyster sample from Ban Bang Pu for C14 dating.

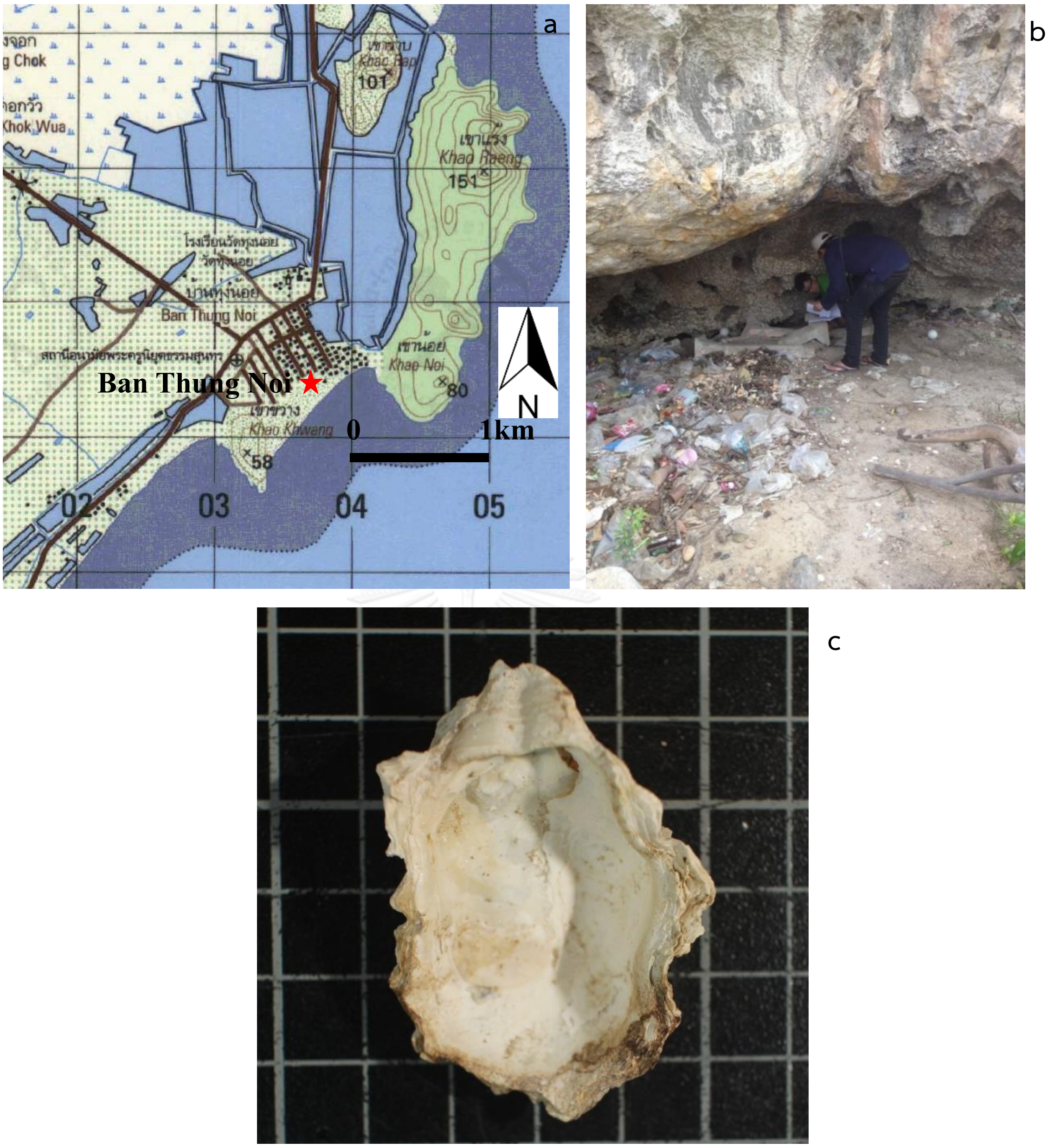


Figure 2.12 (a) Topographic map of Amphoe Kui Buri showing location of sampling point (Ban Thung Noi), (b) level of oysters (about 1, 1.2 and 1.4 m from sea level) attached sea notch at Ban Thung Noi and (c) An oyster sample from Ban Thung Noi for C14 dating.

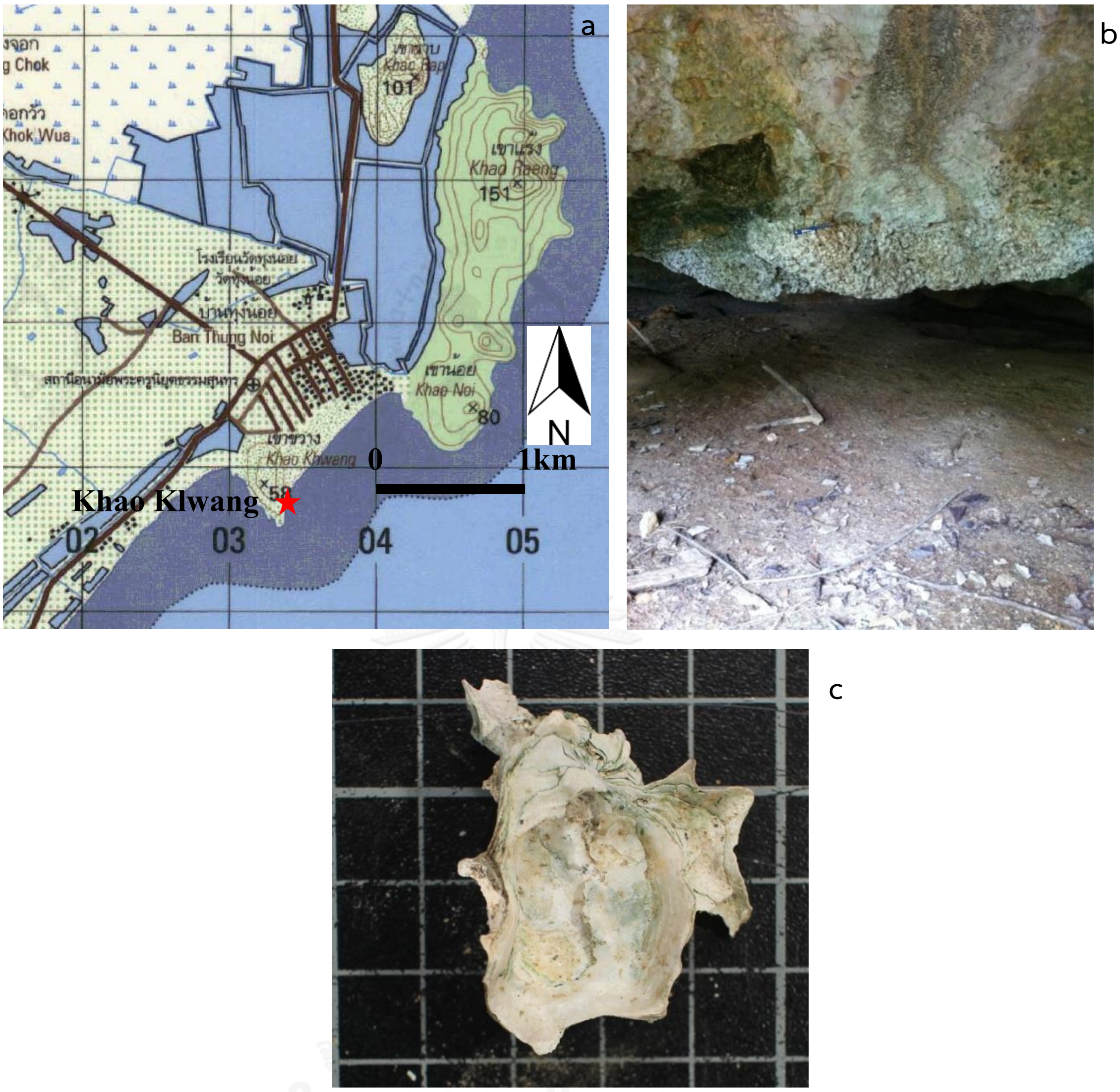


Figure 2.13 (a) Topographic map of Amphoe Kui Buri showing location of sampling point (Khao Klwang), (b) level of oysters (about 2 m from sea level) attached sea notch at Khao Klwang and (c) An oyster sample from Khao Klwang for C14 dating.

CHAPTER 3
RESULTS

3.1 Geomorphology of Study Area

3.1.1 Recent and paleo-coastal landforms

The Sam Roi Yot study areas are dominated by mountainous area from north to south. The largest unit is the study area is located at Khao Sam Roi Yot in the central part. Ridges and swales are dominant in the south of Kui Buri. Dimension of the ridge is about 6,500 m long, and up to 2,000 m wide and in the north of Kui Buri with 6,500 m long, width up to 4,000 m, Sam Roi Yot with 5,000 m long and up to 2,500 m wide. At the southern Pran Buri, ridge owns 4,500 m long, and up to 700 m wide and at northern Pran Buri, the ridges are about 6,000 m long, and up to 1,000 m wide. Recent beach extends from Pran Buri to Kui Buri with 45 km long. Tidal flat was found from the east to the south of Khao Sam Roi Yot. At the south of Khao Sam Roi Yot, tidal flat displays about 4,000 m long, and up to 2,500 m wide. Colluvial deposits were found at the foot of the mountain. Swampy are was found at the west of Khao Sam Roi Yot with 22,000 m long, width up to 4,000 m. Alluvial deposits were recognized in west of study areas (Figure 3.1).

The central part of Sam Roi Yot National Park area is dominated by high limestone mountains with cliffs. It is bounded in the east by coastal plain including marshy swale, tidal flat, beach and swampy area. The limestone is characterized by gray to bluish gray with fossils indicating reef limestone interbedded with light brown feldspathic and calcareous sandstone. Permian age is inferred from geological map (Department of Mineral Resources, 2008). The Quaternary unconsolidated sediment lies beneath the low-lying coastal zone. This led to a subdivision of the study sites according to geomorphological units such as beach ridge plain, alluvial, colluvial and high-relief units. The area in the west of the national park shows swampy environment including tidal creeks, inlet and outlet (Klong Khao Daeng).

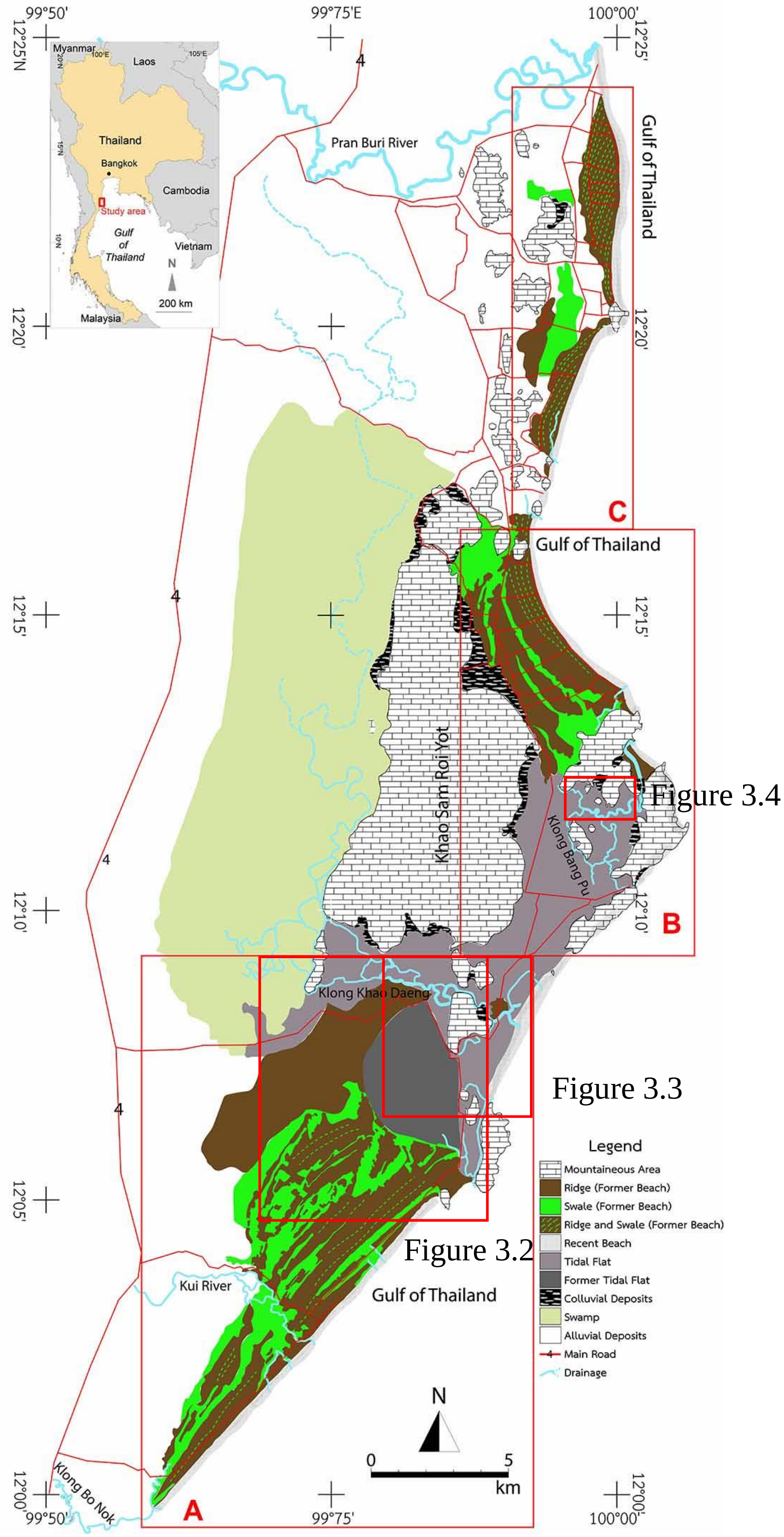


Figure 3.1 Geomorphologic map of Sam Roi Yot National Park and its nearby areas at Kui Buri (A), Sam Roi Yot (B) and Pran Buri (C), Changwat Prachuap Khiri Khan.

In the southern part of the swampy area, a semi-circle shape was interpreted as paleo-bay, connected to the headland by tombolo (Figure 3.2). Beach ridge plain was also dominant in the southern part of the area. The inner part of beach ridge consists of narrow ridges intervening with shallow swales. Orientation of ridges conforms to the direction of former tombolo 1 formation. Between the inner and outer beach ridge sets, a large swale with traces of a tidal channel, developed in swale, was recognized. The orientation of outer set of ridges started with cuspate sand cape and conforms to the direction of former tombolo 2. OSL dating results from sand ridges (see sample locations in Figure 2.7) are shown in Tables 3.2 to 3.4. Progradation of beach ridge plain also unveiled the gradual regression until reaching the mean sea level at the present day coastline (Figure 3.3).

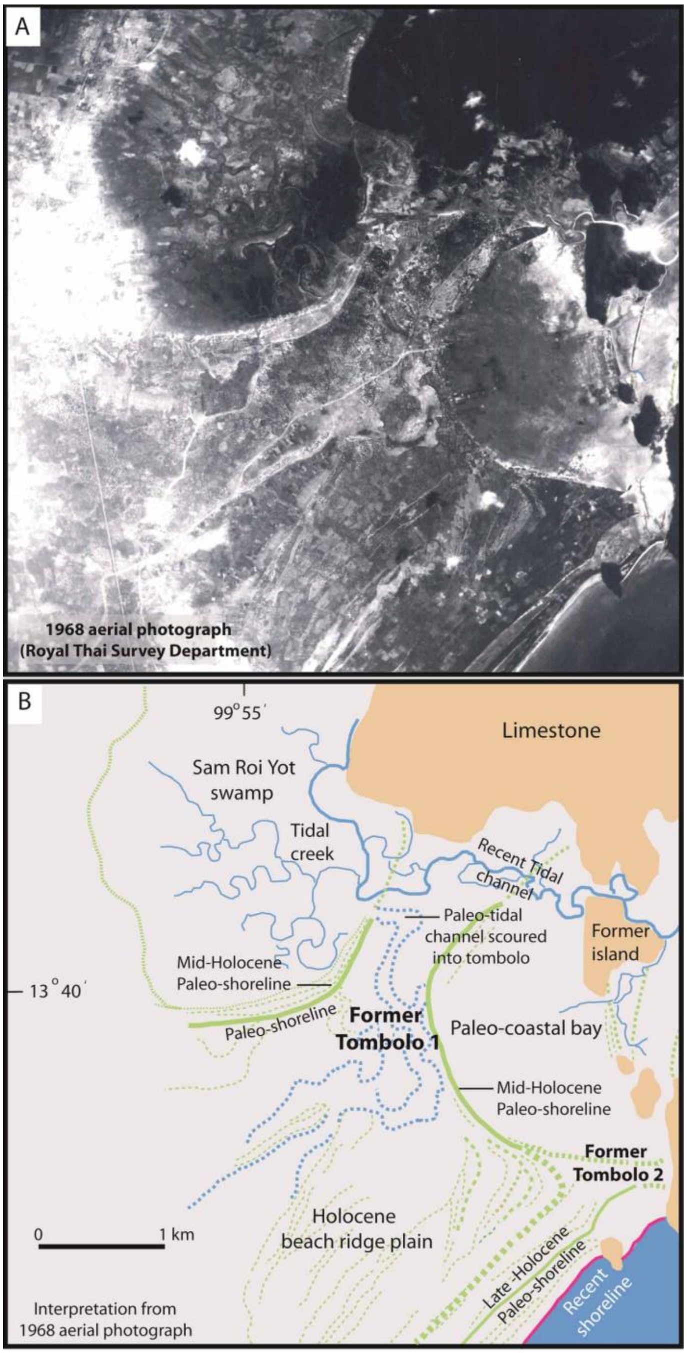


Figure 3.2 Aerial photograph and interpretation showing the classification of ancient landforms and their paleogeography. Former tombolo 1 was recognized in the middle part leading to the formation of brackish swamp in the west and the semi-circle paleo-coastal bay. Inner part of beach ridge plain found in the south formed at the same time as tombolo 1. The outer ridges set formed at the same time as tombolo 2 (Air-photo taken in 1968; Royal Thai Survey Department).

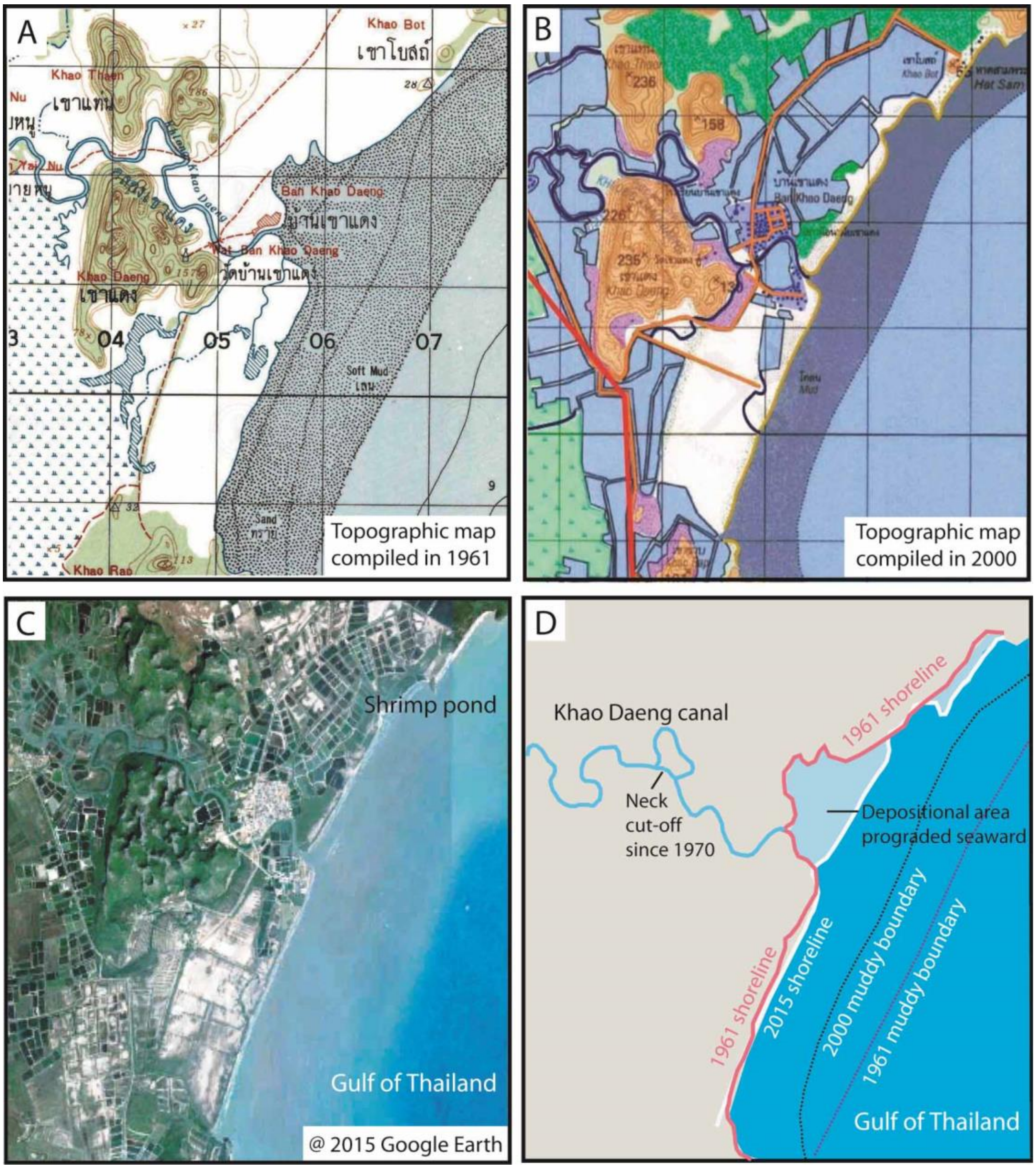


Figure 3.3 Comparison of shoreline positions from topographical maps compiled in the years 1961 (A) and 2000 (B) as well as a satellite image taken in 2015 from Google Earth (C). Neck cut-off of Khao Daeng canal has been completed since 1970. Progradation seaward occurred from 1961 to 2015. Active mud concentrations to the present day confirm the continuity of sediment supply to the coast (D).

3.1.2 Geological and biological indicators of sea level change

3.1.2.1 Sea notch

Permian limestone terrain dominates as karst mountainous area in the middle part of SRY National Park and at the headlands in the eastern part. Tidal notches, formed when sea level remains relatively stable, were used as sea level indicator in microtidal marine areas, for example, in the Mediterranean (Pirazzoli, 2005, Pirazzoli and Evelpidou, 2013) and along the Gulf of Thailand coast (Choowong, 2002, Choowong et al., 2004, Choowong, 2011). At least three distinctive levels of sea notches are common at the base of limestone cliffs at Sam Roi Yot area (Figure 3.5a). Located as far as 3 km inland, the highest notch, generally less incised than the lower one, has no bio-construction features. The distance between a roof and a base is about 45 cm, with 10 cm vertex (Figure 3.4b). The highest sea notch level is on average 2.67 m above present mean tide level (Dusitapirom et al., 2008). Bio-construction, especially oysters, was recognized in the middle and lowest sea notch level (Figure 3.4c). Results of C-14 dating from oysters attached to the sea notch wall are shown in Tables 3.2 to 3.4. At the shore and in places where tidal channels are located, only the lowermost notch is actively formed.

3.1.2.2 Bio-erosion

At the base of limestone headland, bio-erosion (borings) was recognized (Figure 3.4c). Bio-erosion in sea notches, formed by organisms living in the wave zone, can be used to infer the maximum tidal range (Kelletat, 1997). Bio-erosion (bio-corrosion and bio-abrasion), including bivalves (*Lithophaga* sp.), was found at Sam Roi Yot, similar to the fauna found at the Andaman coast by Kazmer and Taborosi (2012) and Scheffers et al. (2012). *Lithophaga* sp. boreholes were recognized above the roof of an active notch (Figure 3.4d, e and f).

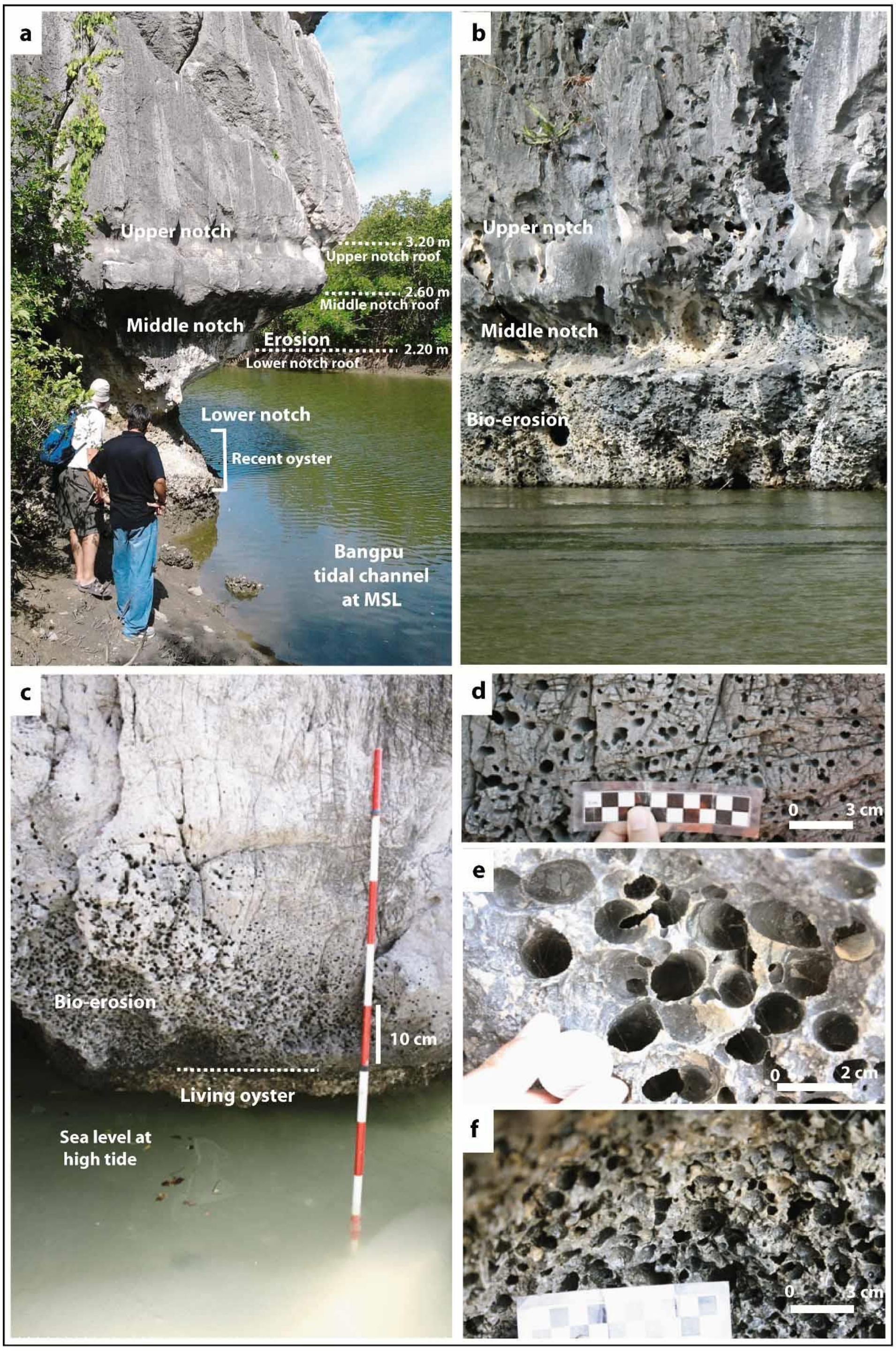


Figure 3.4 Photographs of different levels of sea notches as well as bio-construction and erosions in notches. (a and b) three levels of notches at Bang Pu tidal channel. Middle notch was scoured by the lower one, (c) limestone headland with bio-erosion (*Lithophaga* sp. boreholes) and bio-construction (living oyster), (d, e and f) close-up of *Lithophaga* sp. boreholes.

3.2 Mollusca Determination

Mollusca fossils were collected from 11 locations (Figure 3.5). The classification and fossil catalog were based on Swennen et al. (2001), Surakiatchai (2005), and Robba et al. (2002, 2004 and 2007).

Table 3.1 Occurrence of Gastropoda.

Species	**Area**										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**
Umbonium vestiarium	2	0	0	7	3	3	0	0	0	22	0
Clithon oualaniensis	0	0	0	0	0	0	0	0	0	2	0
Turritella terebra	0	0	1	1	0	0	0	0	0	0	2
Cerithidea cingulata	1	0	0	3	0	2	1	0	0	5	0
Neverita didyma	1	0	0	0	0	0	0	0	0	0	0
Natica tigrina	0	0	0	0	0	0	0	1	2	1	0
Murex trapa	0	0	0	0	0	0	0	0	0	0	2
Nassaria pusilla	1	0	0	0	0	0	0	0	0	0	0
Nassarius siquijorensis	0	0	1	1	0	0	0	0	0	1	1
Hemifusus tuba	0	0	0	1	0	0	0	0	0	0	0
Turricula javana	0	0	0	1	0	1	0	0	0	0	5
Architectonica perdix	0	0	5	1	0	2	0	0	0	1	0

Table 3.2 Occurrence of Bivalvia.

Species	Area										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**
Nuculana cuspidata	0	0	0	0	0	1	0	0	0	1	0
Yoldia belcheri	0	0	0	0	1	2	0	0	0	0	0
Barbatia bistrigata	0	0	0	0	0	0	0	0	0	1	1
Barbatia sp.	0	0	0	0	0	0	0	0	0	0	1
Trisidos semitorta	0	0	0	0	0	0	0	0	0	0	1
Trisidos tortuosa	0	0	0	0	0	0	0	0	0	3	0
Anadara granosa	0	0	0	1	0	1	0	0	0	0	0
Anadara oblonga	0	0	2	1	0	2	0	0	0	1	2
Anadara inaequivalvis	6	4	28	3	0	7	0	0	0	5	8
Anadara pilula	5	3	11	12	0	3	0	0	0	1	1
Scapbarca indica	0	0	1	0	0	0	0	0	0	0	0
Striarca symmetrica	1	0	1	0	0	0	0	0	0	1	0
Planostrea pestigris	0	0	2	0	0	2	0	0	0	0	0
Crassostrea gigas	0	0	1	0	0	8	0	0	0	0	0
Saccostrea cucullata	0	4	4	4	9	7	0	1	0	20	29
Placuna placenta	0	0	0	0	0	2	1	5	0	1	0
Chama aspersa	1	0	0	1	0	1	0	0	0	0	4
Cycladicama oblonga	0	0	7	0	0	0	0	0	0	0	0
Lepidolucina venusta	0	0	2	2	1	1	0	0	0	1	4
Bathytormus radiatus	1	1	1	2	0	1	0	0	0	0	0
Vepricardium coronatum	3	1	5	0	0	3	0	0	0	0	3
Vepricardium sinense	0	0	1	0	0	1	0	0	0	0	1
Mactra luzonica	2	3	32	8	0	6	0	0	0	0	5
Solen curtus	0	0	0	0	0	1	0	0	0	1	0
Tellina emarginata	1	0	0	3	0	0	0	0	0	0	3
Tellina lanceolata	0	0	0	0	0	1	0	0	0	0	0
Tellina timorensis	0	0	0	0	0	0	0	0	0	0	2
Psammotreta edentula	0	0	3	0	0	0	0	0	0	0	1
Gari elongate	0	0	0	0	0	1	0	0	0	0	0
Azorinus abbreviatus	0	0	1	0	0	0	0	0	0	0	0
Donax faba	4	1	8	12	0	0	0	0	0	0	6

Table 3.2 Occurrence of Bivalvia. (Cont.)

Species	Area										
	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**
Donax semigranosas	3	0	13	9	8	6	0	0	0	0	3
Sunetta contempta	1	1	1	1	0	1	0	0	0	0	6
Anomalocardia squamosa	1	1	2	1	0	7	1	0	0	4	0
Placamen chloroticum	0	5	1	0	0	3	0	2	0	0	0
Timoclea scabra	4	0	1	7	0	3	0	0	0	2	0
Meretrix meretrix	3	9	11	5	0	10	0	0	0	2	9
Paphia undulata	7	0	1	1	0	0	0	0	0	1	0
Paphia gallus	0	0	4	4	0	6	0	0	0	0	3
Dosinia cretacea	6	9	27	10	0	13	0	0	0	7	13
Dosinia dautzenbergi	0	0	1	0	0	0	0	0	0	0	7
Dosinia dilecta	0	0	0	0	0	2	0	0	0	0	0
Glauconome sp.	0	0	1	0	0	0	0	0	0	0	0
Corbula fortisulcata	0	1	2	1	0	1	0	0	0	1	0
Cucurbitula cymbium	0	1	0	0	0	2	0	0	0	0	1

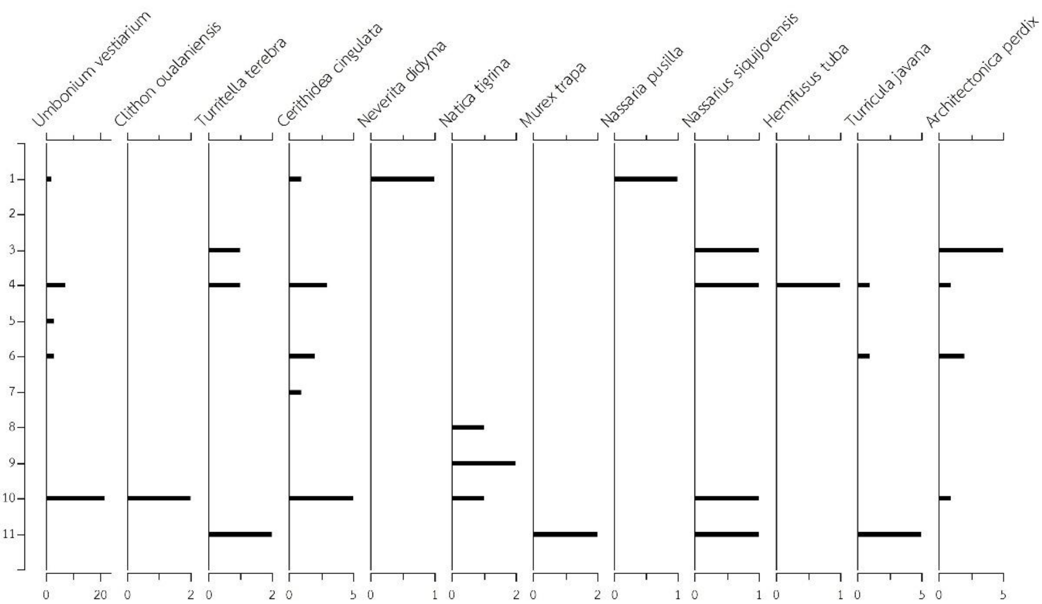


Figure 3.5 Chart of Gastropoda sorting by systematic description (number) (X axis is species of mollusca, Y axis is sampling location).

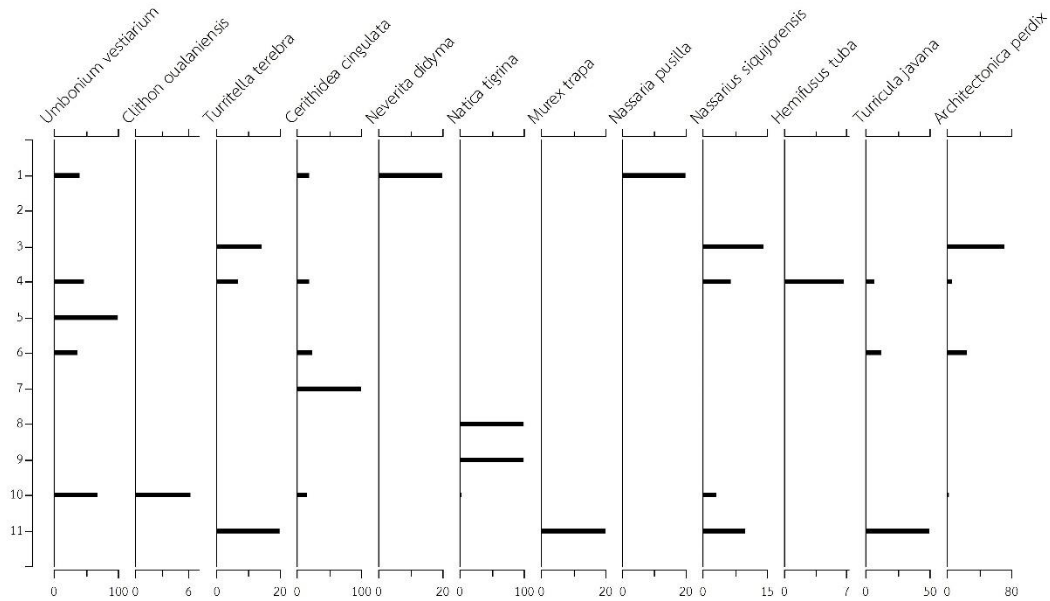


Figure 3.6 Chart of Gastropoda sorting by systematic description (%) (X axis is species of mollusca, Y axis is sampling location).

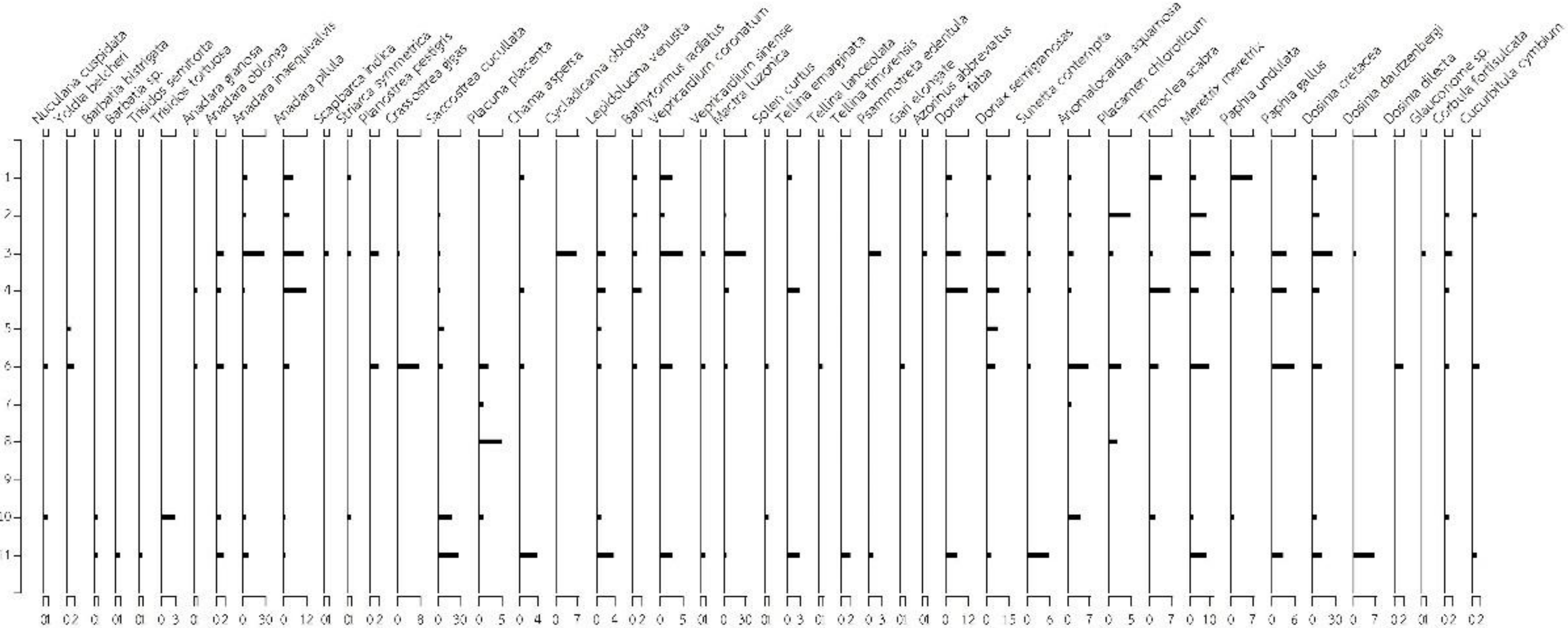


Figure 3.7 Chart of Bivalvia sorting by systematic description (number) (X axis is species of mollusca, Y axis is sampling location).

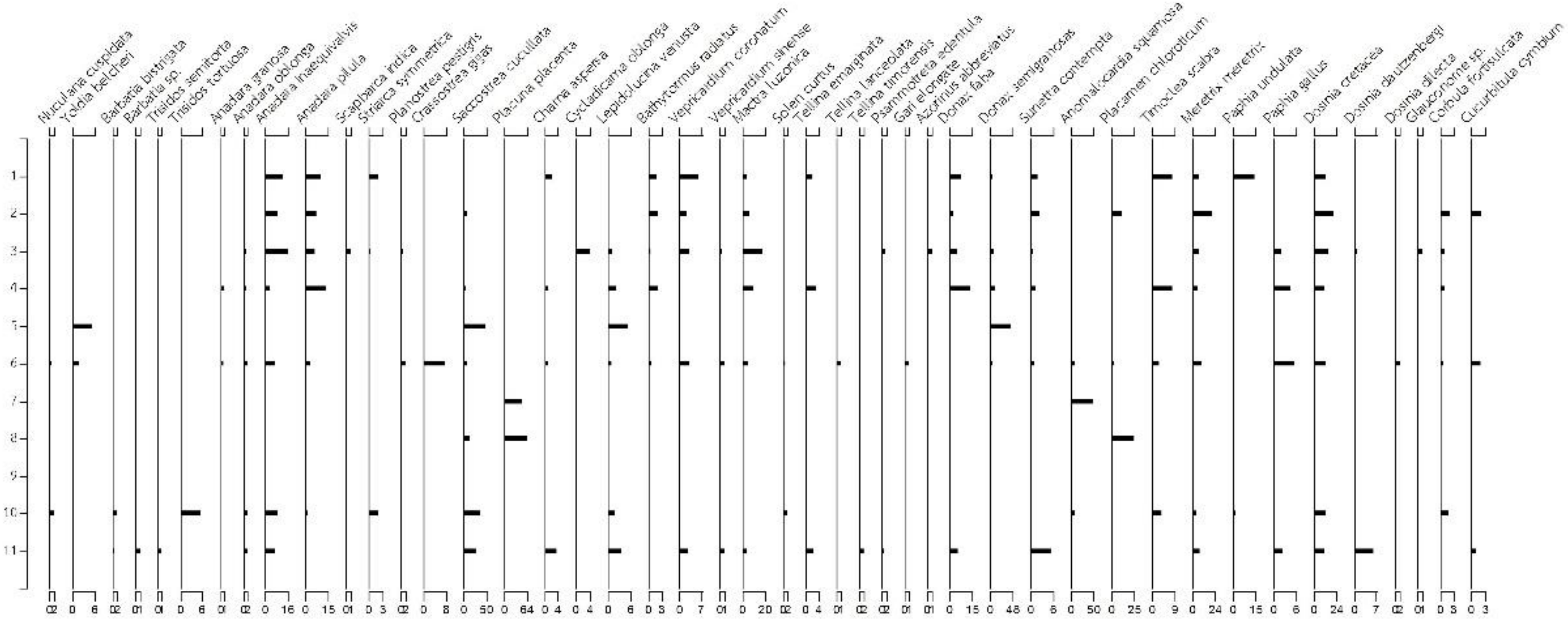


Figure 3.8 Chart of Bivalvia sorting by systematic description (%) (X axis is species of mollusca, Y axis is sampling location).

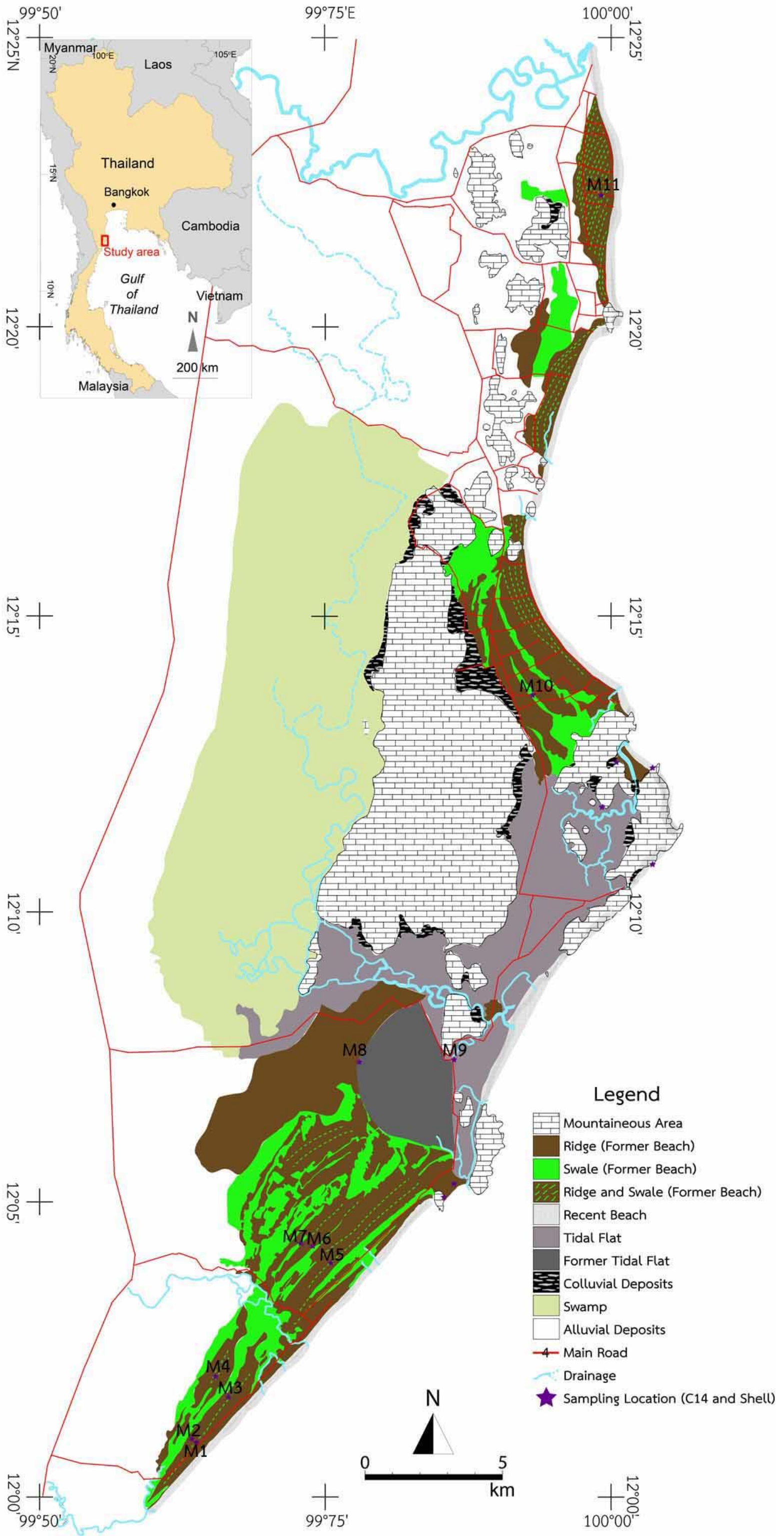


Figure 3.9 Geomorphologic map showing the study locations at Kui Buri, Sam Roi Yot and Pran Buri, Changwat Prachuap Khiri khan. Sampling location (Mollusca) for C-14 are also show.

3.2.1 Systematic classification

Class Gastropoda Cuvier, 1797

Subclass Prosobranchia Milne Edwards, 1848

Order Vetigastropoda Salvini-Plawen, 1980

Superfamily Trochoidea Rafinesque, 1815

Family Trochidae Rafinesque, 1815

Subfamily Umboniinae H. & A. Adams, 1854

Genus *Umbonium* Link, 1807

Umbonium vestiarium (Linnaeus, 1758)

Plate 1, Figure. 1 (a, b)

Description: Shell diameter up to 2 cm, shell coiled to the right (dextral). Solid, shell rounded. Colors are very variable.

Habitat: Mud or sand in intertidal.

Distribution: Indo-Pacific, East Africa, Indonesia, Philippines, Taiwan and Thailand.

Fossil Records: Pliocene of Indonesia, Philippines, Taiwan and Japan; Pleistocene of Indonesia and Philippines; Holocene of Thailand.

Subclass Neritimorpha Golikov & Starobogatov, 1975

Order Cycloneritimorpha Frýda, 1998

Superfamily Neritoidea Rafinesque, 1815

Family Neritidae Rafinesque, 1815

Subfamily Neritinae de Lamarck, 1809

Genus *Clithon* Montfort, 1810

Clithon oualaniensis (Lesson, 1831)

Plate 1, Figure. 2 (a, b)

Description: Solid, rounded shell, diameter up to 7 mm, shell coiled to the right (dextral). Colors pattern are very variable.

Habitat: Mud in intertidal.

Distribution: Indo-Pacific, Indonesia, Philippines, Hong Kong, Japan, Malaysia, Singapore, Australia and Thailand.

Fossil Records: Holocene of Thailand.

Superorder Caenogastropoda Cox, 1959

Order Sorbeoconcha Ponder & Lindberg, 1997

Superfamily Cerithioidea Fleming, 1822

Family Turritellidae Lovén, 1847

Subfamily Turritellinae Lovén, 1847

Genus *Turritella* Lamarck, 1799

Turritella terebra (Linnaeus, 1758)

Plate 1, Figure. 3 (a, b)

Description: Shell height to 140 mm, large sizes. An elongate shell, turriculate, shell coiled to the right (dextral), shell surface decorated by 6 strong spiral ribs.

Habitat: Sandy mud in intertidal.

Distribution: Indo-West Pacific, Malaysia and Thailand.

Fossil Records: Middle Miocene of Indonesia; Late Miocene of India, Indonesia, Philippines and Taiwan; Pliocene of India, Indonesia, Philippines, Taiwan and Japan; Quaternary of Indonesia and Taiwan; Holocene of Thailand.

Superfamily Cerithioidea Férussac, 1819

Family Potamididae H. & A. Adams, 1854

Genus *Cerithidea* Swainson, 1840

Cerithidea cingulata (Gmelin, 1791)

Plate 1, Figure. 4 (a, b)

Description: Shell height to 39 mm. elongate shell, turreted, shell coiled to the right (dextral), shell surface have collabral riblets and 3 spiral bands forming low nodes on crossing the riblets. Colors are brown with black.

Habitat: Mud flat in mangrove.

Distribution: Indian Ocean, the Western Pacific, Gulf of Oman, Indonesia, Japan, China and Thailand.

Fossil Records: Miocene of Japan; Late Miocene of India and Indonesia; Pliocene of India, Indonesia, Taiwan and Japan; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Superfamily Naticoidea Forbes, 1838

Family Naticidae Forbes, 1838

Subfamily Polinicinae Gray, 1847

Genus *Neverita* Risso, 1826

Neverita didyma (Röding, 1798)

Plate 1, Figure. 5 (a, b)

Description: Shell height to 29 mm diameter to 32 mm, medium sizes. A depressed shell, globose conical, shell coiled to the right (dextral). Color is brown.

Habitat: Mud to sand in intertidal to subtidal.

Distribution: India, Western Pacific Oceans, South Africa, Australia Malaysia, Singapore, Japan and Thailand.

Fossil Records: Late Miocene of Indonesia, Philippines and Japan; Pliocene of Indonesia, Taiwan and Japan; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Subfamily Naticinae Guilding, 1834

Genus *Natica* Scopoli, 1777

Natica tigrina (Röding, 1798)

Plate 1, Figure. 6 (a, b)

Description: Shell height to 29 mm diameter to 23 mm, medium sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral). Colors are reddish-brown spots on a white background.

Habitat: Muddy sand to mud flats in mangrove, intertidal to subtidal.

Distribution: India, Japan, Malaysia, Singapore and Thailand.

Fossil Records: Late Miocene to Quaternary of Indonesia; Quaternary of Thailand.

Subclass Caenogastropoda Cox, 1960

Order Neogastropoda Wenz, 1938

Superfamily Muricoidea Rafinesque, 1815

Family Muricidae Rafinesque, 1815

Subfamily Muricinae Rafinesque, 1815

Genus *Murex* Linnaeus, 1758

Murex trapa Röding, 1798

Plate 1, Figure. 7 (a, b)

Description: Shell height to 81 mm, large sizes. An elongate shell, fusiform, shell coiled to the right (dextral), shell surface have collabral ribs overridden by spiral cords; 3 varices per whorl bearing recurved, moderately long spines.

Habitat: Fine sandy and muddy in intertidal to subtidal.

Distribution: Madagascar, Fiji, China, Ryukyu Islands, Malaysia and Thailand.

Fossil Records: Middle and Late Miocene of Indonesia; Pliocene of Indonesia, Philippines and Taiwan; Quaternary of Indonesia; Holocene of Thailand.

Superfamily Buccinoidea, Rafinesque, 1815

Family Nassariidae Iredale, 1916

Subfamily Cylleninae Bellardi, 1882

Genus *Nassaria* Link, 1807

Nassaria pusilla (Röding, 1798)

Plate 1, Figure. 8 (a, b)

Description: Shell height to 25 mm, medium sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral), shell surface have with axial ribs which are crossed by spiral cords.

Habitat: Mud and coarse sand in intertidal to subtidal.

Distribution: Persian Gulf, Indonesia, China Sea and Thailand

Fossil Records: Miocene of India; Pliocene of Indonesia; Holocene of Thailand.

Subfamily Nassariinae Iredale, 1916

Genus *Nassarius* Duméril, 1805

Nassarius siquijorensis (Adams, 1852)

Plate 1, Figure. 9 (a, b)

Description: Shell height to 26 mm, medium sizes. An elongate shell, elongate-ovate, shell coiled to the right (dextral). Shell surface have slender ribs and of spiral grooves in the furrows between ribs.

Habitat: Fine sandy and muddy in sublittoral to upper bathyal.

Distribution: Indo-Pacific, New Caledonia, Red Sea, Japan, Hong Kong and Thailand.

Fossil Records: Late Middle Miocene to Quaternary of Indonesia; Holocene of Thailand.

Family Melongenidae Gill, 1871

Genus *Hemifusus* Swainson, 1840

Hemifusus tuba (Gmelin, 1791)

Plate 1, Figure. 10 (a, b)

Description: Shell height to 120 mm, large sizes. An elongate shell, elongate- fusiform, shell coiled to the right (dextral), shell surface have with axial ribs which are crossed by spiral cords.

Habitat: Sandy and muddy in intertidal to subtidal.

Distribution: China**,** Japan and Thailand.

Fossil Records: Holocene of Thailand.

Superfamily Conoidea Fleming, 1822

Family Clavatulidae Gray, 1853

Subfamily Turriculinae Powell, 1942

Genus *Turricula* Schumacher, 1817

Turricula javana (Linnaeus, 1767)

Plate 1, Figure. 11 (a, b)

Description: Shell height to 62 mm, large shell. An elongate shell, elongate-fusiform, shell coiled to the right (dextral), surface have spiral ribs and siphonal canal long.

Habitat: Sands, rocks and muddy in intertidal to subtidal.

Distribution: Indo-Pacific, Mozambique, Queensland, Japan and Thailand.

Fossil Records: Late Miocene of Indonesia; Pliocene of India and Indonesia; Quaternary of Indonesia; Holocene of Thailand.

Subclass Heterobranchia Burmeister, 1837

Order Heterostropha Fischer, 1885

Superfamily Architectonicoidea Gray, 1850

Family Architectonicidae Gray, 1850

Genus *Architectonica* Röding, 1798

Architectonica perdix (Hinds, 1844)

Plate 1, Figure. 12 (a, b)

Description: Shell diameter to 43 mm, large shell. An elongate shell, conical-depressed, shell coiled to the right (dextral), shell surface have axial ribs.

Habitat: Sandy in intertidal to subtidal.

Distribution: Eastern India, west-central Pacific Oceans, Australia, Polynesia, Hong Kong and Thailand.

Fossil Records: Holocene of Thailand.

Class Bivalvia Linnaeus, 1758

Subclass Protobranchia Pelseneer, 1889

Order Nuculanida Campbell, 2000

Superfamily Nuculanoidea H. & A. Adams, 1858 (1854)

Family Nuculanidae H. & A. Adams, 1858 (1854)

Subfamily Nuculaninae H. & A. Adams, 1858 (1854)

Genus *Nuculana* Link, 1807

Nuculana cuspidata (Gould, 1861)

Plate 2, Figure. 1 (a, b)

Description: Shell length to 10 mm. Ovate-elongate, small shell, Anterior is pointed and posterior is round.

Habitat: Muddy in intertidal.

Distribution: South China Sea and Thailand

Fossil Records: Holocene of Thailand.

Family Yoldiidae Dall, 1908

Subfamily Yoldiinae Dall, 1908

Genus *Yoldia* Möller, 1842

Yoldia belcheri (Hinds, 1843)

Plate 2, Figure. 2 (a, b)

Description: Shell length to 15 mm. Ovate, shells is thick and shell surface have radial ribs. Anterior is subtriangular and posterior is round.

Habitat: Mud in intertidal.

Distribution: South Africa to Southwest Pacific and Thailand.

Fossil Records: Holocene of Thailand.

Subclass Pteriomorphia Beurlen, 1944

Order Arcida Stoliczka, 1871

Superfamily Arcoidea Lamarck, 1809

Family Arcidae Lamarck, 1809

Subfamily Arcinae Lamarck, 1809

Genus *Barbatia* Gray, 1842

Barbatia bistrigata (Dunker, 1866)

Plate 2, Figure. 3 (a, b)

Description: Shell length to 40 mm. Subrectangular-elongate, mid-anterior is bifurcated ribs and posterior ribs are wide flat topped.

Habitat: Sand and gravel in intertidal to subtidal.

Distribution: India, Korea, Japan and Thailand.

Fossil Records: Late Miocene to Quaternary of Southeast Asia and Japan; Holocene of Thailand.

Barbatia sp.

Plate 2, Figure. 4 (a, b)

Description: Shell length to 40 mm. Subrectangular-elongate Anterior is round and posterior is round.

Fossil Records: Holocene of Thailand.

Genus *Trisidos* Röding, 1798

Trisidos semitorta (Lamarck, 1819)

Plate 2, Figure. 5 (a, b)

Description: Shell length to 100 mm. Elongate-oval, somewhat twisted, shells is thick. Anterior and posterior are round.

Habitat: Mud, sand, shell sand and gravel in intertidal to subtidal.

Distribution: India, Southwest Pacific, Japan and Thailand.

Fossil Records: Late Oligocene of India and Indonesia; Early Miocene of India, Myanmar and Indonesia; Mid-Late Miocene of Indonesia and Philippines; Pliocene of Indonesia and Philippines; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Trisidos tortuosa (Linnaeus, 1758)

Plate 2, Figure. 6 (a, b)

Description: Shell length to 100 mm. Elongate-subtrianular shells is thick and twisted. Left valve with sharp posterior umbonal keel and sculpture obsolescent over the flat postero-dorsal area of the left valve.

Habitat: Mud, sand and gravel in intertidal to subtidal.

Distribution: India, Southwest Pacific, Red Sea, Japan and Thailand.

Fossil Records: Early-Mid Miocene of Indonesia; Late Miocene of Indonesia; Pliocene of Indonesia, Taiwan and Japan; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Subfamily Anadarinae Reinhart, 1935

Genus *Anadara* Gray, 1847

Anadara granosa (Linnaeus, 1758)

Plate 2, Figure. 7 (a, b)

Description: Shell length to 88 mm. Ovate-rectangular, shells is thick and convex. Hinge teeth are taxodont and shell surface have about 19-20 strongly noded radial ribs. Anterior is round and posterior is subtriangular.

Habitat: Mud in mangrove to intertidal.

Distribution: India, southern Japan, Malaysia and Thailand.

Fossil Records: Late Miocene of Indonesia and Philippines; Pliocene of Indonesia, Philippines, Taiwan and Japan; Quaternary of Southeast Asia, Taiwan and Japan; Holocene of Thailand.

Anadara oblonga (Philippi, 1849)

Plate 2, Figure. 8 (a, b)

Description: Shell length to 35 mm. Ovate-elongate, shells is thick and moderately convex. Hinge teeth are taxodont and shell surface have about 21-22 narrow, minutely nodded ribs. Anterior is round and posterior is slightly sharp.

Habitat: Mud and sand in intertidal.

Distribution: Philippines, Taiwan, West Pacific and Thailand.

Fossil Records: Late Miocene of Indonesia; Pliocene of Indonesia and Taiwan; Quaternary of Indonesia, Thailand and Taiwan; Holocene of Thailand.

Anadara inaequivalvis (Bruguiere, 1789)

Plate 3, Figure. 1 (a, b)

Description: Shell length to 86 mm. Ovate-rectangular, shell is thick and convex. Hinge teeth are taxodont and shell surface have about 34-37 radial ribs. Anterior is round and posterior is subtriangular.

Habitat: Sandy and muddy in mangrove to intertidal.

Distribution: Indo-Pacific, Red Sea, Australia, Japan, Mediterranean and Thailand.

Fossil Records: Late Miocene and Pliocene of Indonesia; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Anadara pilula (Reeve, 1843)

Plate 3, Figure. 2 (a, b)

Description: Shell length to 29 mm. Subtrigonal, shells is thick and convex. Hinge teeth are taxodont and shell surface have about 25-26 radiating ribs. Anterior and posterior are round.

Habitat: Fine muddy sand in intertidal.

Distribution: Australia, Philippines and Thailand.

Fossil Records: Holocene of Thailand.

Anadara indica (Gmelin, 1791)

Plate 3, Figure. 3 (a, b)

Description: Shell length to 50 mm. Elongate-subrectangular, shells is thin and convex. Hinge teeth are taxodont and shell surface have about 32-35 radiating ribs. Anterior and posterior are round.

Habitat: Sand and rock in intertidal.

Distribution: India-Pacific, Australia and Thailand.

Fossil Records: Holocene of Thailand.

Family Noetiidae Stewart, 1930

Genus *Striarca* Conrad, 1862

Striarca symmetrica (Reeve, 1844)

Plate 3, Figure. 4 (a, b)

Description: Shell length to 12 mm. Subequilateral, shells is thin. Anterior and posterior are round.

Habitat: Mix in intertidal to subtidal.

Distribution: Persia, Australia, China, Japan and Thailand.

Fossil Records: Mid Miocene of Indonesia; Late Miocene of Indonesia and Japan; Pliocene of Indonesia and Japan; Quaternary of Southeast Asia and Japan; Holocene of Thailand.

Order Ostreoida Férussac, 1822

Superfamily Ostreoidea Rafinesque, 1815

Family Ostreidae Rafinesque, 1815

Subfamily Ostreinae Rafinesque, 1815

Genus *Planostrea* Harry, 1985

Planostrea pestigris (Hanley, 1846)

Plate 3, Figure. 5 (a, b)

Description: Shell length to 75 mm. Ovate-triangular, shells is thick and flat. Anterior is round and posterior is extensive.

Habitat: Rock and coral in intertidal to subtidal.

Distribution: Australia, Japan and Thailand.

Fossil Records: Late Miocene of Indonesia; Pliocene of Indonesia and Japan; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Subfamily Crassostreinae Scarlato & Starobogatov, 1979

Genus Crassostrea Sacco, 1897

Crassostrea gigas (Thunberg, 1793)

Plate 3, Figure. 6 (a, b)

Description: Shell height to 500 mm. Ovate, shells is thick and large. Surface with growth lamellae.

Habitat: hard substrates in mangrove to intertidal.

Distribution: Indo-Pacific, Japan, Korea**,** Hong Kong and Thailand.

Fossil Records: Miocene of Japan; Pliocene of Taiwan and Japan; Quaternary of Japan; Holocene of Thailand.

Subfamily Saccostreinae Salvi & Mariottini, 2016

Genus *Saccostrea* Dollfus & Dautzenberg, 1920

Saccostrea cucullata (Born, 1778)

Plate 3, Figure. 7 (a, b)

Description: Shell height to 90 mm. Cornucopia-like shell, shells is thick. High ligamental area, distinct umbonal cavity and coarse radial folds.

Habitat: Rock and root in mangrove to intertidal.

Distribution: Indo-Pacific, Australia, New Zealand, Japan and Thailand.

Fossil Records: Miocene of Indonesia; Pliocene of Red Sea area, Indonesia, Philippines, Taiwan and Japan; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Superfamily Anomioidea Rafinesque, 1815

Family Placunidae Rafinesque, 1815

Genus *Placuna* Lightfoot, 1786

Placuna placenta (Linnaeus, 1758)

Plate 3, Figure. 8 (a, b)

Description: Shell length to 150 mm. Flat orbicular, shells is thin, fragile, long and widely. Shell surface have commarginal lines. Anterior and posterior are round.

Habitat: Sand and mud in mangrove to intertidal.

Distribution: Indo-Pacific, Red Sea, Australia, China, Japan, Malaysia, Singapore, Hong Kong and Thailand.

Fossil Records: Late Miocene of Indonesia and Philippines; Pliocene of Indonesia, Philippines, Taiwan and Japan; Quaternary of Indonesia; Holocene of Thailand.

Subclass Heterodonta Neumayr, 1884

Order Veneroida H. & A. Adams, 1857

Superfamily Chamoidea Lamarck, 1809

Family Chamidae Lamarck, 1809

Genus *Chama* Linnaeus, 1758

Chama aspersa Reeve, 1846

Plate 3, Figure. 9 (a-d)

Description: Shell length to 33 mm. Irregularly ovate, shells is thick. Anterior and posterior are round.

Habitat: Sandy mud in intertidal.

Distribution: Indo-Pacific and Thailand.

Fossil Records: Holocene of Thailand.

Superfamily Ungulinoidea Gray, 1854

Family Ungulinidae Gray, 1854

Genus *Cycladicama* Valenciennes in Rousseau, 1854

Cycladicama oblonga (Hanley, 1846)

Plate 3, Figure. 10 (a, b)

Description: Shell length to 50 mm. Ovate-triangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior is round and posterior is subtriangular.

Habitat: Fine sandy and muddy in intertidal to subtidal.

Distribution: Japan and Thailand.

Fossil Records: Middle Miocene to Quaternary of Indonesia, Philippines, Taiwan and Japan; Holocene of Thailand.

Order Lucinida Gray, 1854

Superfamily Lucinoidea J. Fleming, 1828

Family Lucinidae J. Fleming, 1828

Subfamily Lucininae J. Fleming, 1828

Genus *Lepidolucina* Glover & J. D. Taylor, 2007

Lepidolucina venusta (Philippi, 1847)

Plate 3, Figure. 11 (a, b)

Description: Shell length to 34 mm. Orbicular, shells is small and flat. Anterior and posterior are round.

Habitat: Sand and mud in intertidal.

Distribution: Southwest Pacific, Australia, Philippines and Thailand.

Fossil Records: Holocene of Thailand.

Order Carditida Dall, 1889

Superfamily Crassatelloidea Férussac, 1822

Family Crassatellidae Férussac, 1822

Subfamily Crassatellinae Férussac, 1822

Genus *Bathytormus* Stewart, 1930

Bathytormus radiatus (G. B. Sowerby I, 1825)

Plate 3, Figure. 12 (a, b)

Description: Shell length to 20 mm. Triangular, shells is thick and flat. Stronger and more widely spaced concentric ridges .Anterior is pointed and posterior is round.

Habitat: Mud and sand in subtidal.

Distribution: Indo-Pacific and Thailand.

Fossil Records: Lower Miocene of Myanmar; Middle Miocene of Myanmar and Indonesia; Upper Miocene to Pliocene of Indonesia and Philippines; Quaternary of Indonesia; Holocene of Thailand.

Order Cardiida Ferussac, 1822

Superfamily Cardioidea Lamarck, 1809

Family Cardiidae Lamarck, 1809

Subfamily Cardiinae Lamarck, 1809

Genus *Vepricardium* Iredale, 1929

Vepricardium coronatum (Schröter, 1786)

Plate 4, Figure. 1 (a, b)

Description: Shell length to 39 mm. Subcircular, shells is thick and convex. Hinge teeth are heterodont, shell surface have about 33-39 radiating ribs. Anterior is round and posterior is subtriangular. Colors are light pink.

Habitat: Muddy, sandy or mixed bottoms in intertidal and subtidal.

Distribution: Indo-Pacific, South Africa, Indonesia, Japan

Fossil Records: Pliocene of Malaysia and Indonesia Quaternary of the Indo-Pacific area; Holocene of Thailand.

Vepricardium sinense (G. B. Sowerby II, 1839)

Plate 4, Figure. 2 (a, b)

Description: Shell length to 27 mm. Subcircular, shells is thick and convex. Hinge teeth are heterodont, shell surface have about 21-28 radiating ribs. Anterior and posterior are round.

Habitat: Mud and sand in intertidal to subtidal.

Distribution: Hong Kong**,** Philippines and Thailand.

Fossil Records: Pliocene of Indonesia and Taiwan; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Superfamily Mactroidea Lamarck, 1809

Family Mactridae Lamarck, 1809

Subfamily Mactrinae Lamarck, 1809

Genus *Mactra* Linnaeus, 1767

Mactra luzonica Reeve, 1854

Plate 4, Figure. 3 (a, b)

Description: Shell length to 50 mm. Ovate-triangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior and posterior are round. Pallial sinus is short and contiguous posterior adductor scar.

Habitat: Muddy and sand in subtidal.

Distribution: Pakistan, Australia, South China Sea and Thailand.

Fossil Records: Holocene of Thailand.

Order Veneroida H. & A. Adams, 1856

Superfamily Solenoidea Lamarck, 1809

Family Solenidae Lamarck, 1809

Genus *Solen* Linnaeus, 1758

Solen curtus Des Moulins, 1832

Plate 4, Figure. 4 (a, b)

Description: Shell length to 92 mm. Elongate, shells is straight, cylindrical and thin. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior and posterior are rectangular. Anterior adductor muscle scar is elongate.

Habitat: Sandy and muddy in intertidal.

Distribution: India, Southwest Pacific oceans, South Africa, Japan and Thailand.

Fossil Records: Holocene of Thailand.

Superfamily Tellinoidea Blainville, 1814

Family Tellinidae Blainville, 1814

Subfamily Tellininae Blainville, 1814

Genus *Tellina* Linnaeus, 1758

Tellina emarginata (Sowerby I, 1825)

Plate 4, Figure. 5 (a, b)

Description: Shell length to 40 mm. Subelliptical, shells is thin and flat. Anterior is subtriangular and posterior is round.

Habitat: Gravel in intertidal to subtidal.

Distribution: Indo-Pacific, Australia, Japan and Thailand.

Fossil Records: Holocene of Thailand.

Tellina lanceolata Gmelin, 1791

Plate 4, Figure. 6 (a, b)

Description: Shell length to 36 mm. Ovate-oblong, shells is thin and flat. Anterior is sharp and posterior is round.

Habitat: Sand and mud in intertidal.

Distribution: Indo-Pacific, Australia and Thailand.

Fossil Records: Holocene of Thailand.

Tellina timorensis (Lamarck, 1818)

Plate 4, Figure. 7 (a, b)

Description: Shell length to 50 mm. Elongate-subquadrangular, shells is thin and flat. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior is round and posterior is subtriangular.

Habitat: Sand in intertidal.

Distribution: Indo-Pacific, Red Sea, Japan, Indonesia and Thailand.

Fossil Records: Upper Miocene of Indonesia, Philippines and Japan; Pliocene and Quaternary of Indonesia; Holocene of Thailand.

Subfamily Macominae Olsson, 1961

Genus *Psammotreta* Dall, 1900

Psammotreta edentula (Spengler, 1798)

Plate 4, Figure. 8 (a, b)

Description: Shell length to 73 mm. Ovate-triangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior is subtriangular and posterior is round. Pallial sinus is deep and wide.

Habitat: Mud and sand in mangrove to intertidal.

Distribution: Red Sea, Australia, China Sea, Java and Thailand.

Fossil Records: Holocene of Thailand.

Family Psammobiidae Fleming, 1828

Subfamily Psammobiinae Fleming, 1828

Genus *Gari* Schumacher, 1817

Gari elongata (Lamarck, 1818)

Plate 4, Figure. 9 (a, b)

Description: Shell length to 65 mm. Elongate, ovate-subquadrangular. Anterior is oval and posterior is obliquely subtruncate.

Habitat: Mud, sand and mud flat in mangrove to intertidal.

Distribution: China, Japan and Thailand.

Fossil Records: Holocene of Thailand.

Family Solecurtidae d'Orbigny, 1846

Subfamily Solecurtinae d'Orbigny, 1846

Genus *Azorinus* Récluz, 1869

Azorinus abbreviatus (Gould, 1861)

Plate 4, Figure. 10 (a, b)

Description: Shell length to 79 mm. Elongate-subrectangular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines on the middle part. Anterior and posterior are round. Pallial sinus is rounded.

Habitat: Sandy and muddy in intertidal and subtidal.

Distribution: Indo-Pacific, Red Sea, Torres Strait, Japan, China and Thailand.

Fossil Records: Early Miocene of India; Middle Miocene of India and Myanmar; Upper Miocene of India and Indonesia; Pliocene of India, Indonesia, Philippines, Taiwan, Japan, New Hebrides and Fiji; Quaternary of Indo-Pacific area; Holocene of Thailand.

Family Donacidae Fleming, 1828

Genus *Donax* Linnaeus, 1758

Donax faba Gmelin, 1791

Plate 4, Figure. 11 (a, b)

Description: Shell length to 25 mm. ovate-trigonal, shells is thick. Anterior is elliptical and posterior is subtriangular and shorter.

Habitat: Sand in intertidal.

Distribution: Japan, Indo-Pacific and Thailand.

Fossil Records: Holocene of Thailand.

Donax semigranosus Dunker, 1877

Plate 4, Figure. 12 (a, b)

Description: Shell length to 17 mm. Trigonal, shells is thick. Anterior is narrowly rounded and posterior is obliquely truncated and shorter.

Habitat: Sand in intertidal.

Distribution: Japan, China and Thailand.

Fossil Records: Quaternary of Japan; Holocene of Thailand.

Order Venerida Gray, 1854

Superfamily Veneroidea Rafinesque, 1815

Family Veneridae Rafinesque, 1815

Genus *Sunetta* Link, 1807

Sunetta contempta E. A. Smith, 1891

Plate 4, Figure. 13 (a, b)

Description: Shell length to 20 mm. Ovate, subequilateral, shells is thick and flat. Anterior is oval and posterior is subtruncate.

Habitat: Mud and sand in subtidal.

Distribution: Indo-Pacific, South Africa, Australia, Taiwan and Thailand.

Fossil Records: Holocene of Thailand.

Genus *Anomalocardia* Schumacher, 1817

Anomalocardia squamosa (Linnaeus, 1758)

Plate 4, Figure. 14 (a, b)

Description: Shell length to 37 mm. Subtrigonal, shells is thick and moderately convex. Hinge teeth are heterodont, shell surface have radial ribs and low commarginal ribs. Anterior is rounded and posterior is sharp.

Habitat: Mud in mangrove to intertidal.

Distribution: Australia, Japan and Thailand.

Fossil Records: Late Miocene and Pliocene of Indonesia.

Genus *Placamen* Iredale, 1925

Placamen chloroticum (Philippi, 1849)

Plate 5, Figure. 1 (a, b)

Description: Shell length to 31 mm. Subtrigonal-ovate, shells is thick and moderately convex. Hinge teeth are heterodont, shell surface have distant raised commarginal high ridges. Anterior is rounded and posterior is subtriangular. Lunule is convex.

Habitat: Muddy sand, sand or shell gravel in intertidal to subtidal.

Distribution: Indo-Pacific, Madagascar, Australia, East China Sea and Thailand.

Fossil Records: Middle and Upper Miocene of Indonesia; Pliocene of Indonesia, Philippines, Taiwan and Japan; Quaternary of Indonesia; Holocene of Thailand.

Genus *Timoclea* T. Brown, 1827

Timoclea scabra (Hanley, 1845)

Plate 5, Figure. 2 (a, b)

Description: Shell length to 15 mm. Ovate-trigonal, shells is small. Sculpture of broad, bifurcated radial ribs and widely spaced commarginal lamellae more raised on crossing the ribs. Anterior is rounded and posterior is triangular.

Habitat: Mud in intertidal to subtidal.

Distribution: Queensland, Japan, Chaina and Thailand.

Fossil Records: Upper Miocene to Quaternary of Indonesia; Holocene of Thailand.

Genus *Meretrix* Lamarck, 1799

Meretrix meretrix (Linnaeus, 1758)

Plate 5, Figure. 3 (a, b)

Description: Shell length to 68 mm. Trigonal to ovate-trigonal, shells is thick and moderately convex. Hinge teeth are heterodont, shell surface have commarginal lines. Anterior is rounded and posterior is subtriangular. Pallial sinus is small. Colors are very variable.

Habitat: Sand and mud in mangrove to intertidal.

Distribution: Indo-Pacific, South Africa, Indonesia, Japan and Thailand.

Fossil Records: Upper Miocene of Japan; Pliocene of Indonesia, Philippines, Taiwan, China and Japan; Quaternary of West Pacific area; Holocene of Thailand.

Genus *Paphia* Röding, 1798

Paphia undulata (Born, 1778)

Plate 5, Figure. 4 (a, b)

Description: Shell length to 44 mm. Elongate-oval, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have low commarginal lines. Anterior and posterior are round. Pallial sinus is oval.

Habitat: Muddy in intertidal to subtidal.

Distribution: Indo-Pacific, Red Sea, Australia, Japan, Malaysia and Thailand.

Fossil Records: Upper Miocene of Indonesia and Japan; Pliocene of Indonesia, Philippines, Taiwan and Japan; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Paphia gallus (Gmelin, 1791)

Plate 5, Figure. 5 (a, b)

Description: Shell length to 45 mm. Ovate, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have low commarginal ribs. Anterior and posterior are round. Pallial sinus is deep.

Habitat: Sand and mud in intertidal.

Distribution: Indo-Pacific, Aden, Torres Strait, South China Sea and Thailand.

Fossil Records: undetermined Miocene of Indonesia; Pliocene of Madagascar and Mozambique; Quaternary of Japan; Holocene of Thailand.

Genus *Dosinia* Scopoli, 1777

Dosinia cretacea (Reeve, 1850)

Plate 5, Figure. 6 (a, b)

Description: Shell length to 18 mm. suborbicular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have low commarginal lines. Anterior and posterior are round**.** Pallial sinus is deep. Lunule is small.

Habitat: Mud in mangrove to intertidal.

Distribution: India**,** Red Sea, Indonesia, Malaysia, Philippines, Papua New Guinea and Thailand**.**

Fossil Records: Middle and Upper Miocene of Indonesia; Pliocene of Indonesia and **Philippines**; Quaternary of the Indo-Pacific area; Holocene of Thailand.

Dosinia dautzenbergi Fischer-Piette & Delmas, 1967

Plate 5, Figure. 7 (a, b)

Description: Shell length to 30 mm. Suborbicular, inequilateral. Shell is thick. Anterior is short and posterior is long, gently convex**.**

Habitat: Sand in intertidal.

Distribution: Andaman Sea, Indonesia, Malaysia and Thailand.

Fossil Records: Holocene of Thailand.

Dosinia dilecta Adams, 1856

Plate 5, Figure. 8 (a, b)

Description: Shell length to 36 mm. Orbicular, shells is thin and moderately convex. Hinge teeth are heterodont, shell surface have low commarginal lines. Anterior and posterior are round**.** Pallial sinus is deep. Lunule is small and deeply.

Habitat: Sand in intertidal.

Distribution: Andaman Sea, Indonesia, Malaysia and Thailand.

Fossil Records: Holocene of Thailand.

Superfamily Cyrenoidea Gray, 1840

Family Glauconomidae Gray, 1853

Genus *Glauconome* Gray, 1828

Glauconome sp.

Plate 5, Figure. 9 (a, b)

Description: Shell length to 27 mm. Elongate-oval, shells is thick. Anterior is oval and posterior is obliquely subtruncate.

Fossil Records: Holocene of Thailand.

Order Myida Stoliczka 1870

Superfamily Myoidea Lamarck, 1809

Family Corbulidae Lamarck, 1818

Genus *Corbula* Bruguière, 1797

Corbula fortisulcata Smith, 1879

Plate 5, Figure. 10 (a, b)

Description: Shell length to 17 mm. Subtrigonal-ovate, inequivalve and almost equilateral, shells is thick. Hinge teeth are heterodont. Shell surface right valve have coarse commarginal ribs and left valve with faint, sparce, concentric ribs.

Habitat: Fine sandy and muddy in intertidal to subtidal.

Distribution: Southwest Pacific, Taiwan and Thailand.

Fossil Records: Upper Miocene and Pliocene of the Philippines; Holocene of Thailand.

Superfamily Gastrochaenoidea Gray, 1840

Family Gastrochaenoidae Gray, 1840

Genus *Cucurbitula* Gould, 1861

Cucurbitula cymbium (Spengler, 1783)

Plate 5, Figure. 11 (a, b)

Description: Shell length to 24 mm. Peculiar shell, body is encapsulated by chain of calcareous globules.

Habitat: Attached to dead shells, enclosed in calcareous capsules in intertidal to subtidal.

Distribution: Australia and Thailand.

Fossil Records: Holocene of Thailand.

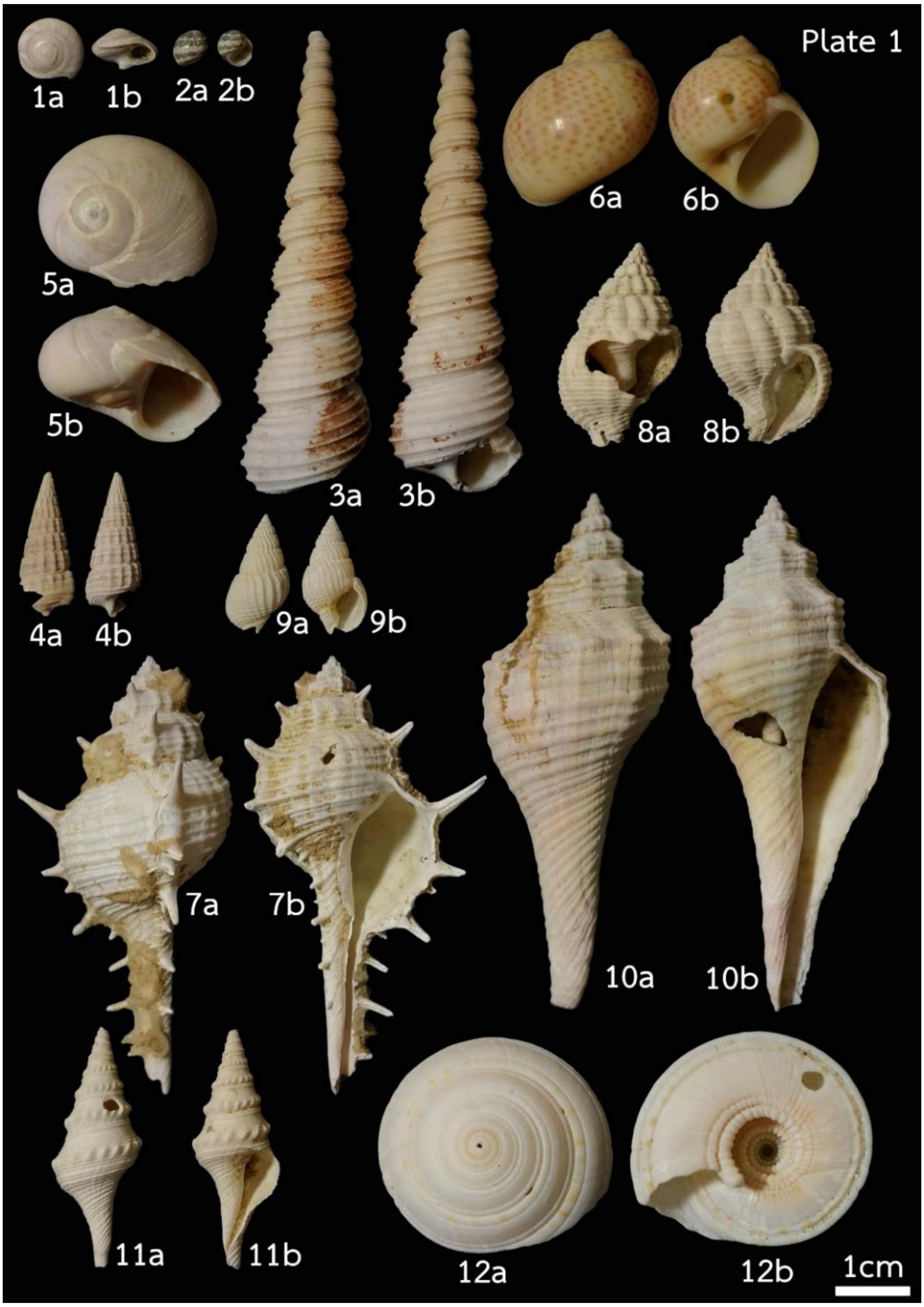


Figure 3.10 Mollusca collected from the study areas 1) *Umbonium vestiarium*, 2) *Clithon oualaniensis*, 3) *Turritella terebra*, 4) *Cerithidea cingulate*, 5) *Neverita didyma*, 6) *Natica tigrina*, 7) *Murex trapa*, 8) *Nassaria pusilla*, 9) *Nassarius siquijorensis*, 10) *Hemifusus tuba*, 11) *Turricula javana* and 12) *Architectonica perdix*.

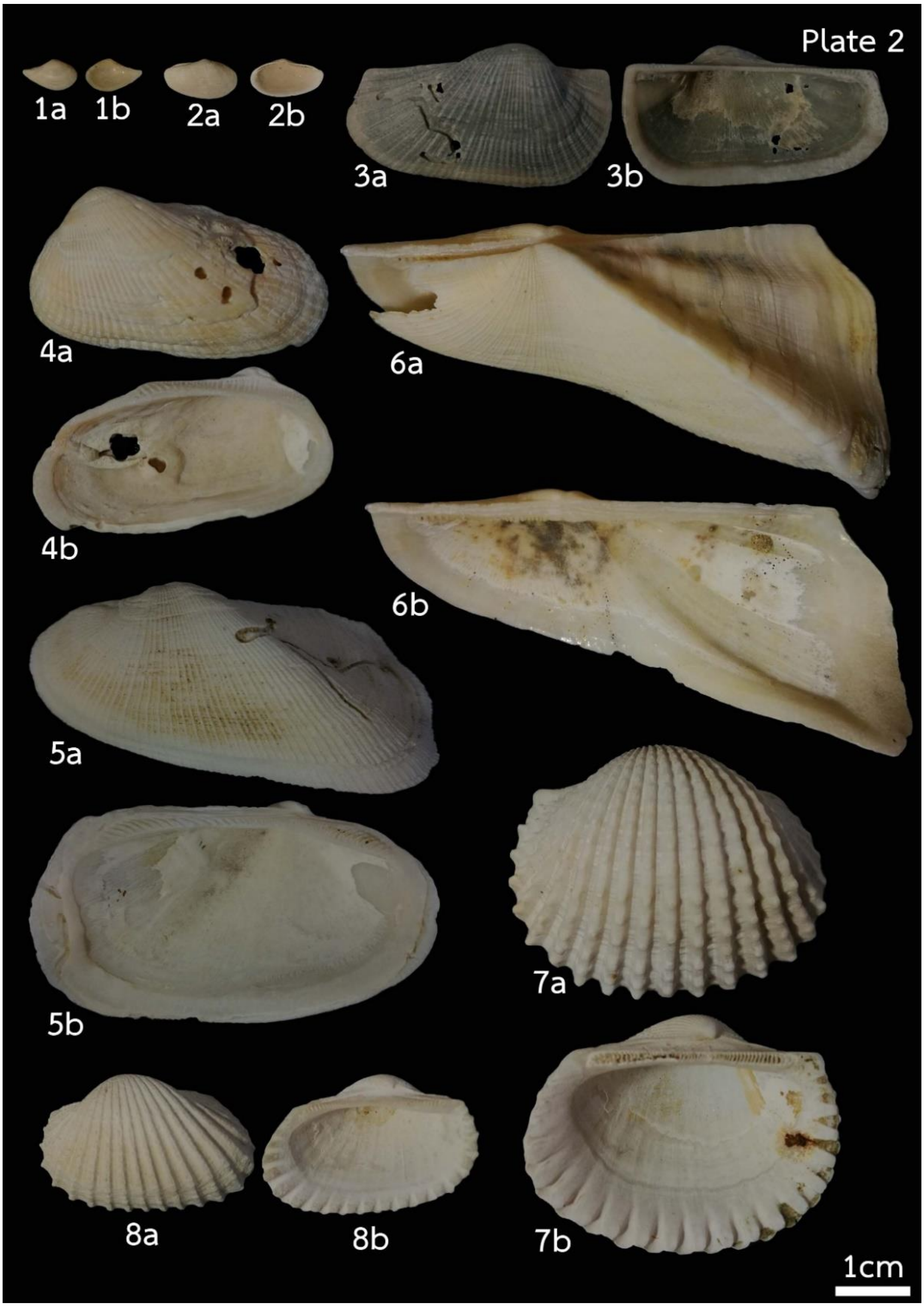


Figure 3.11 Mollusca collected from the study areas 1) *Nuculana cuspidata*, 2) *Yoldia belcheri*, 3) *Barbatia bistrigata*, 4) *Barbatia* sp., 5) *Trisidos semitorta*, 6) *Trisidos tortuosa*, 7) *Anadara granosa* and 8) *Anadara oblonga*.

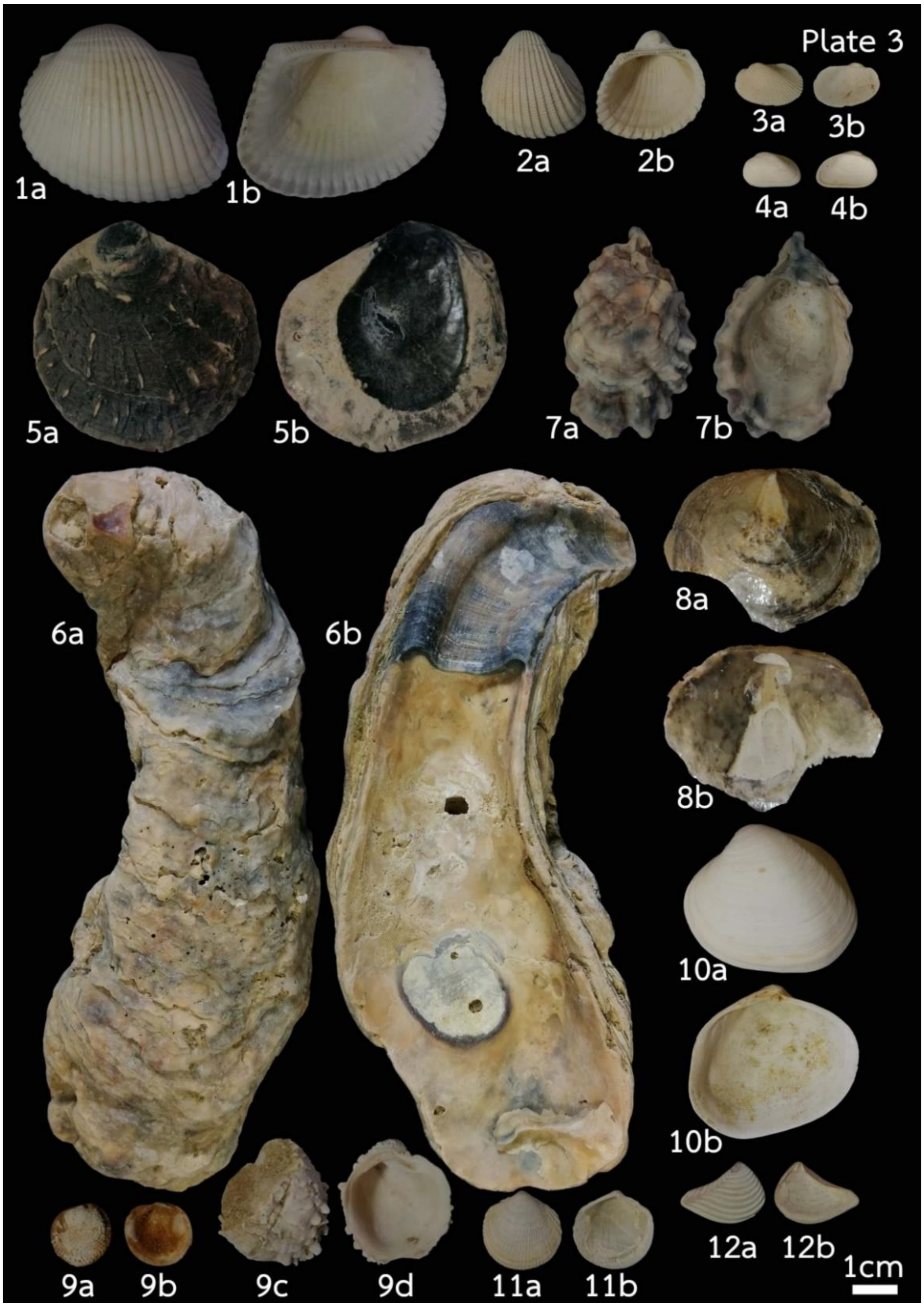


Figure 3.12 Mollusca collected from the study areas 1) *Anadara inaequivalvis*, 2) *Anadara pilula*, 3) *Scapbarca indica*, 4) *Striarca symmetrica*, 5) *Planostrea pestigris*, 6) *Crassostrea gigas*, 7) *Saccostrea cucullata*, 8) *Placuna placenta*, 9) *Chama aspersa*, 10) *Cycladicama oblonga*, 11) *Lepidolucina venusta* and 12) *Bathytormus radiates*.

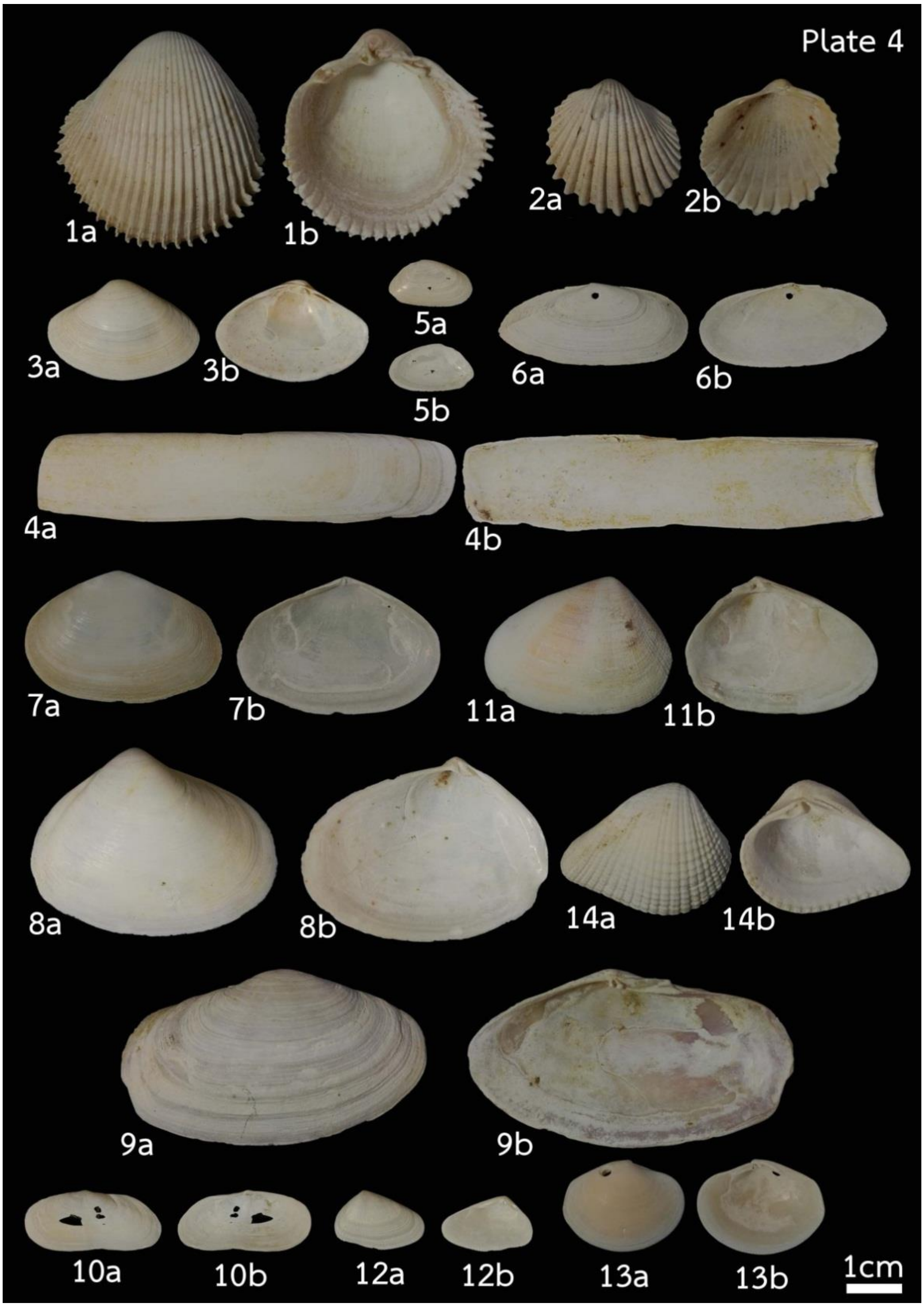


Figure 3.13 Mollusca collected from the study areas 1) *Vepricardium coronatum*, 2) *Vepricardium sinense,* 3) *Mactra luzonica,* 4) *Solen curtus,* 5) *Tellina emarginata*, 6) *Tellina lanceolata*, 7) *Tellina timorensis*, 8) *Psammotreta edentula*, 9) *Gari elongate,* 10) *Azorinus abbreviatus*, 11) *Donax faba*, 12) *Donax semigranosas*, 13) *Sunetta contempta* and 14) *Anomalocardia squamosa*.

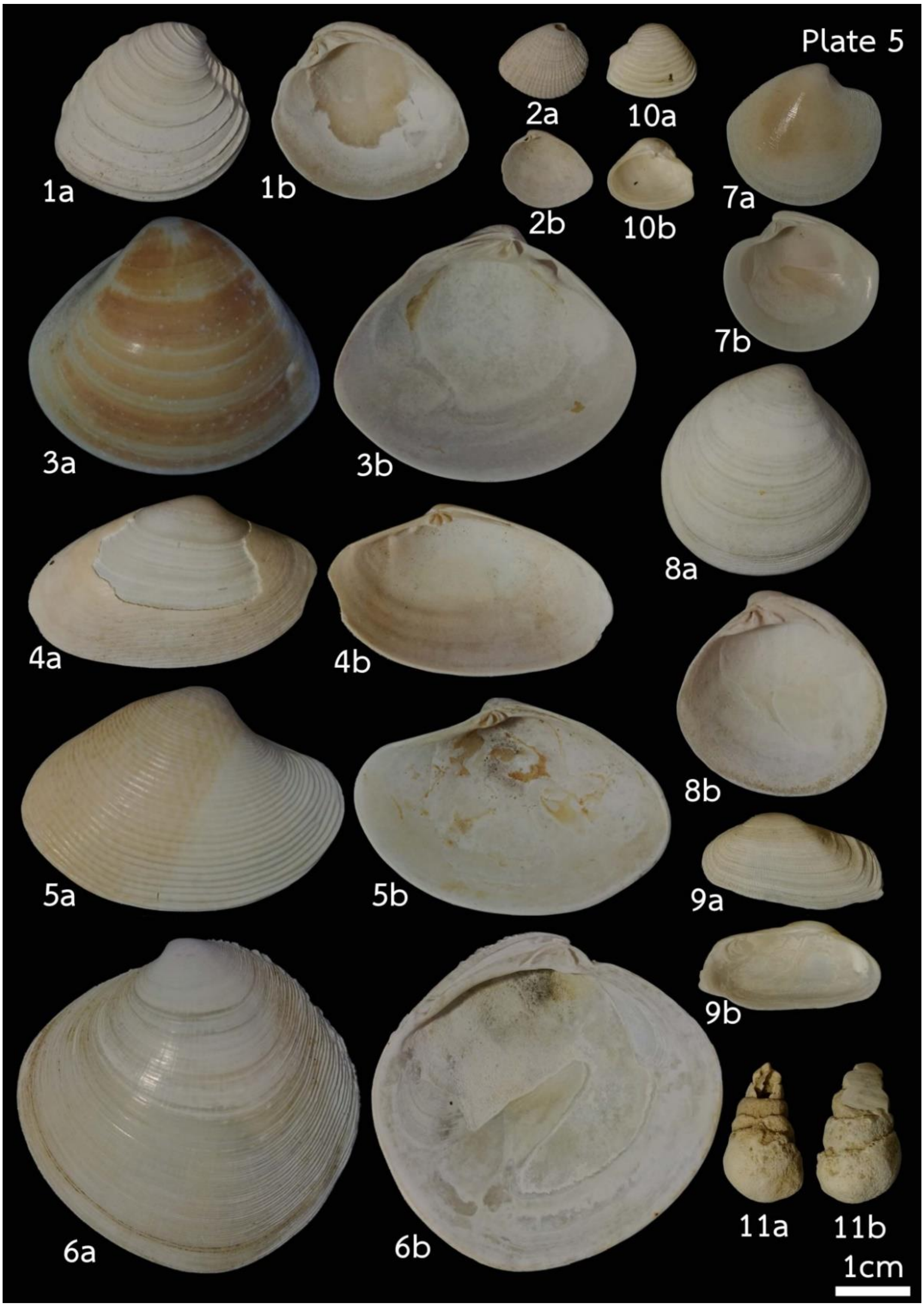


Figure 3.14 Mollusca collected from the study areas 1) *Placamen chloroticum*, 2) *Timoclea scabra*, 3) *Meretrix meretrix*, 4) *Paphia undulata*, 5) *Paphia gallus*, 6) *Dosinia cretacea*, 7) *Dosinia dautzenbergi*, 8) *Dosinia dilecta*, 9) *Glauconome* sp., 10) *Corbula fortisulcata* and 11) *Cucurbitula cymbium*.

3.3 Ages of Samples

Ages of oyster fossils from 6 sea notches are shown in Table 3.3 and locations are shown in Figure 3.15.

Table 3.3 Radiocarbon dating of oyster attached notch wall.

Sample no.	Notch level	Altitude (m a MHW)	Lab code	Material	$\delta^{13}C$ (%)	Conventional Age (yr BP)	Cal. Age (a BP)(2SD)	Mean Cal Age(a BP)
KhaoThian								
O-01	Middle	2.0	IHLC3917	oyster	-12.00	3,400±170	2,789-3,610	3,216
Ban KhungTanot								
O-02	Lower	1.0	IHLC3918	oyster	-12.00	2,480±150	1,714-2,477	2,100
Ban ThungNoi								
O-03-1	Middle	1.4	IHLC3919	oyster	-12.00	5,160±160	5,062-5,854	5,476
O-03-2	Middle	1.2	IHLC3920	oyster	-12.00	2,140±210	1,255-2,202	1,702
O-03-3	Lower	1.0	IHLC3921	oyster	-12.00	1,380±150	641-1,216	902
KhaoKhwang								
O-04	Middle	2.0	IHLC3922	oyster	-12.00	2,680±200	1,858-2,806	2,352
KhaoLukKlom								
O-05	Middle	2.5	IHLC3923	oyster	-12.00	3,090±110	2,596-3,159	2,851
Ban Bang Pu								
O-06-1	Middle	2.6	IHLC3924	oyster	-12.00	780±180	45-633	366
O-06-2	Middle	2.3	IHLC3925	oyster	-12.00	1,060±180	288-940	617
O-06-3	Middle	2.0	IHLC3926	oyster	-12.00	2,420±120	1,741-2,314	2,028

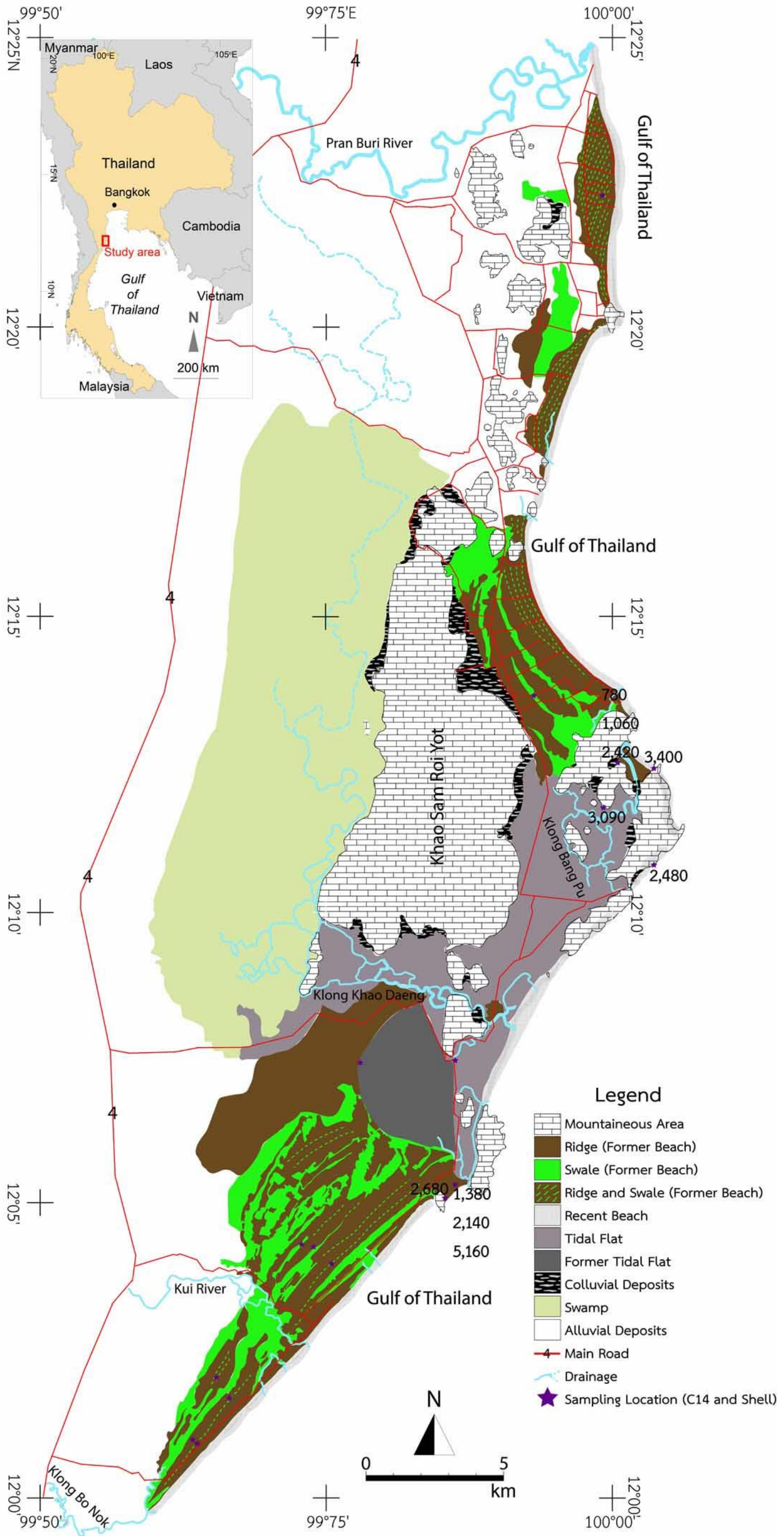


Figure 3.15 Geomorphologic map showing the study locations at Kui Buri, Sam Roi Yot and Pran Buri, Changwat Prachuap Khiri Khan. Sampling location (C14 and Mollusca) are also shows.

Ages of sediment dated by OSL from Kui Buri area (4 transects, 23 samples) are shown in Table 3.4 and location is shown in Figure 3.16.

Table 3.4 OSL dating results from beach ridge plain (Kui Buri).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
Transect 1								
K1-1	310	0.77±0.1	2.14±0.1	0.39±0.1	5.36	0.62±0.1	0.68±0.02	1,090±180
K1-2	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	1.29±0.04	2,410±450
K1-3	540	0.84±0.1	2.76±0.1	0.34±0.1	2.15	0.66±0.1	2.49±0.16	3,760±610
K1-4	890	0.73±0.1	2.40±0.1	0.34±0.1	1.17	0.55±0.1	4.11±0.16	6,650±1,100
K1-5	1,070	0.82±0.1	1.71±0.1	0.32±0.1	4.92	0.62±0.1	4.31±0.20	7,860±1,480
Transect 2								
K2-1	540	0.77±0.1	2.49±0.1	0.35±0.1	2.07	0.63±0.1	1.50±0.07	2,370±380
K2-2	600	0.75±0.1	2.31±0.1	0.35±0.1	7.29	0.58±0.1	1.85±0.10	3,180±570
K2-3	970	0.71±0.1	2.07±0.1	0.31±0.1	1.05	0.56±0.1	3.12±0.17	5,520±1,020
K2-4	1,350	0.68±0.1	2.11±0.1	0.41±0.1	4.06	0.62±0.1	4.88±0.30	7,810±1,340
Transect 3								
K3-1	285	0.65±0.1	1.81±0.1	0.41±0.1	9.34	0.56±0.1	0.54±0.02	960±170
K3-2	1,100	0.82±0.1	3.51±0.1	0.44±0.1	1.98	0.80±0.1	2.84±0.10	3,560±460
K3-3	1,600	0.77±0.1	2.09±0.1	0.43±0.1	1.85	0.68±0.1	4.19±0.43	6,170±1,100
K3-4	1,700	0.84±0.1	2.64±0.1	0.56±0.1	2.83	0.82±0.1	5.67±0.39	6,890±960
Transect 4								
K4-1	170	0.69±0.1	1.91±0.1	0.35±0.1	2.40	0.58±0.1	0.51±0.04	880±160
K4-2	450	0.70±0.1	2.48±0.1	0.53±0.1	12.36	0.67±0.1	1.58±0.08	2,300±350
K4-3	1,180	1.04±0.1	2.62±0.1	0.53±0.1	3.20	0.84±0.1	1.98±0.08	2,350±290
K4-4	1,500	0.79±0.1	2.63±0.1	0.57±0.1	0.34	0.84±0.1	4.03±0.18	4,770±600
K4-5	1,900	0.75±0.1	2.53±0.1	0.54±0.1	1.43	0.80±0.1	5.32±0.24	6,650±880
K4-6	2,200	0.77±0.1	2.80±0.1	0.65±0.1	4.00	0.88±0.1	6.41±0.31	7,270±890
K4-7	2,480	0.81±0.1	2.70±0.1	0.72±0.1	1.69	0.96±0.1	7.21±0.36	7,480±850
K4-8	3,100	0.96±0.1	4.05±0.1	0.73±0.1	1.98	1.10±0.1	8.44±0.40	7,650±780
K4-9	3,500	1.25±0.1	5.13±0.1	0.85±0.1	1.77	1.34±0.1	10.60±0.55	7,890±710
K4-10	3,800	1.09±0.1	4.72±0.1	1.01±0.1	2.02	1.41±0.1	11.19±0.53	7,940±670

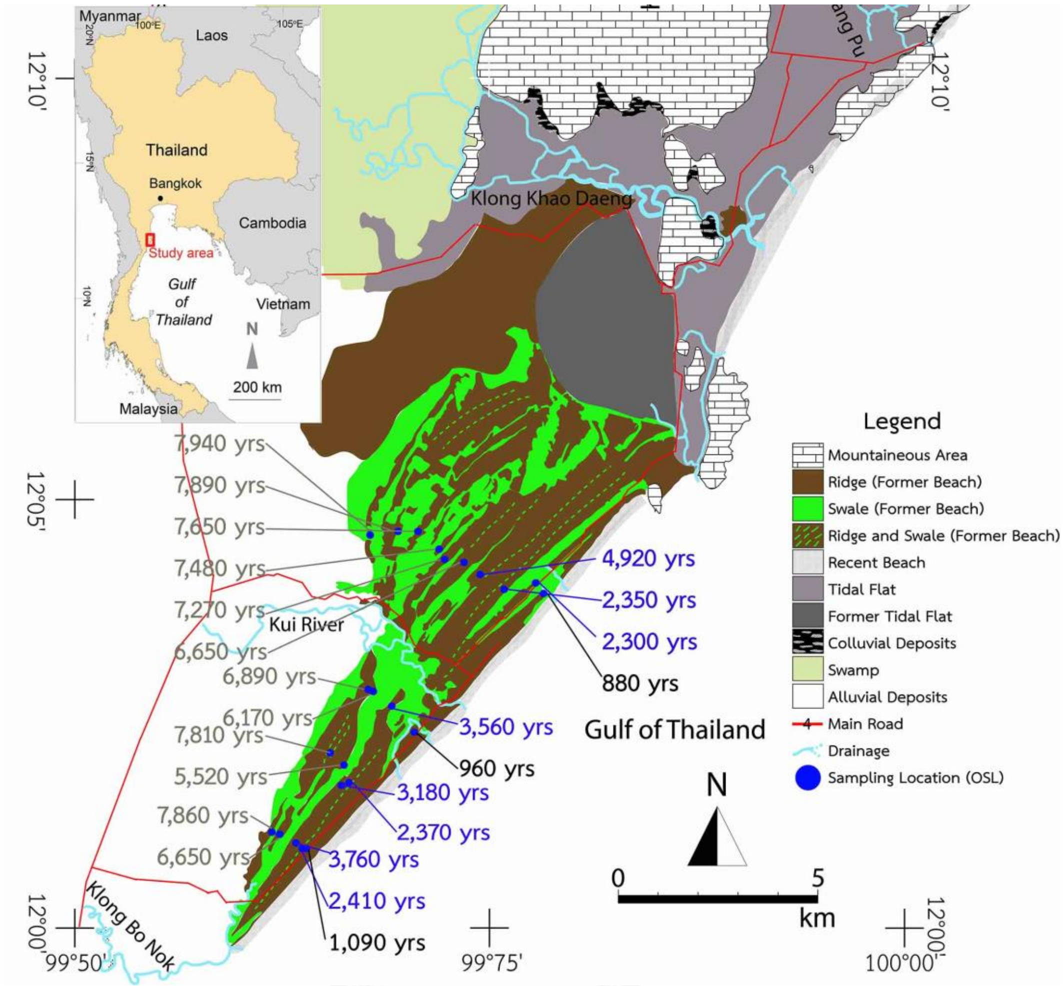


Figure 3.16 Close-up geomorphologic map at Kui Buri (area C), Changwat Prachuap Khiri Khan showing sampling location (OSL) in relation with coastal landforms.

Ages of sediment dated by OSL from Sam Roi Yot area (4 transects, 14 samples) are shown in Table 3.5 and location is shown in Figure 3.17.

Table 3.5 OSL dating results from beach ridge plain (Sam Roi Yot).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
Transect 1								
S1-1	290	1.03±0.1	3.31±0.1	0.62±0.1	0.51	0.99±0.1	2.86±0.18	2,880±340
S1-2	730	0.98±0.1	3.53±0.1	0.80±0.1	0.90	1.14±0.1	6.02±0.27	5,290±520
S1-3	1,030	0.91±0.1	3.79±0.1	1.03±0.1	0.90	1.33±0.1	7.24±0.41	5,450±510
S1-4	1,450	0.99±0.1	4.10±0.1	1.06±0.1	0.87	1.40±0.1	8.75±0.46	6,260±550
Transect 2								
S2-1	570	1.14±0.1	4.86±0.1	0.89±0.1	0.36	1.35±0.1	2.63±0.11	1,940±160
S2-2	1,450	1.00±0.1	3.86±0.1	0.98±0.1	0.53	1.32±0.1	5.91±0.30	4,470±400
S2-3	1,900	0.77±0.1	3.51±0.1	1.01±0.1	0.73	1.27±0.1	5.89±0.33	4,650±440
Transect 3								
S3-1	700	0.81±0.1	2.98±0.1	0.67±0.1	1.83	0.94±0.1	3.09±0.19	3,280±400
S3-2	1,300	1.03±0.1	4.47±0.1	0.95±0.1	4.18	1.29±0.1	4.54±0.20	3,520±310
S3-3	1,800	0.89±0.1	2.91±0.1	0.84±0.1	1.06	1.11±0.1	5.85±0.24	5,290±520
Transect 4								
S4-1	490	1.15±0.1	4.83±0.1	0.70±0.1	0.58	1.20±0.1	3.37±0.11	2,810±250
S4-2	1,260	0.80±0.1	3.15±0.1	0.80±0.1	1.22	1.06±0.1	4.48±0.16	4,210±420
S4-3	1,670	0.86±0.1	3.48±0.1	0.85±0.1	0.68	1.16±0.1	5.95±0.41	5,140±560

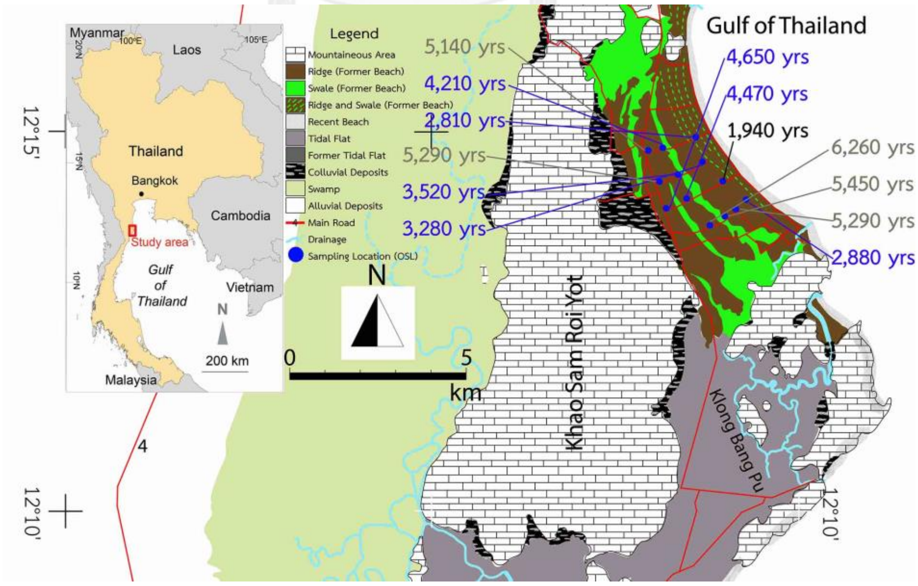


Figure 3.17 Close-up geomorphologic map at Sam Roi Yot (area B), Changwat Prachuap Khiri Khan showing sampling locations (OSL) in relation to coastal landforms.

Ages of sediment dated by OSL in Pran Buri area (4 transects, 11 samples) are shown in Table 3.6 and location is shown in Figure 3.18.

Table 3.6 OSL dating results from beach ridge plain (Pran Buri).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
Transect 1								
P1-1	160	1.32±0.1	9.34±0.1	1.06±0.1	0.85	1.63±0.1	15.35±0.61	8,250±550
P1-2	300	1.05±0.1	4.06±0.1	1.33±0.1	1.07	1.86±0.1	16.60±0.77	10,200±780
Transect 2								
P2-1	160	1.05±0.1	4.50±0.1	1.14±0.1	0.85	1.51±0.1	6.45±0.23	4,270±320
P2-2	340	1.11±0.1	4.62±0.1	1.03±0.1	2.15	1.42±0.1	9.39±0.61	6,630±630
P2-3	470	1.66±0.1	6.52±0.1	0.76±0.1	1.34	1.48±0.1	14.20±0.62	9,610±770
Transect 3								
P3-1	200	0.89±0.1	2.98±0.1	0.55±0.1	0.68	0.88±0.1	1.86±0.07	2,110±250
P3-2	415	0.64±0.1	2.12±0.1	0.60±0.1	0.29	0.80±0.1	1.91±0.12	2,390±330
P3-3	750	1.24±0.1	4.21±0.1	0.82±0.1	0.56	1.27±0.1	9.73±0.44	7,650±690
Transect 4								
P4-1	265	0.71±0.1	2.75±0.1	0.79±0.1	0.79	1.02±0.1	1.88±0.16	1,850±230
P4-2	500	1.31±0.1	6.88±0.1	0.75±0.1	0.39	1.42±0.1	4.94±0.25	3,460±290
P4-3	940	1.15±0.1	3.44±0.1	0.88±0.1	0.84	1.24±0.1	8.10±0.65	6,510±730

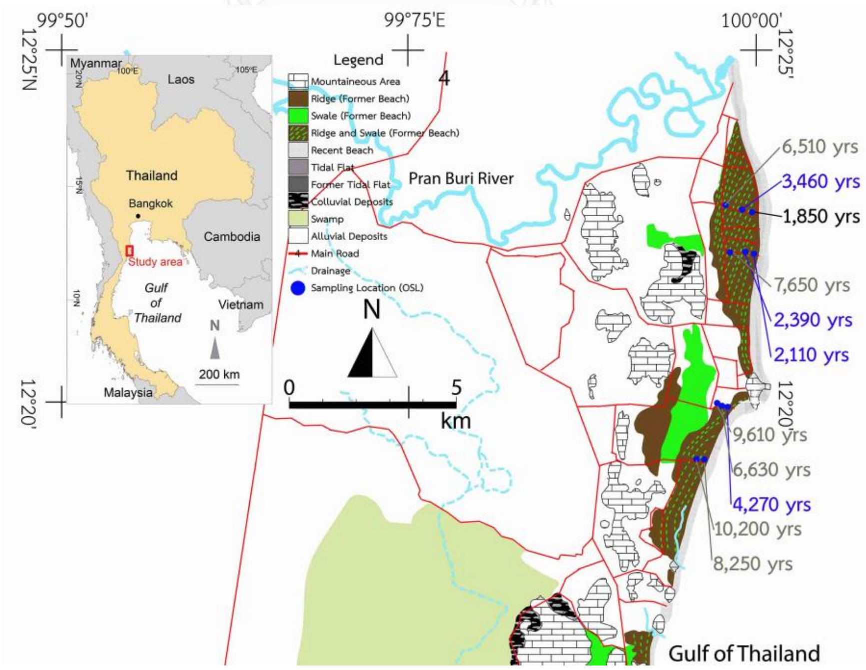


Figure 3.18 Close-up geomorphologic map at Pran Buri (area C), Changwat Prachuap Khiri Khan showing the sampling location (OSL).

3.4 Stratigraphic Columns

Stratigraphic columns of Kui Buri area (4 transects, 13 columns) are shown in Figures 3.19 to 3.27.

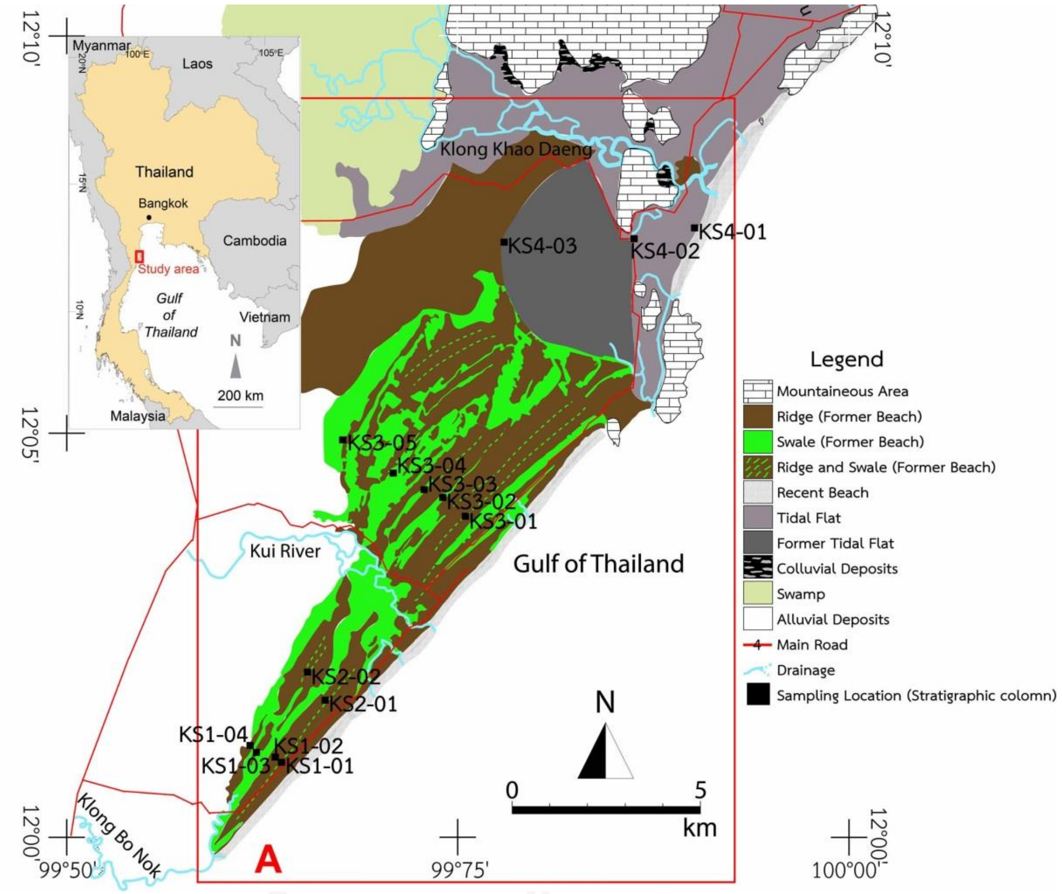


Figure 3.19 Close up of geomorphologic map at Kui Buri (area A), Changwat Prachuap Khiri Khan showing the sampling location (stratigraphic column).

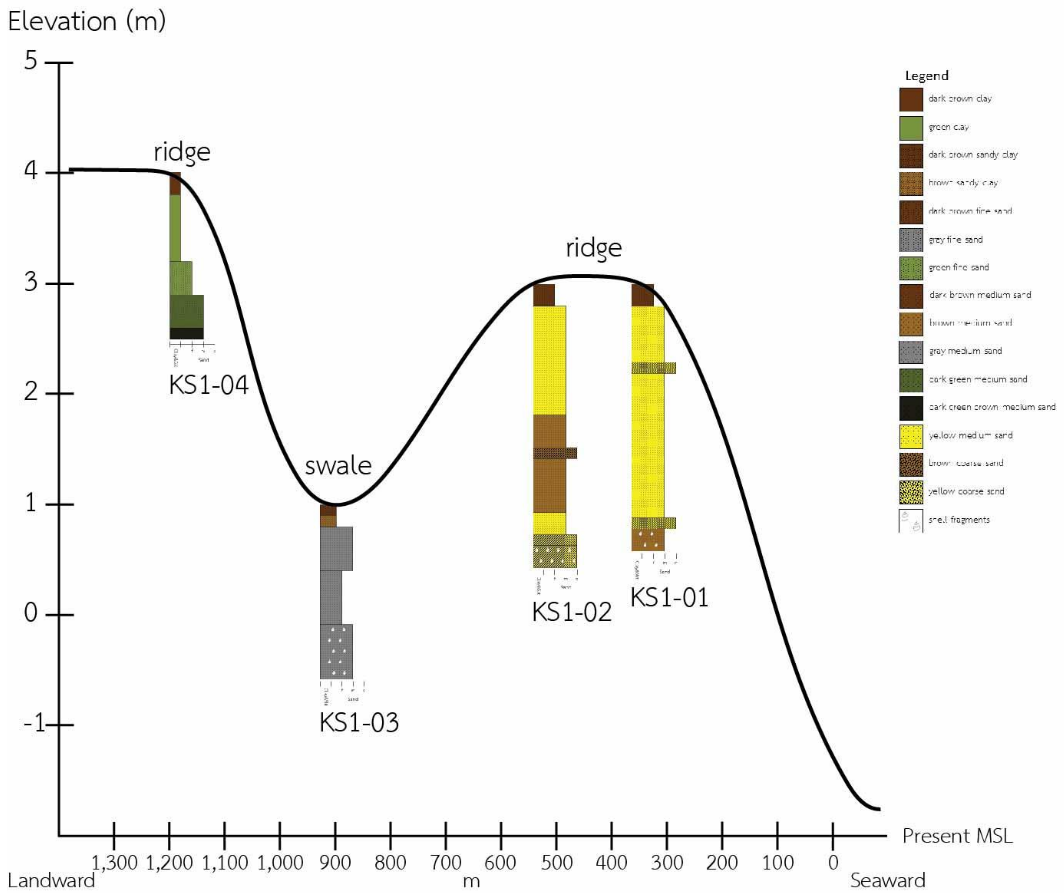


Figure 3.20 Stratigraphic columns of Kui Buri transect 1 (KS1), 4 columns (KS1-01, KS1-02, KS1-03 and KS1-04).

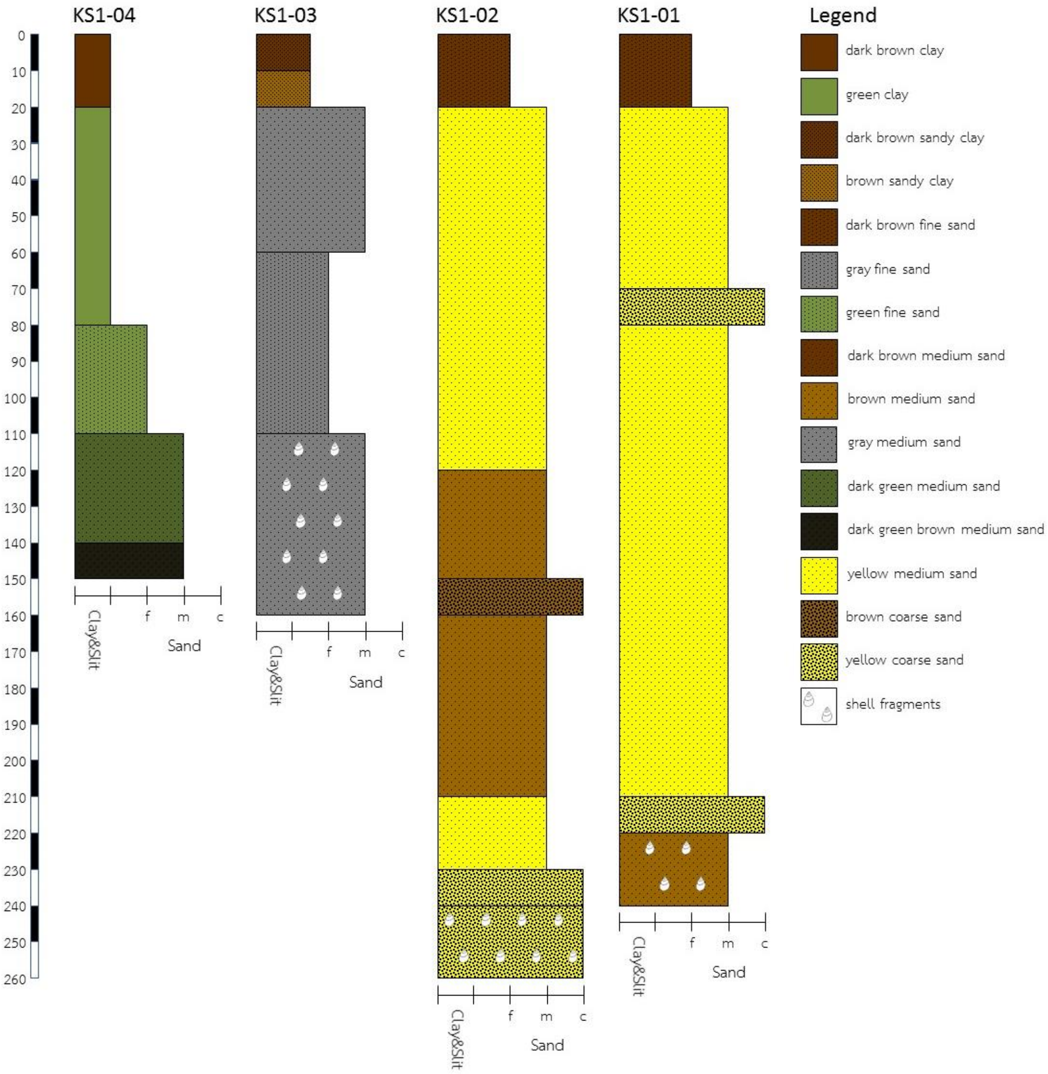


Figure 3.21 Zoom in stratigraphic columns of Kui Buri transect 1 (KS1), 4 columns (KS1-01, KS1-02, KS1-03 and KS1-04).

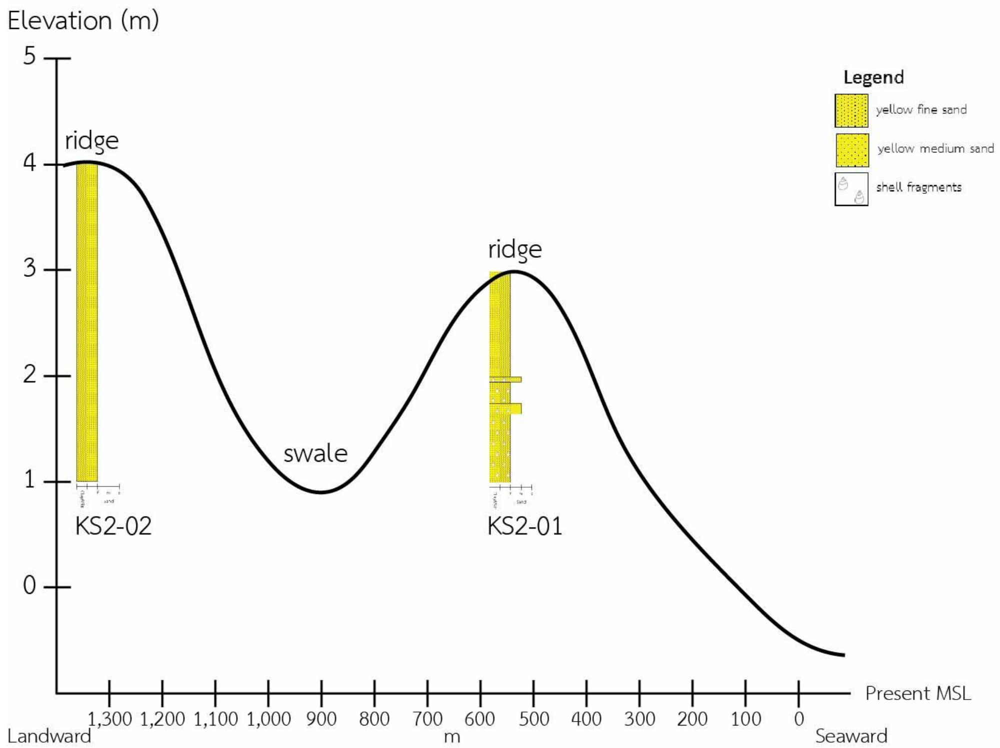


Figure 3.22 Stratigraphic columns of Kui Buri transect 2 (KS2), 2 columns (KS2-01 and KS2-02).

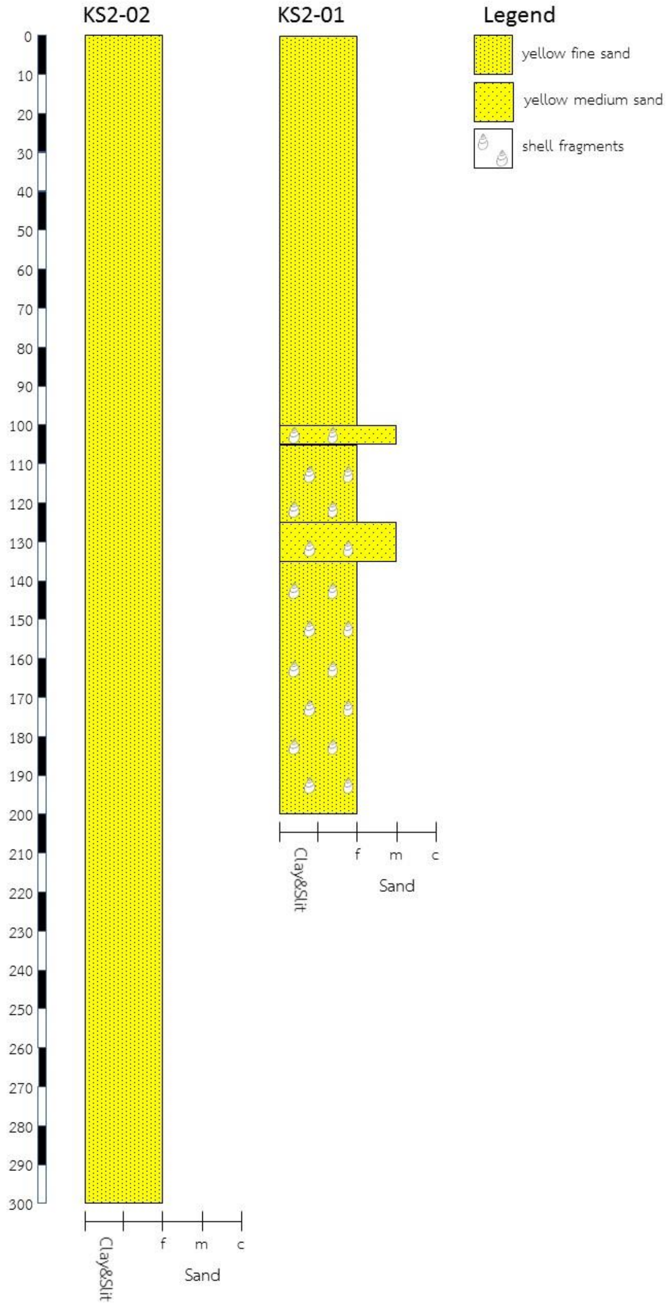


Figure 3.23 Zoom in stratigraphic columns of Kui Buri transect 2 (KS2), 2 columns (KS2-01 and KS2-02).

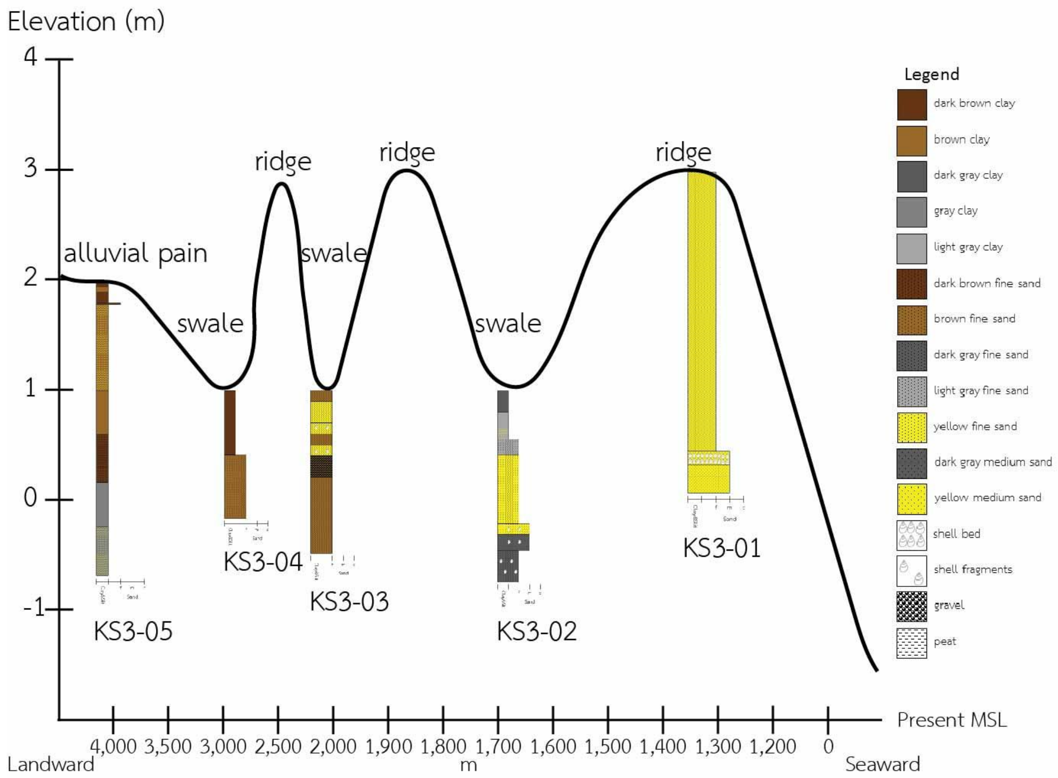


Figure 3.24 Stratigraphic columns of Kui Buri transect 3 (KS3), 5 columns (KS3-01, KS3-02, KS3-03, KS3-04 and KS3-05).

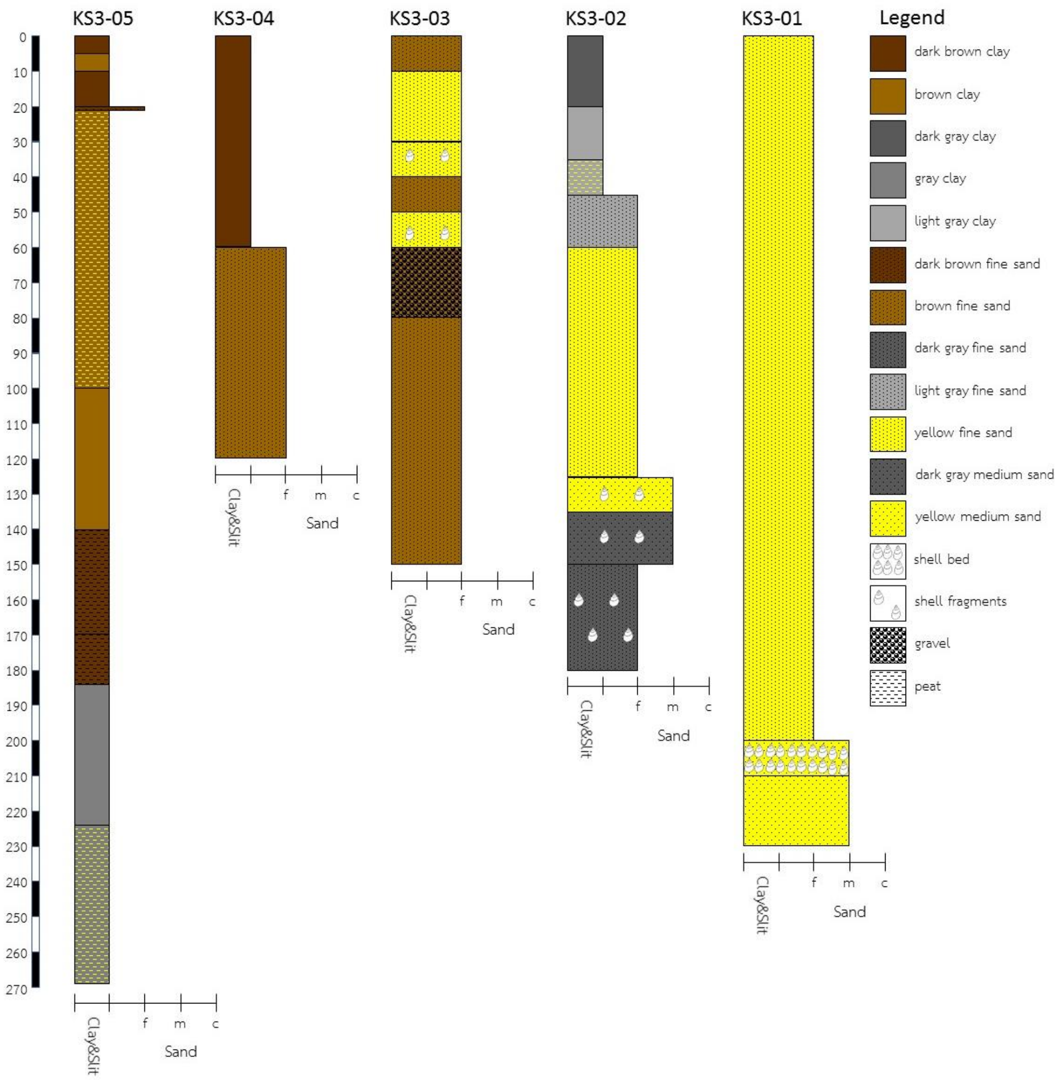


Figure 3.25 Zoom in stratigraphic columns of Kui Buri transect 3 (KS3), 5 columns (KS3-01, KS3-02, KS3-03, KS3-04 and KS3-05).

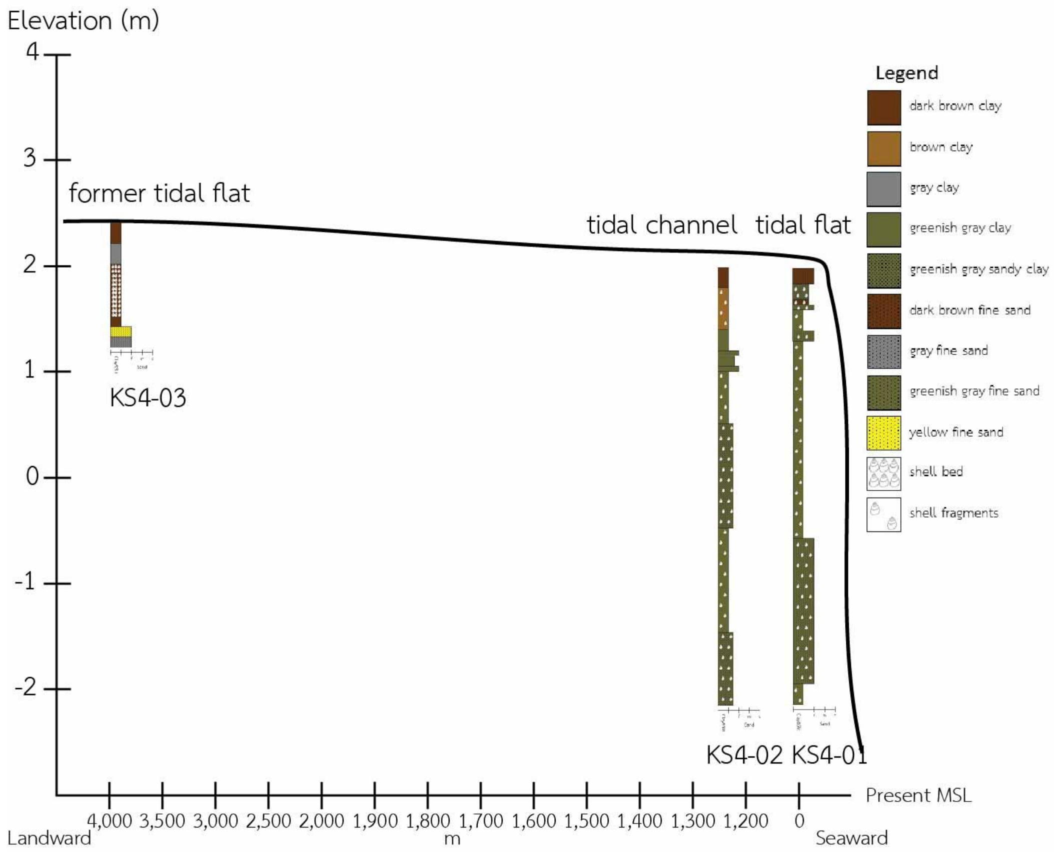


Figure 3.26 Stratigraphic columns of Kui Buri transect 4 (KS4), 3 columns (KS4-01, KS4-02, and KS4-03).

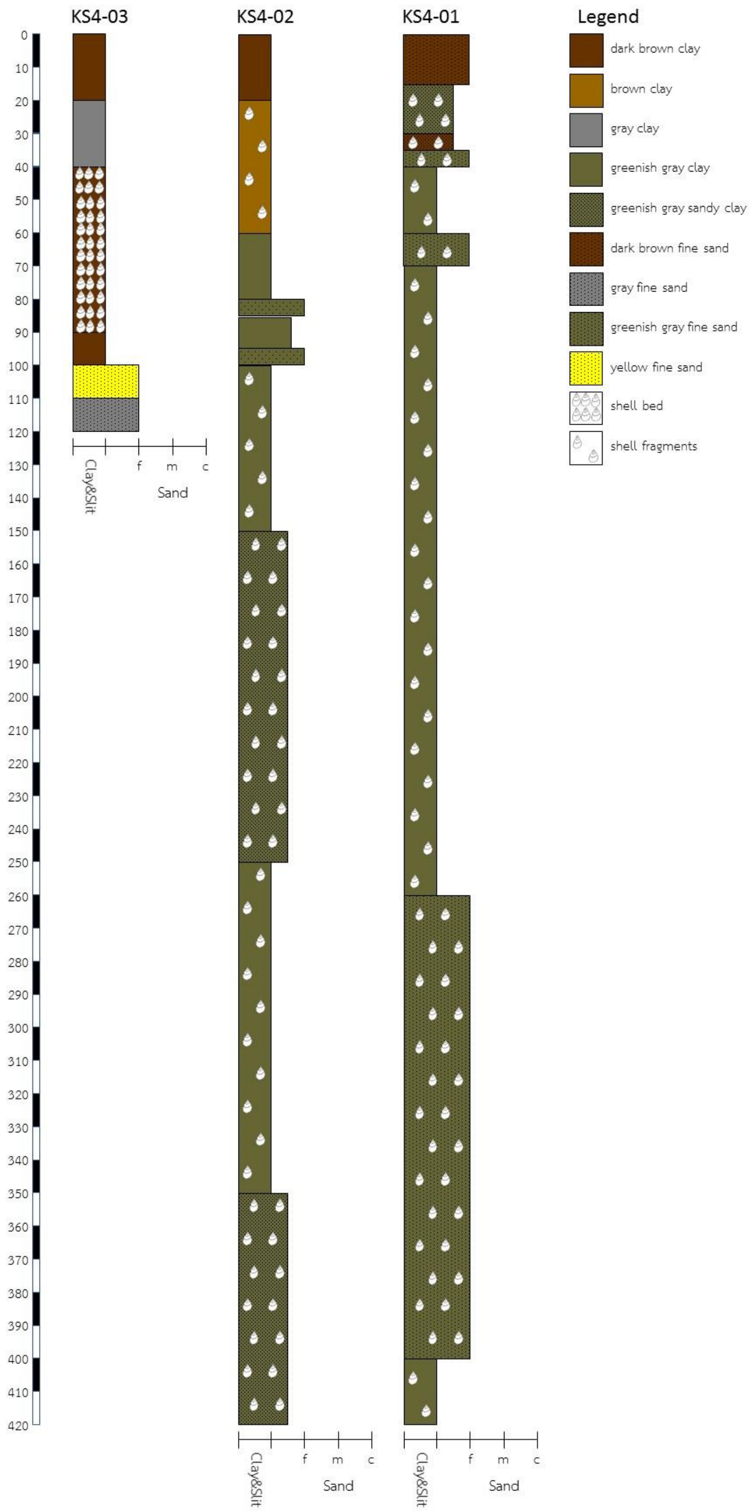


Figure 3.27 Zoom in stratigraphic columns of Kui Buri transect 4 (KS4), 3 columns (KS4-01, KS4-02, and KS4-03).

Stratigraphic columns of Sam Roi Yot area (3 transects, 7 columns) are shown in Figures 3.28 to 3.34.

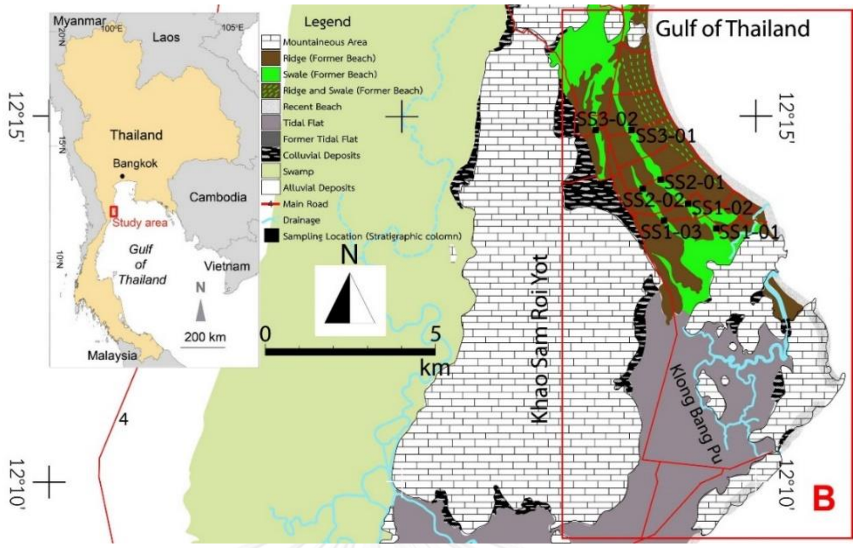


Figure 3.28 Geomorphologic map at Sam Roi Yot (area B), Changwat Prachuap Khiri Khan showing the sampling location (stratigraphic column).

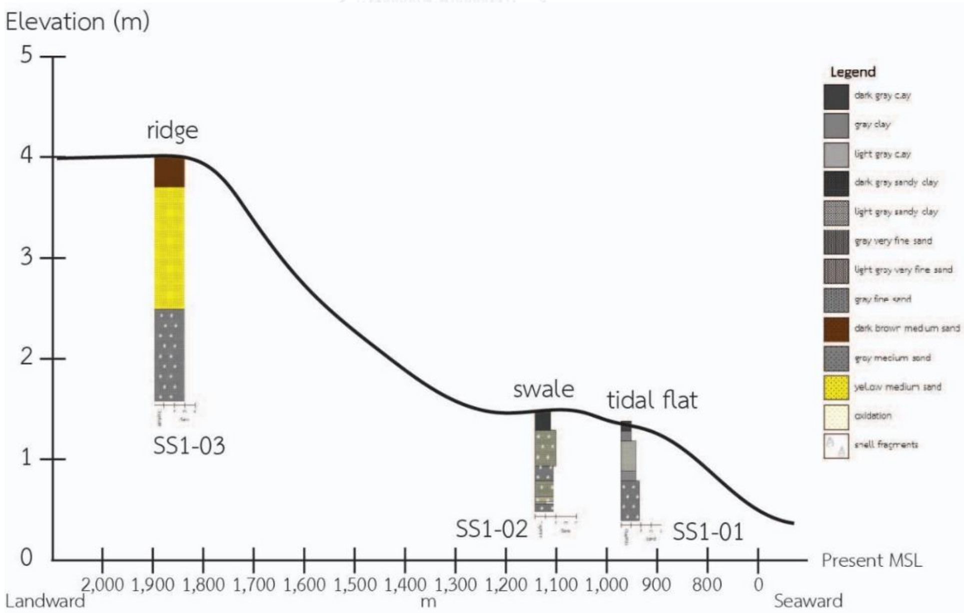


Figure 3.29 Stratigraphic columns of Sam Roi Yot transect 1 (SS1), 3 columns (SS1-01, SS1-02, and SS1-03).

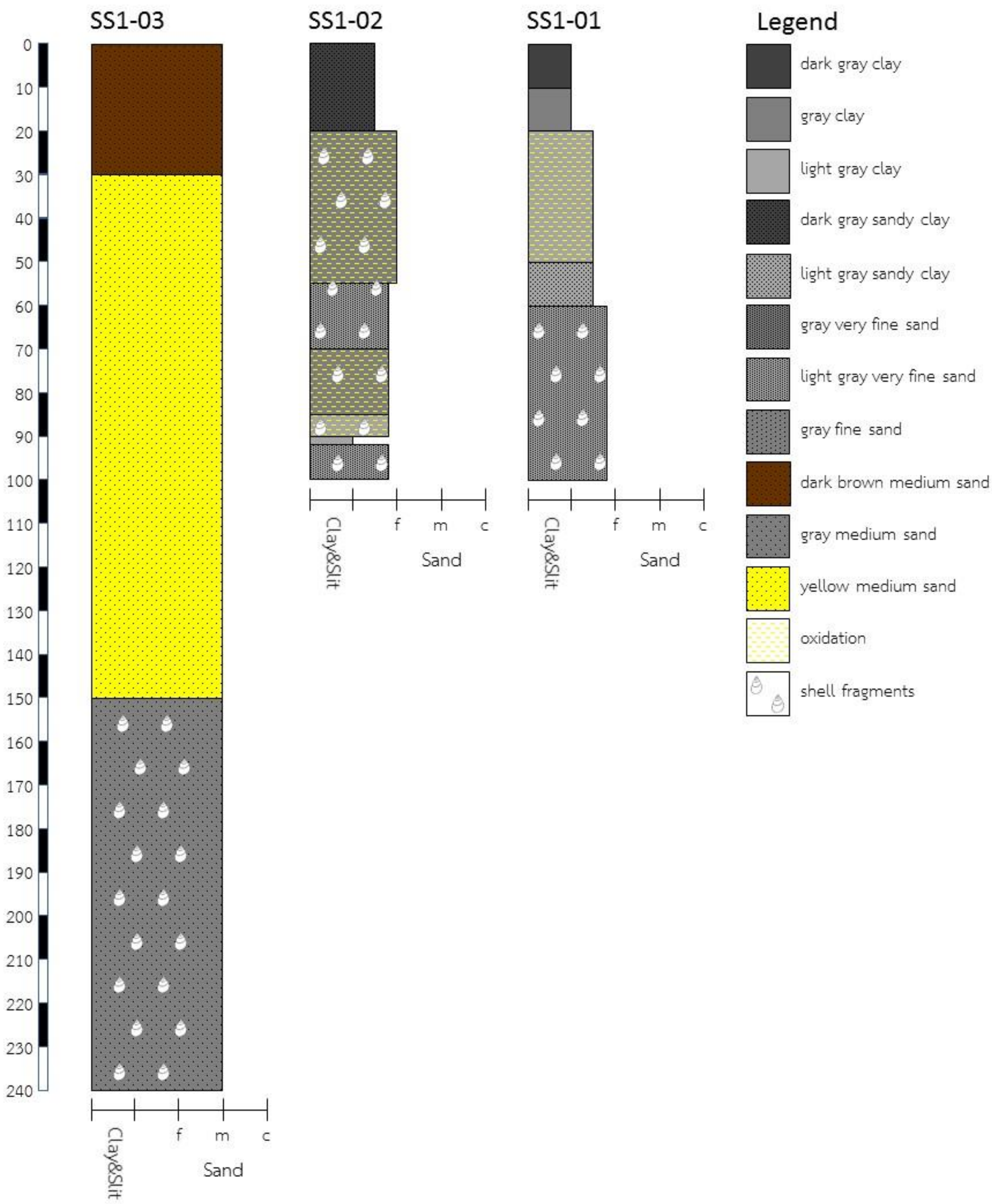


Figure 3.30 Zoom in stratigraphic columns of Sam Roi Yot transect 1 (SS1), 3 columns (SS1-01, SS1-02, and SS1-03).

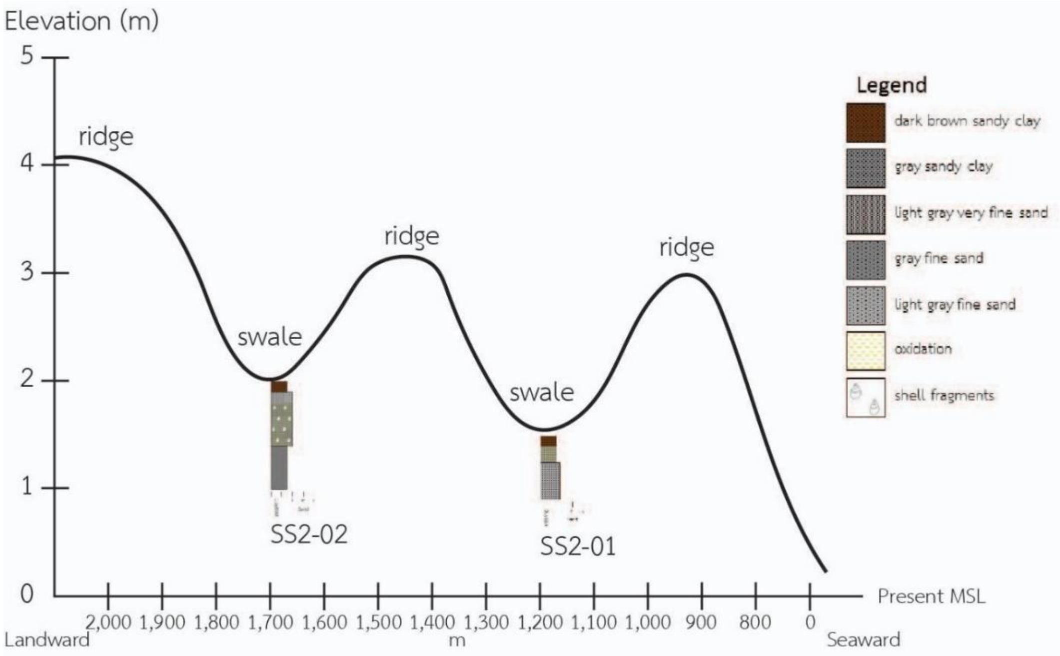


Figure 3.31 Stratigraphic columns of Sam Roi Yot transect 2 (SS2), 2 columns (SS2-01 and SS2-02).

Figure 3.32 Zoom in stratigraphic columns of Sam Roi Yot transect 2 (SS2), 2 columns (SS2-01 and SS2-02).

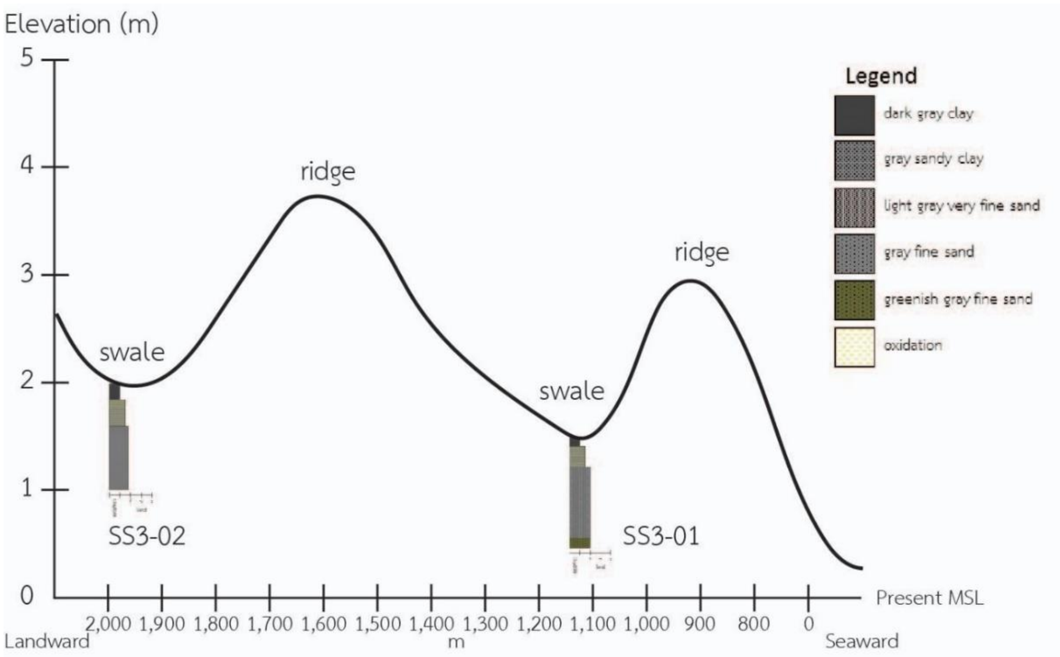


Figure 3.33 Stratigraphic columns of Sam Roi Yot transect 3 (SS3), 2 columns (SS3-01 and SS3-02).

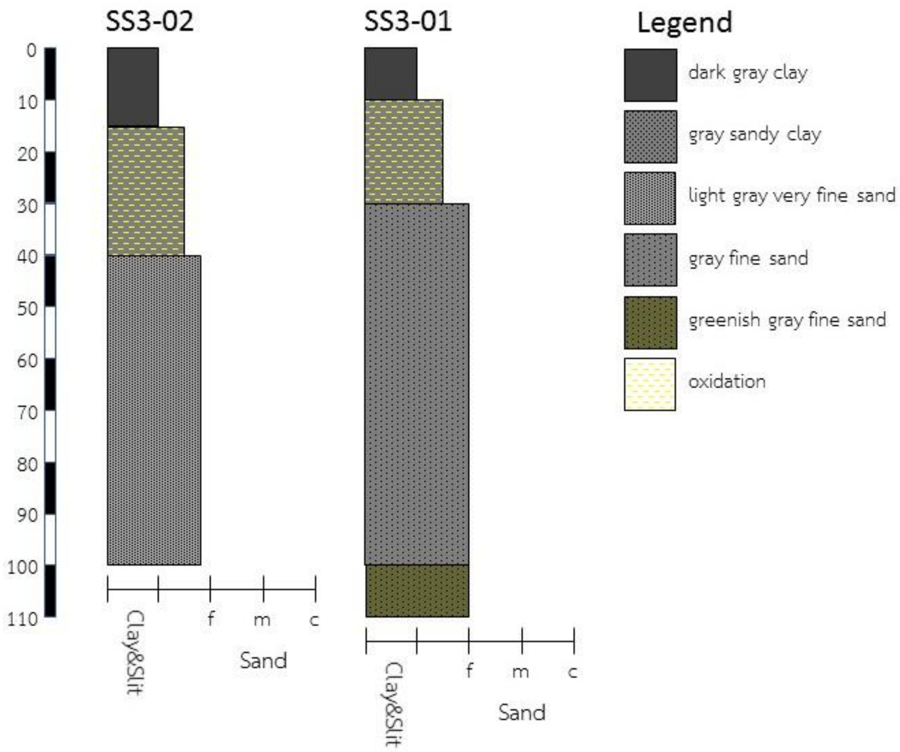


Figure 3.34 Zoom in stratigraphic columns of Sam Roi Yot transect 3 (SS3), 2 columns (SS3-01 and SS3-02).

Stratigraphic columns of Pran Buri area (2 transects, 5 columns) are shown in Figures 3.35 to 3.39.

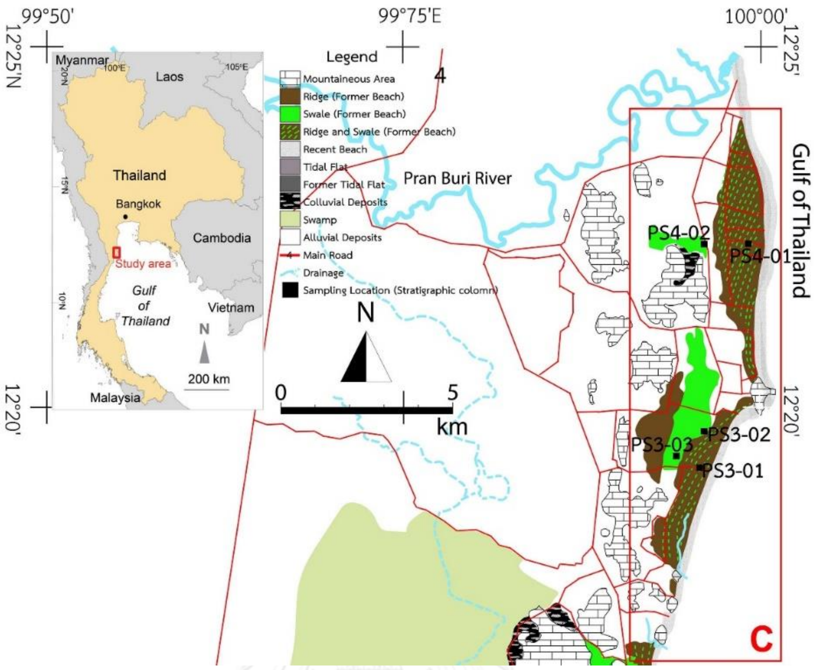


Figure 3.35 Geomorphologic map at Pran Buri (area C), Changwat Prachuap Khiri Khan showing sampling location (stratigraphic column).

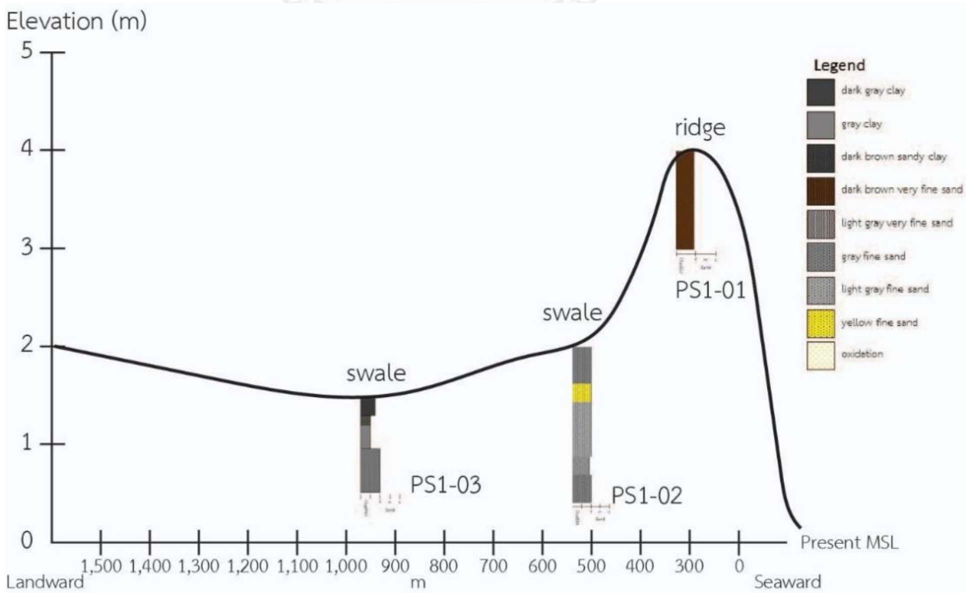


Figure 3.36 Stratigraphic columns of Pran Buri transect 1 (PS1), 3 columns (PS1-01, PS1-02 and PS1-03).

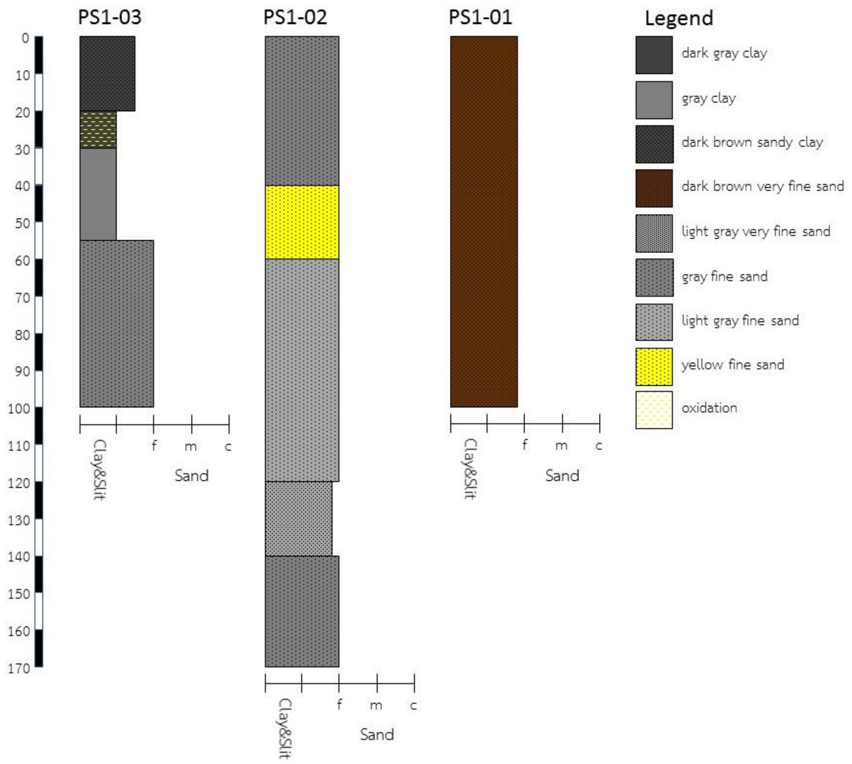


Figure 3.37 Zoom in stratigraphic columns of Pran Buri transect 1 (PS1), 3 columns (PS1-01, PS1-02 and PS1-03).

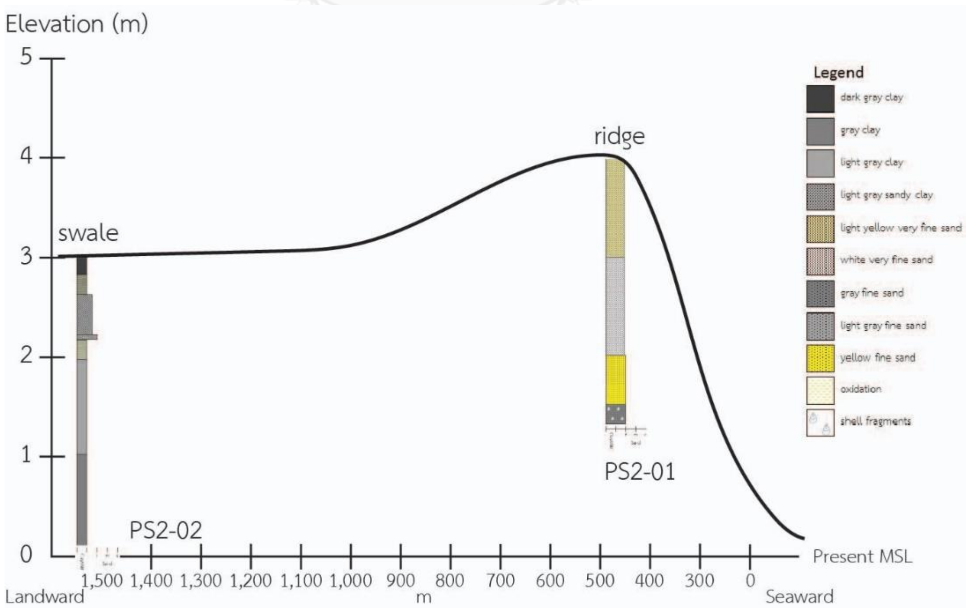


Figure 3.38 Stratigraphic columns of Pran Buri transect 2 (PS2), 3 columns (PS2-01 and PS2-02).

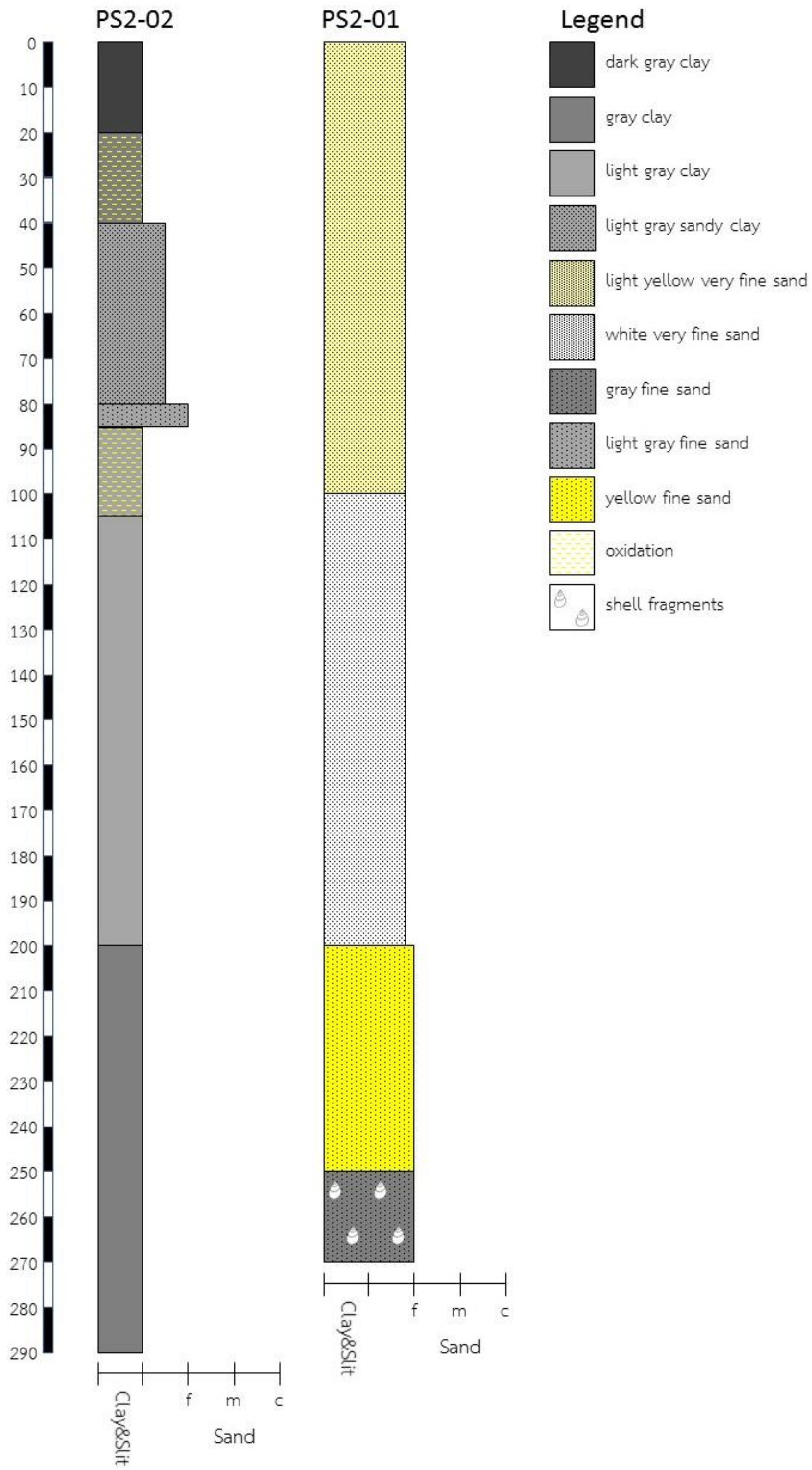


Figure 3.39 Zoom in stratigraphic columns of Pran Buri transect 2 (PS2), 3 columns (PS2-01 and PS2-02).

CHAPTER 4
DISCUSSIONS

4.1 Paleoenvironment Interpretation from Fauna

Paleoenvironment interpretation reported in this chapter was based on the occurrence of dominant molluscan fossils found in different environments such as tidal flat, beach ridge, swale, swampy areas. The discussion started with the interpretation of molluscan habitats as follows.

Figure 4.1 to 4.4 show the identified shells found in the study area. X axis indicates species of mollusca, and Y axis indicates sampling location. It is noted that the environments of individual shells are from literatures. Such as *Anadara inaequivalvis* mostly indicates mangroves environment as suggested by Robba et al. (2002) who reported this species in Thailand. Shells living in the intertidal environments are reported earlier by Robba et al. (2002). Subtidal shells are reported by Robba et al. (2002). The shells living bathyal environment are reported earlier by Robba et al. (2002).

Dominant molluscan at M1 area (Figure 3.5) are *Umbonium vestiarium*: 2, *Anadara inaequivalvis*: 6, *Paphia undulata*: 7 and *Dosinia cretacea*: 6. They indicate the intertidal to subtidal environment (Figure 4.1-4.4 and Table 3.1-3.2).

Dominant molluscan at M2 area (Figure 3.5) are *Meretrix meretrix*: 9 and *Dosinia cretacea*: 9. They indicate the intertidal (mangrove) environment. (Figure 4.1-4.4 and Table 3.1-3.2).

Dominant molluscan at M3 area (Figure 3.5) are *Architectonica perdix*: 5, *Anadara inaequivalvis*: 28, *Mactra luzonica*: 32 and *Dosinia cretacea*: 27. They indicate the intertidal to subtidal environment. (Figure 4.1-4.4 and Table 3.1-3.2).

Dominant molluscan at M4 area (Figure 3.5) are *Umbonium vestiarium*: 7, *Anadara pilula*: 12, *Donax faba*: 12 and *Dosinia cretacea*: 10. They indicate the intertidal environment. (Figure 4.1-4.4 and Table 3.1-3.2).

Dominant molluscan at M5 area (Figure 3.5) are *Umbonium vestiarium*: 3 and *Donax semigranosas*: 8. They indicate the intertidal environment. (Figure 4.1-4.4 and Table 3.1-3.2).

Dominant molluscan at M6 area (Figure 3.5) are *Umbonium vestiarium*: 3, *Meretrix meretrix*: 10 and *Dosinia cretacea*: 13. They indicate the intertidal environment. (Figure 4.1-4.4 and Table 3.1-3.2).

At M7 area (Figure 3.5), molluscan 3 species were found *Cerithidea cingulata*: 1, *Placuna placenta*: 1 and *Anomalocardia squamosa*: 1. They indicate the intertidal (mangrove) environment. (Figure 4.1-4.4 and Table 3.1-3.2).

At M8 area (Figure 3.5), molluscan 4 species were found *Natica tigrina*: 1, *Saccostrea cucullata*: 1, *Placuna placenta*: 5, and *Placamen chloroticum*: 2. They indicate the intertidal (mangrove) environment. (Figure 4.1-4.4 and Table 3.1-3.2).

At M9 area (Figure 3.5), only 1 species was found *Natica tigrina*: 1. It indicate the intertidal (mangrove) environment. (Figure 4.1-4.4 and Table 3.1-3.2).

Dominant molluscan at M10 area (Figure 3.5) are *Umbonium vestiarium*: 22 and *Saccostrea cucullata*: 20. They indicate the intertidal environment. (Figure 4.1-4.4 and Table 3.1-3.2).

Dominant molluscan at M11 area (Figure 3.5) are *Saccostrea cucullata*: 29 and *Dosinia cretacea*: 13. They indicate the intertidal (mangrove) environment. (Figure 4.1-4.4 and Table 3.1-3.2).

Based on the above-mentioned dominant and distribution molluscan fossils (Tables 3.1 and 3.2), almost of them indicated living in the intertidal (mangrove) environment (Swennen et al., 2001 Surakiatchai, 2005 and Robba et al., 2002, 2004 and 2007). This makes it clear that the paleoshoreline where to found molluscan, were active areas (intertidal zone). The molluscan are marine (no freshwater or land molluscan).

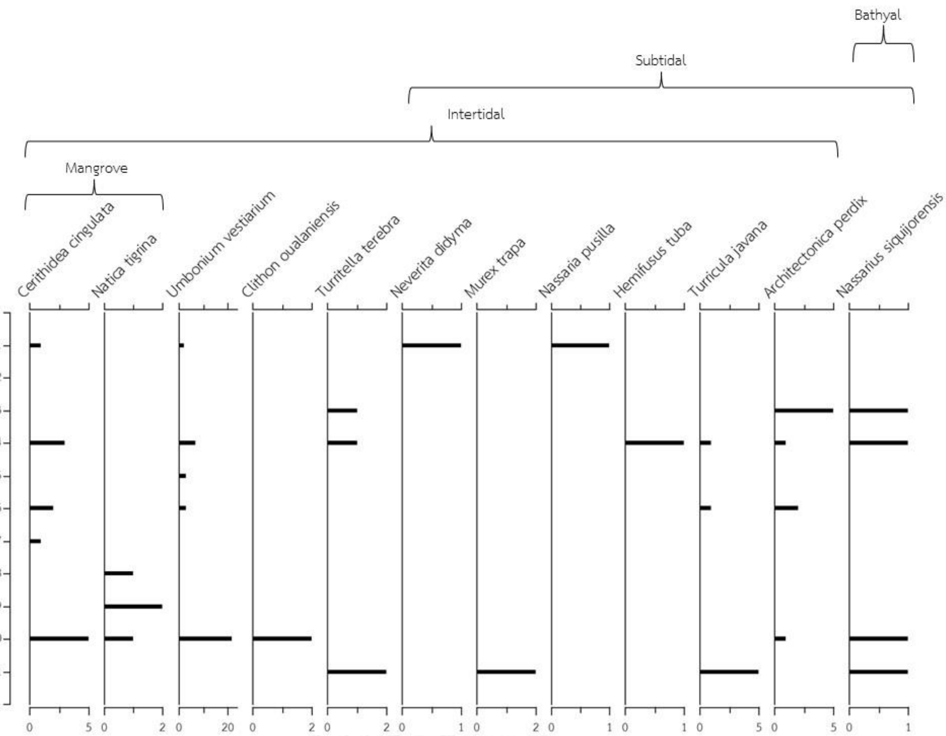


Figure 4.1 Chart of Gastropoda sorting by habitat (number) (X axis is species of mollusca, Y axis is sampling location).

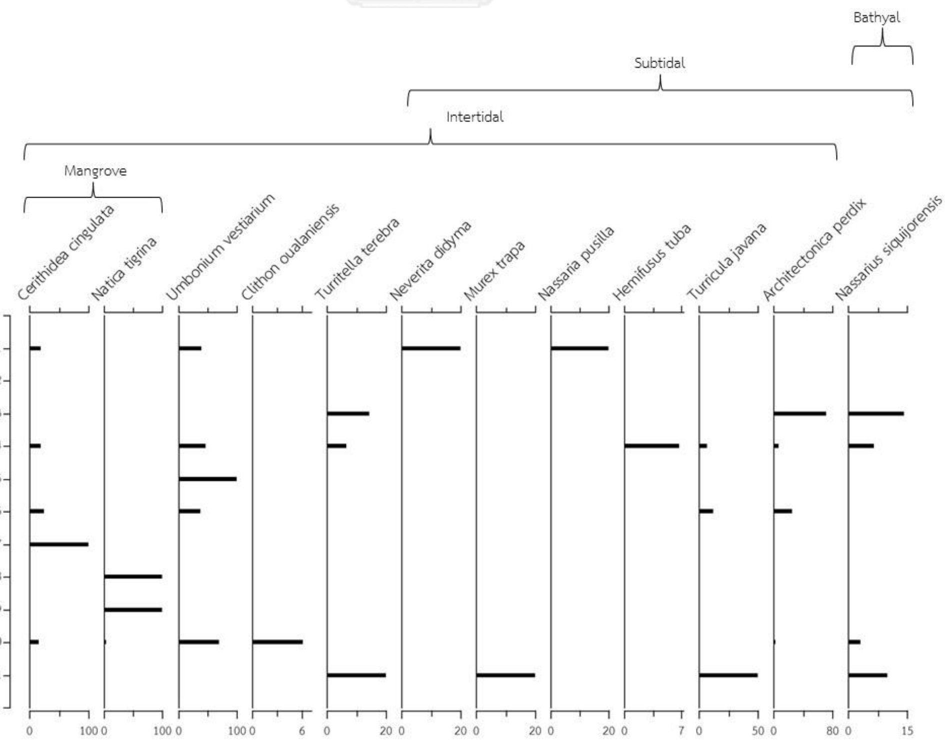


Figure 4.2 Chart of Gastropoda sorting by habitat (%) (X axis is species of mollusca, Y axis is sampling location).

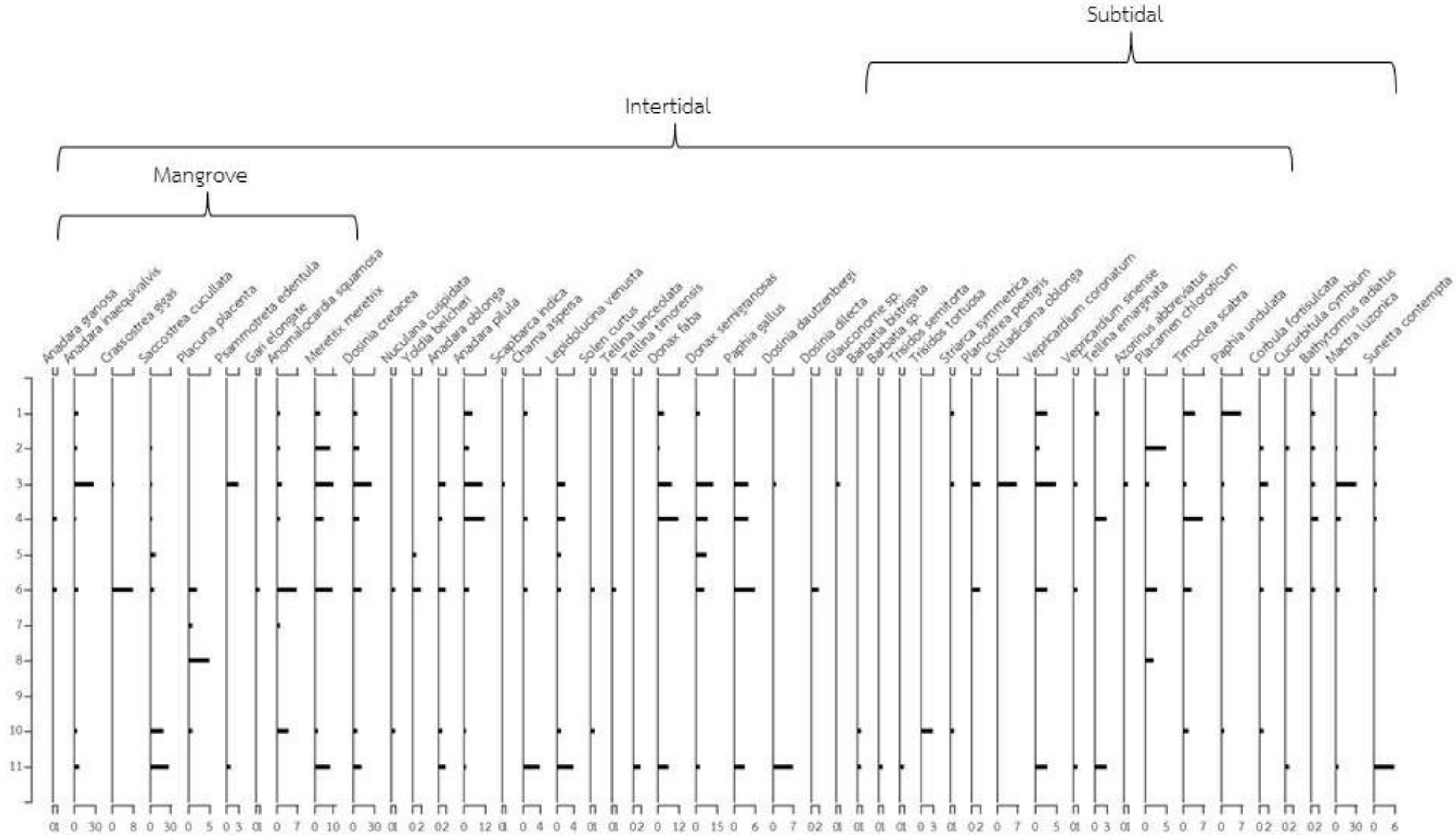


Figure 4.3 Chart of Bivalvia sorting by habitat (number) (X axis is species of mollusca, Y axis is sampling location).

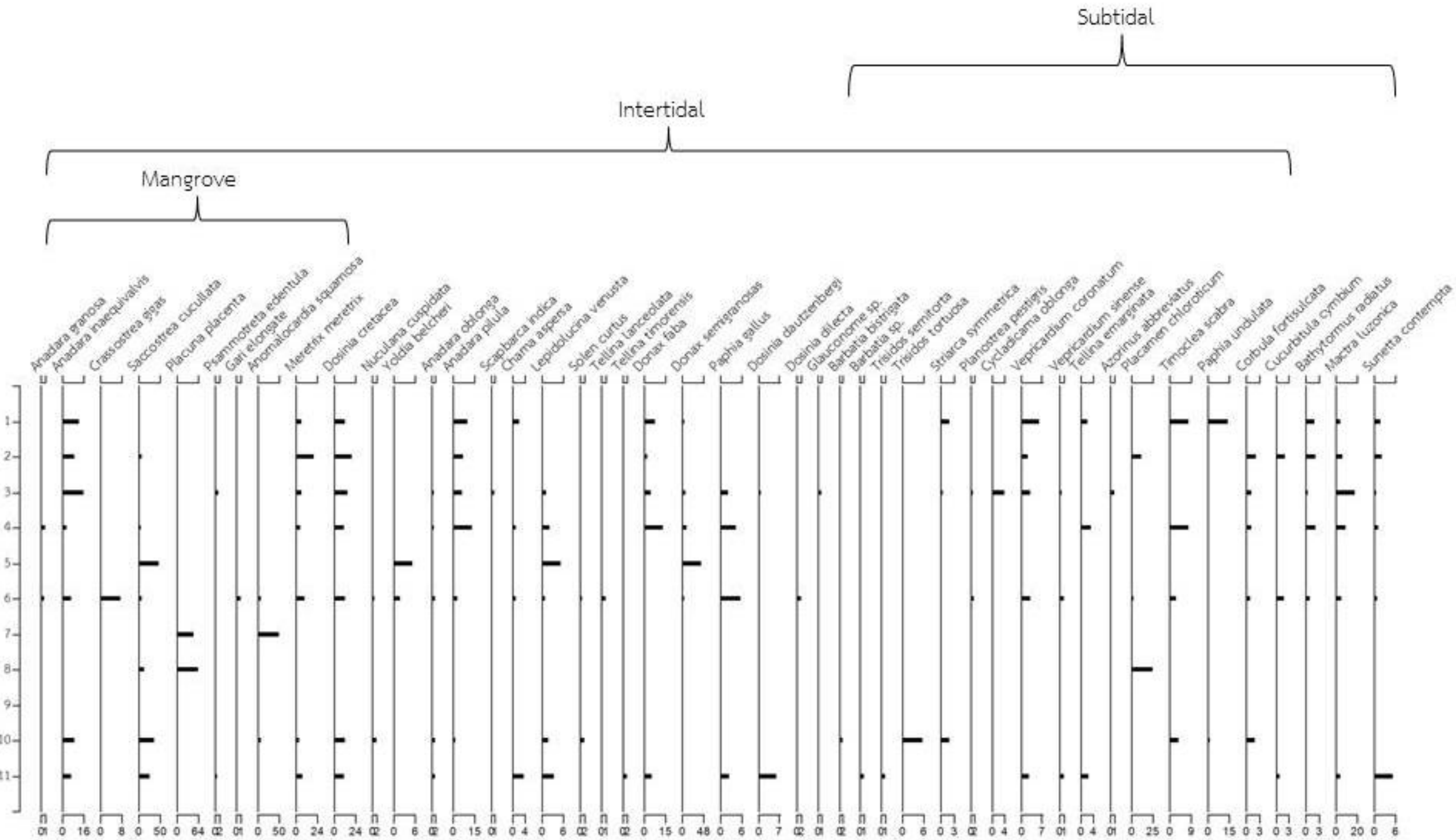


Figure 4.4 Chart of Bivalvia sorting by habitat (%) (X axis is species of mollusca, Y axis is sampling location).

4.2 Middle to late Holocene paleogeography

Paleogeographic reconstructions of the inland coastal zone of the Gulf of Thailand, from the Central Plains of Thailand, have been rarely published (Umitsu et al., 2002). Along the coast of Gulf of Thailand, a few paleo-shoreline delineations were reported, for example, at Sam Roi Yot (Chalermlarp, 1990) and Chumphon (Phantuwongraj, 2010, Nimnate et al., 2015). At the Andaman Sea, episodic evolution of beach ridge plain at Phrathong Island was first reported by (Lansai, 2004) and recently published by (Brill et al., 2014). Notches and caves are commonly found in limestone bedrock from Phang Nga to Satun and fossil shells attached to notch walls were dated as indicator of paleo-sea level (Scheffers et al., 2012).

Coastal landforms around the Gulf of Thailand are somewhat different from those recognized along the west coast. Gulf of Thailand is classified as depositional coast with a distinct sequence of beach ridges, lagoons with broad marsh plains and tidal flats (Choowong, 2011). The most extensive invasion by the sea occurred in the central plain of Thailand where the Holocene transgression reached as far as 70 km to the north of Bangkok (Nutalaya and Rau, 1981). In the peninsula, the furthest landward transgression occurred at the east coast, at Nakon Srithammarat, reaching about 40 km inland from the present shoreline. In this study approximately determine the boundary of paleo-coastal landforms in relation to the gradual regression of sea level from the middle to late Holocene (Figures 4.5 and 4.6).

The recognition of paleo-bay and former tombolo highlights our better understanding in paleo-geographical evolution of the area in relation to records of sea level change in Thailand. However, unusually flooding by typhoons or storms in the past also led to an overwash of the low-lying areas along the coastline. Traces of washover sediment were recognized on top of baymouth spit. Baymouth bar was scoured and left behind the healed storm surge channel. Tropical storms and typhoons hit the coastline of Gulf of Thailand in 1952 (typhoon Vae); 1962 (tropical storm Harriet); 1989 (typhoon Gay); and 1997 (tropical storm Linda) (Williams et al., 2016). These events prove that Sam Roi Yot coastal zone was often affected by tropical storms and typhoons in the past.

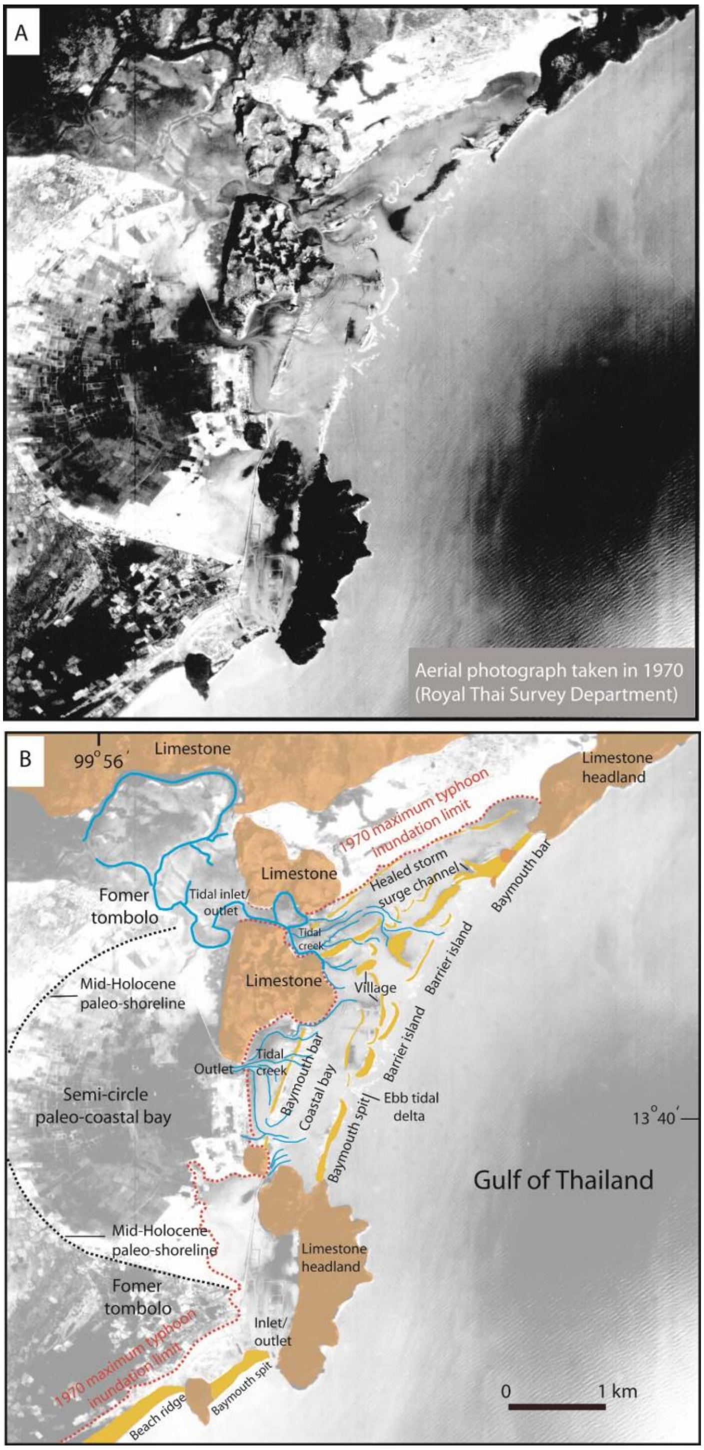


Figure 4.5 (A) Air-photo taken in 1970 showing former tombolos and semi-circle paleo-coastal bay formed in the middle Holocene. (B) After tropical storm Harriet (1962) left behind the erosional features, a decadal scale of small barrier system was reconstructed.

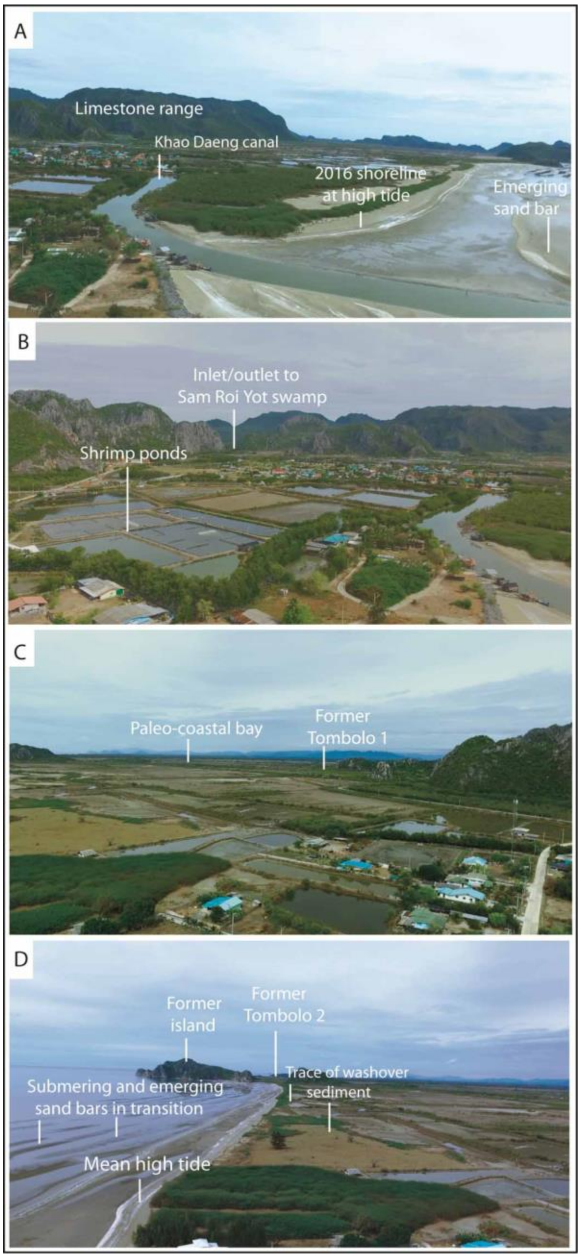


Figure 4.6 Oblique view of recent morphology of barrier system. (A) Khao Daeng canal is the main transporting route to supply land sediment to the coast. Trace of present normal high tide in 2016 and subaqueous sand bar were also observed (looking northwest). (B) Inlet/outlet to SRY swamp is located far inland between limestone hills (looking northwest. (C) Locations of paleo-coastal bay and tombolo 1 are located far inland (looking southwest). (D) Trace of washover sediment, submerging and emerging sand bar in transition are found at the shore (looking south).

4.3 Shoreline Evolution

Based on Table 3.3, at the southern part of Kui Buri, OSL dating from 3 transects shows as follows.

At the first transect, the age of beach ridge reached up to 7,860 years ago, currently locating around 1,070 m away from recent shoreline. At the second transect, the age of beach ridge is up to 7,810 years ago, currently locates around 1,350 m away from recent shoreline. At the third transect, the age of ridge is up to 6,890 years ago, and currently locates around 1,700 m away from recent shoreline. In the north of Kui Buri, one longest transect shows the age of beach ridge up to 7,940 years ago, currently locates around 3,800 m away from recent shoreline.

At Sam Roi Yot area, there are 4 transects from the south to the north. At first transect, the age of beach ridge provides up to 6,260 years ago, currently locates around 1,450 m away from recent shoreline, second transect up to 4,650 years ago, currently around 1,900 m away from recent shoreline, and third transect up to 5,290 years ago, currently locates around 1,800 m away from recent shoreline. At final transect, the age of ridge is up to 5,140 years ago, currently locates around 1,670 m away from recent shoreline.

At the south of Pran Buri area, there are 2 transects of OSL dating. At first transect, the age of beach ridge is up to 10,200 years ago, currently locates around 300 m away from recent shoreline and second transect up to 9,610 years ago, currently at around 470 m away from recent shoreline. At the north of Pran Buri area, there are 2 transects. At first transect, the age of ridge is up to 7,680 years ago, currently around 750 m away from recent shoreline and second transect up to 6,510 years ago, currently around 940 m away from recent shoreline.

Based on the above-mentioned age dating results, the shoreline evolution around Kui Buri area can be classified into 7 periods. First period started from 7,000-8,000 years ago, second period started from 6,000-6,500 years ago, third period started from 5,000-5,500 years ago, fourth period started from 3,000-3,500 years ago, fifth period started from 2,000-2,500 years ago, sixth period started from 900-1,000 years ago and seventh period is the recent time.

At Sam Roi Yot area, results of dating provided the possible classification of shoreline evolution into 5 periods. First period started from 5,000-6,500 years ago, second period started from 4,000-5,000 years ago, third period started from 3,000-4,000 years ago, fourth period started from 1,500-3,000 years ago and fifth period is recent.

At Pran Buri area, dating results are available to classify the evolution of shoreline into 5 periods. First period started from 9,000-10,000 years ago, second period started from 6,500-8,000 years ago, third period started from 3,000-4,500 years ago, fourth period started from 1,800-2,500 years ago and fifth period is recent.

4.4 History of sea level change

Episodic coastal plain evolution in relation to sea level change has been reported from several parts of the Thai-Malay peninsula (Geyh et al., 1979, Tjia, 1996, Hesp et al., 1998, Mallinson et al., 2014, Culver et al., 2015). Sedimentological, paleontological, and geomorphological evidence help to define the Holocene coastal evolution of the Setiu wetland region, part of the lower Thai-Malay peninsula, in the last 7 millennia (Mallinson et al., 2014). A rapid sea level rise is suggested to have occurred between 5,700 and 3,000 years ago. Along the limestone and granite coasts of the Phang-nga Bay and Phuket (Andaman Sea), bio-erosive notches, benches of rock oysters, belts of boring bivalves and boring sea-urchins, as well as coral colonies were recognized. Since they occur in form of recent as well as dead or inactive formations, they were used to precisely determine past sea levels (Scheffers et al., 2012). Sedimentological and palynological investigations from the Great Songkhla Lake (middle peninsula) revealed that the area was one of the earliest mangrove environments in Southeast Asia (8,420-8,190 cal. Yr BP), which was subsequently replaced by a freshwater swamp at 7,880-7,680 cal. yr BP, owing to the decline of marine influence (Horton et al., 2005). Sea level observations from the Great Songkhla Lake and the other areas of the Malay-Thai Peninsula also reveal an upward trend of Holocene relative sea level from a minimum of -22 m at 9,700-9,250 cal. yr BP to a mid-Holocene high stand of 4,850-4,450 cal. yr BP, which equates to a rise of c. 5.5 mm/yr (Horton et al., 2005). In the Chumphon estuary, located in the upper part of the Thai peninsula, a series of beach ridge plains which formed as spit were recognized as far as 10 km inland from the present shoreline. Progradation of beach ridge plains started after the sea had reached highstand at around 6,500 cal. yr BP (Nimnate et al., 2015).

In this study, relative sea level curves from the Thai-Malay peninsula were compiled (Figure 4.7). We also propose a revised relative sea level curve from Sam Roi Yot based on radiocarbon and OSL dating (Figure 4.7). C-14 dating results of fossils from the innermost to the outer parts of the former tidal flat within former tombolo 1 (see locations in Figure 2.7) provide ages of 7,360 ± 420, 2,200 ± 270 and 1,520 ± 250 years BP, respectively (Surakiatchai, 2005). Radiocarbon dating results from this study of oysters from the sea notch walls provide at least the period of time the oysters lived in and tentatively reflect breaks in the gradual regression, times when the sea level had been stable or come to a standstill, twice. The Sea level reached highstand about 6,500 years ago (Figure 4.8A) and presumably stagnated for 500-1,000 years, leading to the formation of the upper notch. Upper notches found inland (see Figures 3.2a and b) possibly formed at the limestone base during highstand. OSL dating data also unveil the initiation of an extensive progradation of beach ridge plain around 6,000 years ago. Series of continuous beach ridges reflect the start of a continuously falling sea level from 6,000 until 3,000 years ago, leading to the extensive progradation of beach ridge plain. The sea level seems to have remained stable once again from 3,000 to 900 years ago (Figure 4.8B). Middle notches, with living oysters, and large swale, between beach ridges, were formed during this second period of stable sea level.

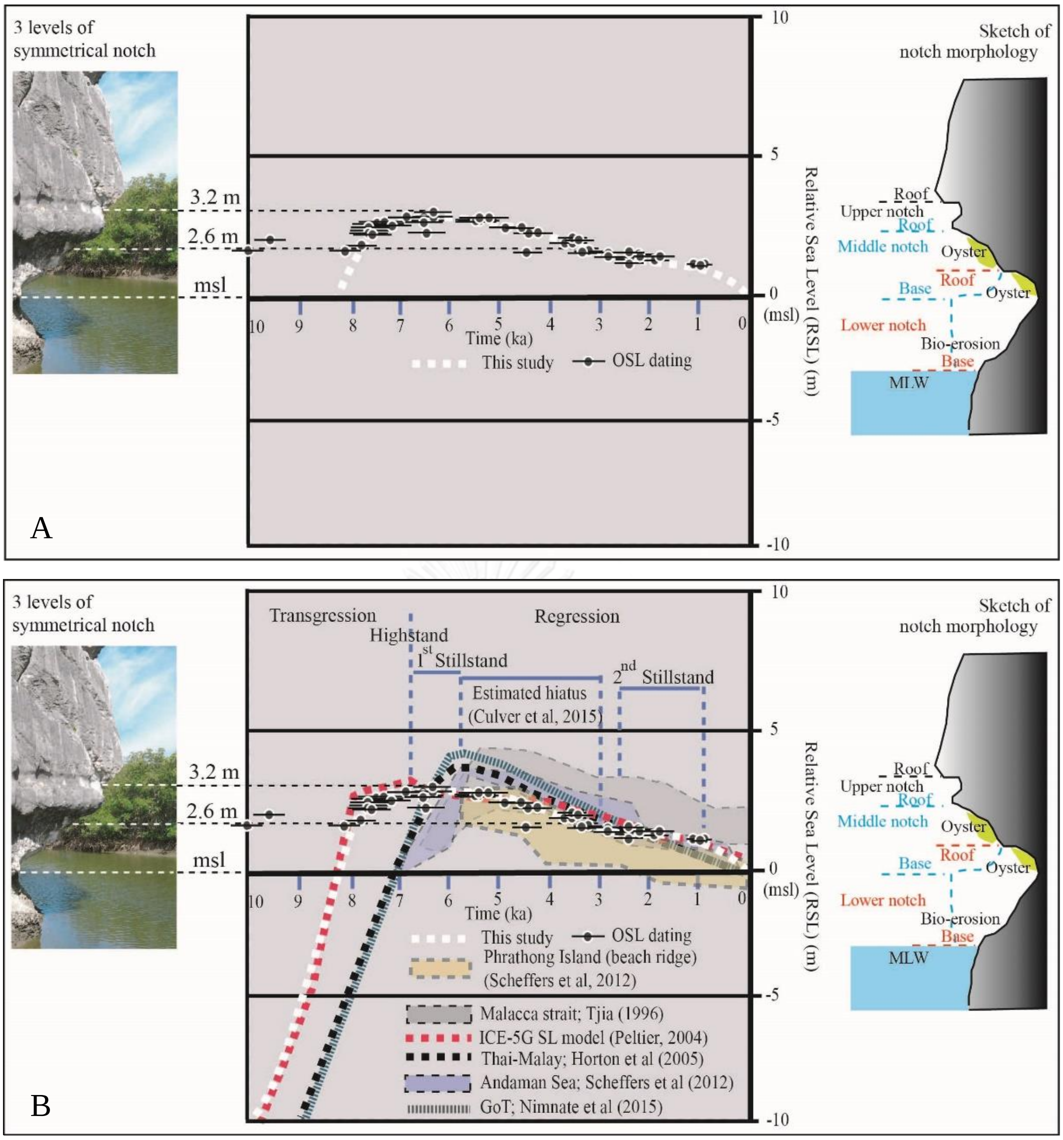


Figure 4.7 (A) Sea level curves of Sam Roi Yot. Three levels of sea notch (left) and sketch of notch morphology (right) showed correlation with sea level curve. (B) Compilation of sea level curves from Southeast Asia and South China Sea. Proposed revised sea level curve for Thailand (white dash-line).

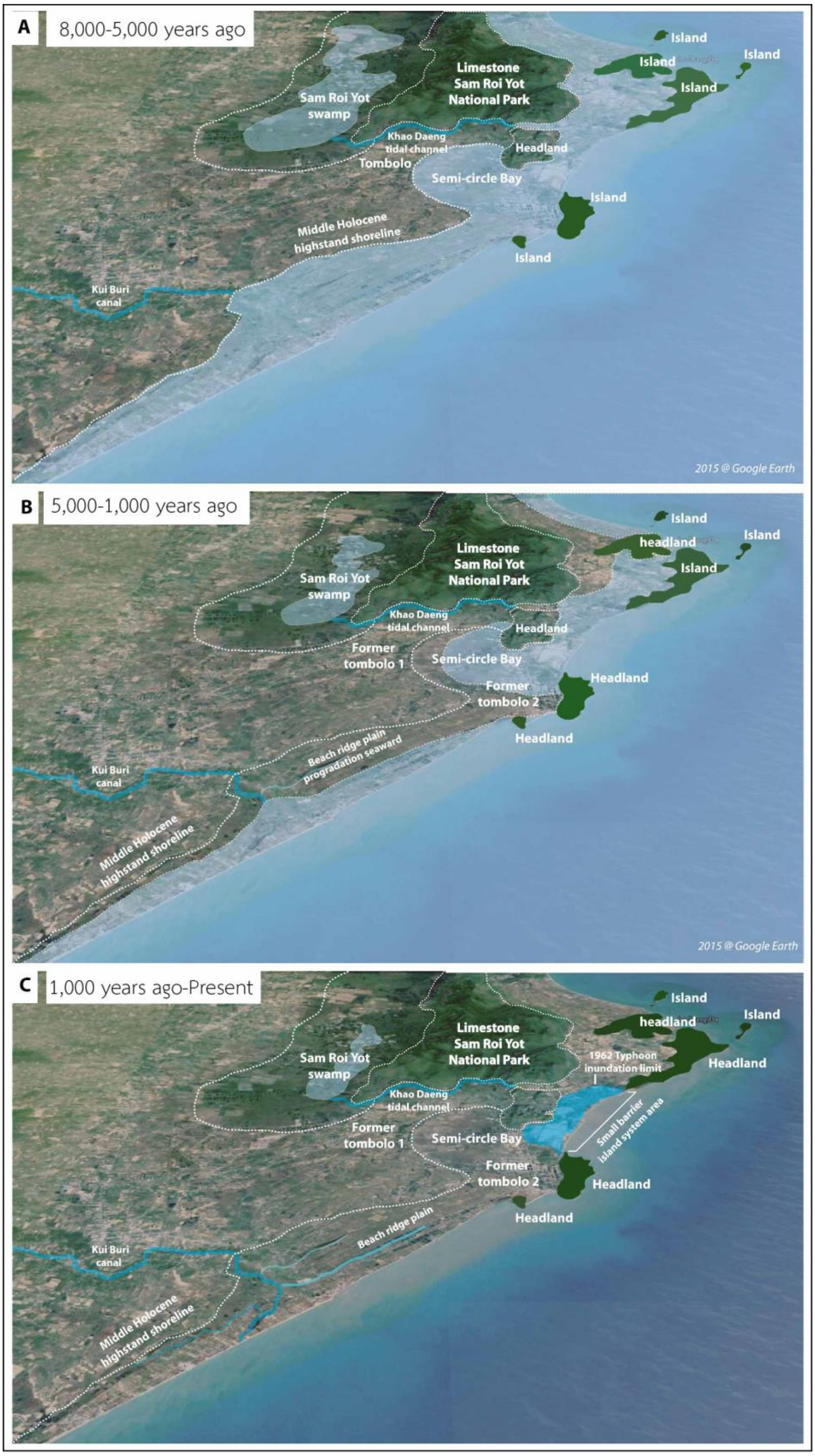


Figure 4.8 Reconstruction of paleogeography from Sam Roi Yot National Park. Background satellite image was taken from Google Earth.

CHAPTER 5
CONCLUSIONS

This study is aimed to construct the model showing paleogeography and history of sea level change during the Holocene from the east coast of the Gulf of Thailand. At Sam Roi Yot National Park, evidence of sea level change was deduced from paleo- and recent landforms. Series of aerial photographs from different periods of time provide clues of paleo-landforms and lead us to a better understanding of the paleogeography of this well-preserved coastal environment.

Overall, physical and biological evidence coupled with good chronology from this area unveil the history of sea level change, both transgressive and regressive formations. The set of innermost beach ridges is a significant transgressive formation, reported for the first time in this study. Results of OSL dating show the progradation of beach ridges landward after the sea reached highstand around 7,800 years ago. The formation of solution sea notches, bio-erosion at the base of limestone and C-14 dating of oyster fossils, attached to sea notch walls, are supporting physical and biological clues to confirm the sea level at different periods of time. All the geological, geomorphological and biological evidence guided us to a successful reconstruction of the paleogeography, in close relation to the history of sea level change.

Up to 57 molluscan species (Gastropoda: 12/Bivalvia: 45) species belongings to 45 genera (Gastropoda: 12/Bivalvia: 33) and 31 familiar (Gastropoda: 10/Bivalvia: 21) were investigated from 11 localities: M1 to M11 (Table 5.1). They are *Umbonium vestiarium*, *Clithon oualaniensis*, *Turritella terebra*, *Cerithidea cingulata*, *Neverita didyma*, *Natica tigrina*, *Murex trapa*, *Nassaria pusilla*, *Nassarius siquijorensis*, *Hemifusus tuba*, *Turricula javana*, *Architectonica perdix*, *Nuculana cuspidata*, *Yoldia belcheri*, *Barbatia bistrigata*, *Barbatia* sp., *Trisidos semitorta*, *Trisidos tortuosa*, *Anadara granosa*, *Anadara oblonga*, *Anadara inaequivalvis*, *Anadara pilula*, *Scapbarca indica*, *Striarca symmetrica*, *Planostrea pestigris*, *Crassostrea gigas*, *Saccostrea cucullata*, *Placuna placenta*, *Chama aspersa*, *Cycladicama oblonga*, *Lepidolucina venusta*, *Bathytormus radiatus*, *Vepricardium coronatum*, *Vepricardium sinense*, *Mactra luzonica*, *Solen curtus*, *Tellina emarginata*, *Tellina lanceolata*, *Tellina* *timorensis*, *Psammotreta edentula*, *Gari elongate*, *Azorinus abbreviatus*, *Donax faba*, *Donax semigranosas*, *Sunetta contempta*, *Anomalocardia squamosal*, *Placamen chloroticum*, *Timoclea scabra*, *Meretrix meretrix*, *Paphia undulata*, *Paphia gallus*, *Dosinia cretacea*, *Dosinia dautzenbergi*, *Dosinia dilecta*, *Glauconome* sp., *Corbula fortisulcata* and *Cucurbitula cymbium*.

Refer to chapter 4, *Anadara inaequivalvis*, *Anadara pilula*, *Saccostrea cucullata*, *Anomalocardia squamosal*, *Meretrix meretrix* and *Dosinia cretacea* were found in most areas. They indicate the intertidal (mangrove) environment (Table 5.1). Refer to section 3.3 in chapter 3, at Kui Buri, sampling points are far about 3.8 km from recent shoreline indicating that paleoshoreline had been there since 7,940 years ago. At Sam Roi Yot, sampling point was about 2 km from recent shoreline confirm that paleoshoreline had been there since 6,260 years ago; whereas at Pran Buri paleoshoreline had been located about 1 km at 6,510 years ago. After that the regression had been occurred until reaching the mean sea level at the present shoreline.

Table 5.1 Summary of molluscan, their environment in the study area.

Area	**Species (Gastropoda/Bivalvia)**	**Depositional Environment**
M1	20 (4/16)	intertidal to subtidal
M2	14 (0/14)	intertidal (mangrove)
M3	32 (3/29)	intertidal to subtidal
M4	27 (7/20)	intertidal
M5	5 (1/4)	intertidal
M6	34 (4/30)	intertidal
M7	3 (1/2)	intertidal (mangrove)
M8	4 (1/3)	intertidal (mangrove)
M9	1 (1/0)	intertidal (mangrove)
M10	23 (6/17)	intertidal
M11	27 (4/23)	intertidal (mangrove)

Paleogeography of study areas from different time was summarized as follows.

At Kui Buri, the coastal plain formed as bay connecting to the open sea at 8,000-2,000 years ago. The tidal flat formed extensively at 1,999-1,000 years ago and then, the former and recent beach ridge and swale were subsequently formed.

At Sam Roi Yot, the area was a semi-enclosed bay at 6,500-2,000 years ago. Ridge and swale (former beach ridge plain) has been formed since 1,999-1,000 years ago.

At Pran Buri, it was the open sea at 10,000-2,000 years ago. Ridge and swale (former beach ridge plain) has been formed since 1,999-1,000 years ago (Table 5.2).

Table 5.2 Summary of Paleogeography in the study area.

Area	**Age (Year)**	**Paleoenvironment**
Kui Buri	8,000-2,000	Open Sea
	1,999-1,000	Tidal Flat
	Recent	Ridge and Swale (Former Beach)
Sam Roi Yot	6,500-2,000	Bay
	1,999-1,000	Ridge and Swale (Recent Beach)
	Recent	Ridge and Swale (Former Beach)
Pran Buri	10,000-2,000	Open Sea
	1,999-1,000	Ridge and Swale (Recent Beach)
	Recent	Ridge and Swale (Former Beach)

REFERENCES

Aitken, M. J. (1985). Thermoluminescence dating. London, Academic Press.

Brill, D., K. Jankaew, N.-P. Neubauer, D. Kelletat, A. Scheffers, A. Vött and H. Brückner (2014). "Holocene coastal evolution of southwest Thailand–implications for the site-specific preservation of palaeotsunami deposits." Zeitschrift für Geomorphologie **58**(3): 273-303.

Chalermlarp, S. (1990). Systematization of geological information for land management: a case study of Changwat Prachuap Khiri Khan. Department of Geology. Bangkok, Thailand, Chulalongkorn University. **M.Sc. thesis:** 252.

Choowong, M. (2002). The geomorphology and assessment of indicators of sea-level changes to study coastal evolution from the Gulf of Thailand. Proceedings of International Symposium on "Geology of Thailand", Department of Mineral Resources, Thailand.

Choowong, M. (2011). Quaternary. Book Series on Geology of Thailand. M. F. Ridd, Barber, A.J., Crow, M.J. Geological Society of London**:** 335-350.

Choowong, M., H. Ugai, T. Charoentitirat, P. Charusiri, V. Daorerk, R. Songmuang and R. Ladachart (2004). "Holocene biostratigraphical records in coastal deposits from sam roi yod national park, prachuap khiri khan, western thailand." The Natural History Journal of Chulalongkorn University **4**(2): 1-18.

Chucha-Em, T. (2007). ESR Dating of Sediments along Mae Tha Fault Zone, Changwat Chiang Mai, Northern Thailand. Department of Geology. Bangkok, Thailand, Chulalongkorn University. **Senior Project:** 58.

Culver, S. J., E. Leorri, D. J. Mallinson, D. R. Corbett and N. A. M. Shazili (2015). "Recent coastal evolution and sea-level rise, Setiu Wetland, Peninsular Malaysia." Palaeogeography, Palaeoclimatology, Palaeoecology **417**: 406-421.

Dusitapirom, U., M. Choowong and V. Daorerk (2008). "Analysis in genesis and pattern of limestone sea notches from Sam Roi Yot National Park, Phrachuap Kirikhan Province, Southern Thailand."

Geyh, M., H. Streif and H.-R. Kudrass (1979). "Sea-level changes during the late Pleistocene and Holocene in the Strait of Malacca." Nature **278**(5703): 441-443.

Hesp, P. A., C. C. Hung, M. Hilton, C. L. Ming and I. M. Turner (1998). "A first tentative Holocene sea-level curve for Singapore." Journal of Coastal Research: 308-314.

Horton, B. P., P. L. Gibbard, G. Mine, R. Morley, C. Purintavaragul and J. M. Stargardt (2005). "Holocene sea levels and palaeoenvironments, Malay-Thai Peninsula, southeast Asia." The Holocene **15**(8): 1199-1213.

Kazmer, M. and D. Taborosi (2012). "Bioerosion on the small scale–examples from the tropical and subtropical littoral." Hantkeniana **7**: 37-94.

Kelletat, D. H. (1997). "Mediterranean coastal biogeomorphology: processes, forms and sea-level indicators." BULLETIN-INSTITUT OCEANOGRAPHIQUE MONACO-NUMERO SPECIAL-: 209-226.

Lansai, C. (2004). Geomorphology of Phrathong Island, Andaman coast of Thailand. Department of Geology. Bangkok, Thailand, Chulalongkorn University. **B.Sc:** 65.

Mallinson, D. J., S. J. Culver, D. R. Corbett, P. R. Parham, N. A. M. Shazili and R. Yaacob (2014). "Holocene coastal response to monsoons and relative sea-level changes in northeast peninsular Malaysia." Journal of Asian Earth Sciences **91**: 194-205.

Nimnate, P., V. Chutakositkanon, M. Choowong, S. Pailoplee, S. Phantuwongraj, C. Sutiwanich, T. Hanpattanapanich, P. Charusiri, M. Udchachon and V. Daorerk (2015). "Evidence of Holocene sea level regression from Chumphon coast of the Gulf of Thailand." ScienceAsia **41**: 55-63.

Nutalaya, P. and J. Rau (1981). "Bangkok: the sinking metropolis." Episodes **4**(1981): 3-8.

Phantuwongraj, S. (2010). "Geological evidence of sea-level change: a preliminary investigation at Panag Tak area, Chumphon province, Thailand." Scientific congress of the Geological Society of Japan **2010**(0): 369-369.

Pirazzoli, P. A. (2005). Sea-level indicators, geomorphic. Encyclopedia of Coastal Science, Springer**:** 836-838.

Pirazzoli, P. A. and N. Evelpidou (2013). "Tidal notches: a sea-level indicator of uncertain archival trustworthiness." Palaeogeography, Palaeoclimatology, Palaeoecology **369**: 377-384.

Reimer, P. J., M. G. Baillie, E. Bard, A. Bayliss, J. W. Beck, P. G. Blackwell, C. B. Ramsey, C. E. Buck, G. S. Burr and R. L. Edwards (2009). "IntCal09 and Marine09 radiocarbon age calibration curves, 0–50,000 years cal BP." Radiocarbon **51**(04): 1111-1150.

Scheffers, A., D. Brill, D. Kelletat, H. Brückner, S. Scheffers and K. Fox (2012). "Holocene sea levels along the Andaman Sea coast of Thailand." The Holocene **22**(10): 1169-1180.

Sinsakul, S. (1992). "Evidence of quarternary sea level changes in the coastal areas of Thailand: a review." Journal of Southeast Asian Earth Sciences **7**(1): 23-37.

Sinsakul, S., M. Sonsuk and P. J. Hasting (1985). "Holocene sea levels in Thailand: Evidence and basis for interpretation." Journal of Geological Society Thailand **8**: 1-12.

Surakiatchai, P. (2005). Classification of gastropoda and bivalvia fossils from the Khao Sam Roi Yod National Park, Prachuap Khiri Khan Province, Thailand. Department of Geology. Bangkok, Thailand, Chulalongkorn University. **M.Sc thesis:** 117.

Swennen, C., R. Moolenbeek, N. Ruttanadakul, H. Hobbelink, H. Dekker and S. Hajisamae (2001). "The molluscs of the southern Gulf of Thailand."

Takashima, I. and K. Watanabe (1994). "Thermoluminescence age determination of lava flows/domes and collapsed materials at Unzen volcano, SW Japan." Bulletin of the Volcanological Society of Japan **39**(1): 1-12.

Thiramongkol, N. (1983). Review of Geomorphology of Thailand. Proc. 1st Symposium on Geomorphology and Quaternary Geology of Thailand, Chulalongkorn Univ.

Tjia, H. D. (1996). "Sea-level changes in the tectonically stable Malay-Thai Peninsula." Quaternary International **31**: 95-101.

Umitsu, M., S. Tiyapairach, N. Chaimanee and K. Kawase (2002). Late Holocene sea-level change and evolution of the Central Plain, Thailand. The Proceedings of the Symposium on Geology of Thailand.

Williams, H., M. Choowong, S. Phantuwongraj, P. Surakietchai, T. Thongkhao, S. Kongsen and E. Simon (2016). "Geologic records of Holocene typhoon strikes on the Gulf of Thailand coast." Marine Geology **372**: 66-78.

APPENDICES

Appendix A Step of OSL dating

Show step by step of OSL dating method.

Samples Preparation

Part I: Annual dose (AD)

1. Weighting samples at approximately 500 grams.
2. Putting sample in the tray, then, spreading across dry at room temperature.
3. Crushing sample using a stone mortar and then sieving samples using sieve sizes of 20 mesh (less than 0.84 mm) diameter 20 cm.
4. Packing a sieved sample in a plastic container and sealed (sample 290 g).
5. Gamma ray spectrometry using to measuring the radiation dose of samples for Uranium (U), Thorium (Th) and Potassium (K).
6. Calculating the annual dose using U, Th and K contents.

Part II: Water content (W)

1. Weighing beakers and record value. (weight of beaker).
2. Putting samples in beakers and record in weight their. (weight of beaker plus wet sample).
3. Bringing this beaker contains the samples to the oven, until the sample is dry and then record weight value. (weight of beaker plus dry sample).

W (%) = [(wet sample-dry sample)/dry sample]/100…………………………….(eq.1)

Part III: Equivalent dose (ED) all steps must be prepared in the dark room.

1. Collecting sediments in PVC tube and sealed by duct tape to protect from sun light.
2. Using wet sieve through a sieve 80-200 mesh (0.177-0.074 mm) diameter 20 cm.
3. Keeping samples in plastic container and rinsing with clean water to clean up contaminated and soil.

4. Soaking samples in 24% hydrofluoric acid (HF) for 20 minutes to eliminate the feldspar into a clay mineral. Then wash the acid out.
5. Soaking samples in 24% hydrochloric acid (HCl) for 20 minutes to get rid of organic material. Then, washing the acid out.
6. Drying samples at a temperature of 40 ° C until dry.
7. Extractions iron minerals extracted from the sample by Iso dynamic magnetic separator or strong magnetic.
8. Preparing samples for X-Ray Diffraction (XRD) analysis.

   8.1 If the element quartz has not 100%

   - If samples still contain organic material or feldspar, need to repeat from step 4 and 5.
   - If the iron minerals are still present, repeat step 7.

   8.2 If samples contain almost 100% quartz, go to the next step 9.
9. Putting samples in a container, protected them from light.
   - Taking the sample to TL/OSL Controller machine.
   - Calculating equivalent dose, of the samples.

Samples Measurements

Part I: Annual dose (AD) for K, Th and U Measurements

- Putting the samples being analyzed in the Gamma Ray Spectrometer
- Turing on AkWin program show in Figure A.1
- Choosing Clear and left click as showing in Figure A.2, after choosing Analyzer in tool bar
- Choosing Analyzer in tool bar, chose Start and left click in Figure A.3
- Measuring the K, Th and U by 24 hours. Stopped show in the Anal: box in red cycle (Figure A.4) when finish.
- Choosing a File in tool bar, chose Save as… and left click in Figure A.5
- Naming by Sample name, date and Save in Figure A.6

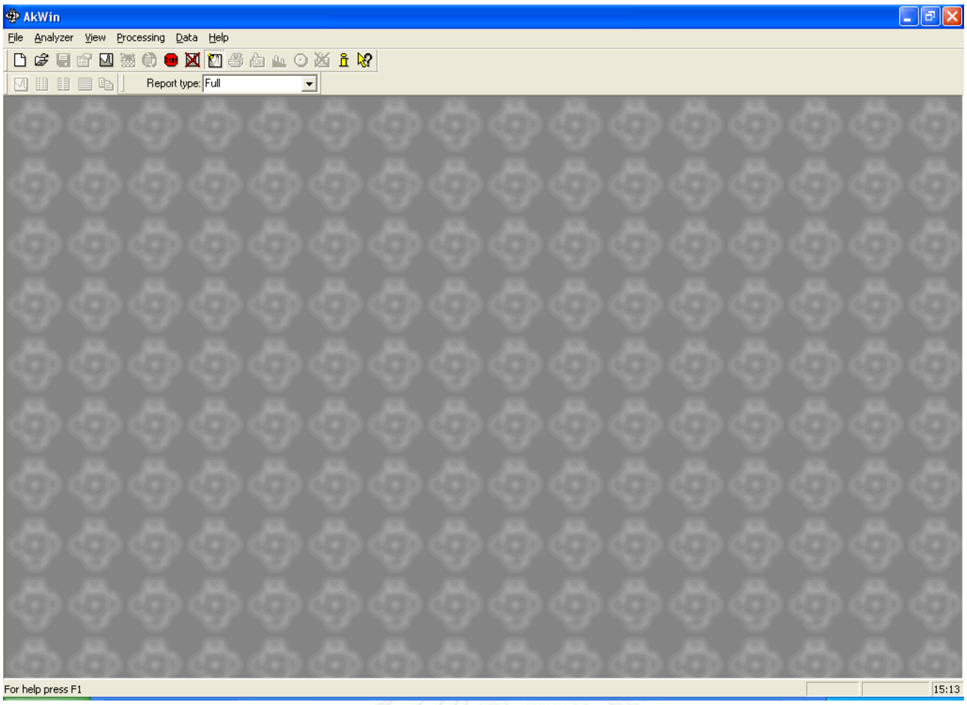


Figure A.1 Akwin program window when open.

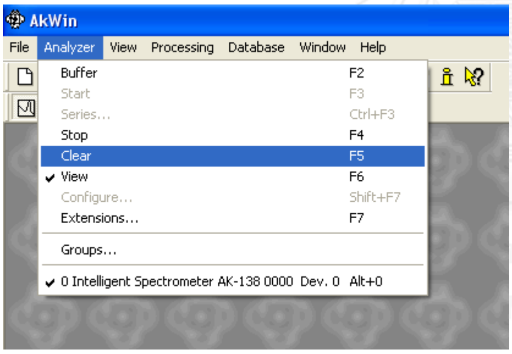


Figure A.2 Akwin program showing clear step.

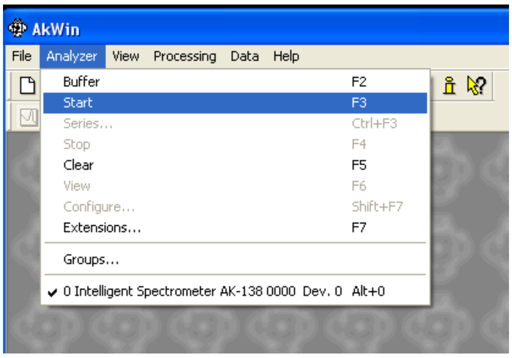


Figure A.3 Akwin program showing start step.

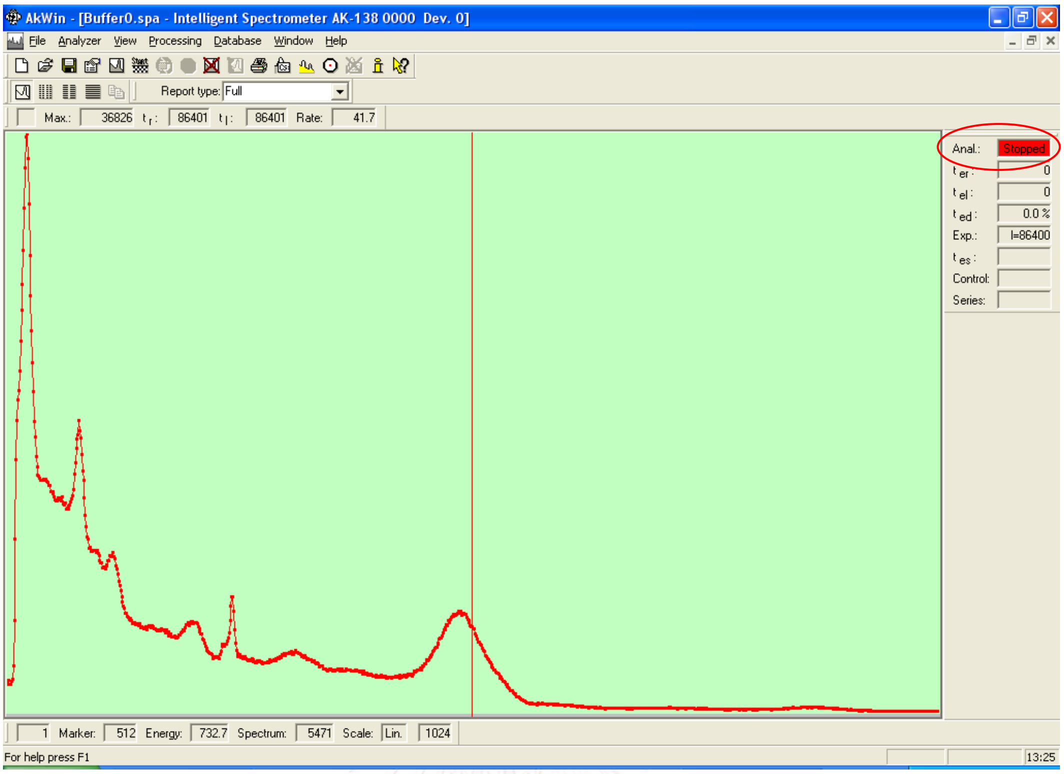


Figure A.4 Akwin program showing finish step.

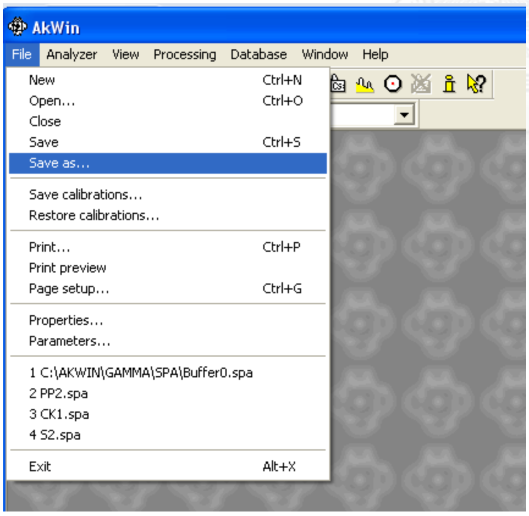


Figure A.5 Akwin program showing Save as step.

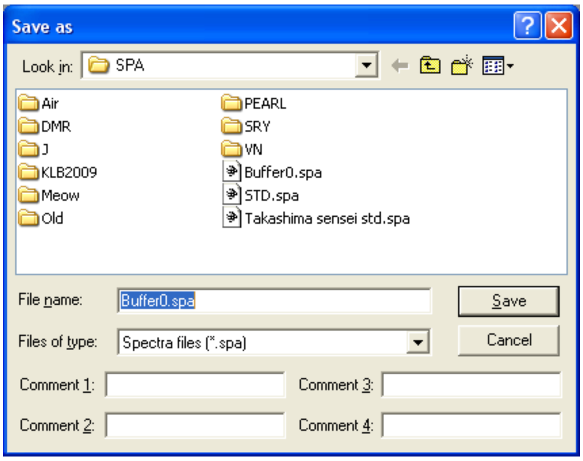


Figure A.6 Akwin program showing Save as window.

K, Th and U calculator

- Open AkWin program
- Chose File in tool bar, chose Open… and left click in Figure A.7
- Chose File are you want and left click on Open in Figure A.8
- After open file program show data K, U and Th in the red box in Figure A.9 as described in next step.

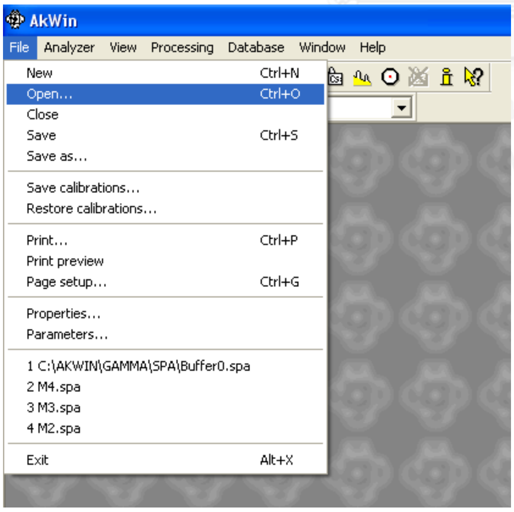


Figure A.7 Akwin program showing Open step.

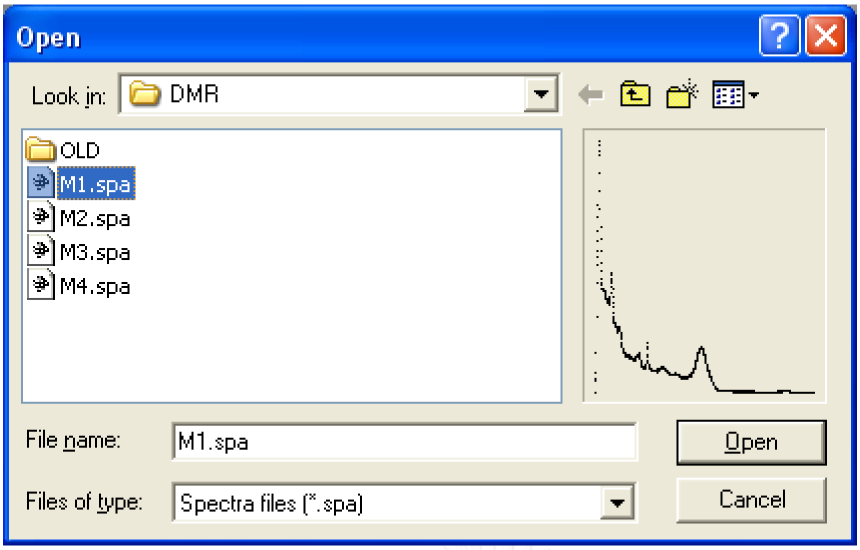


Figure A.8 Akwin program showing Open window.

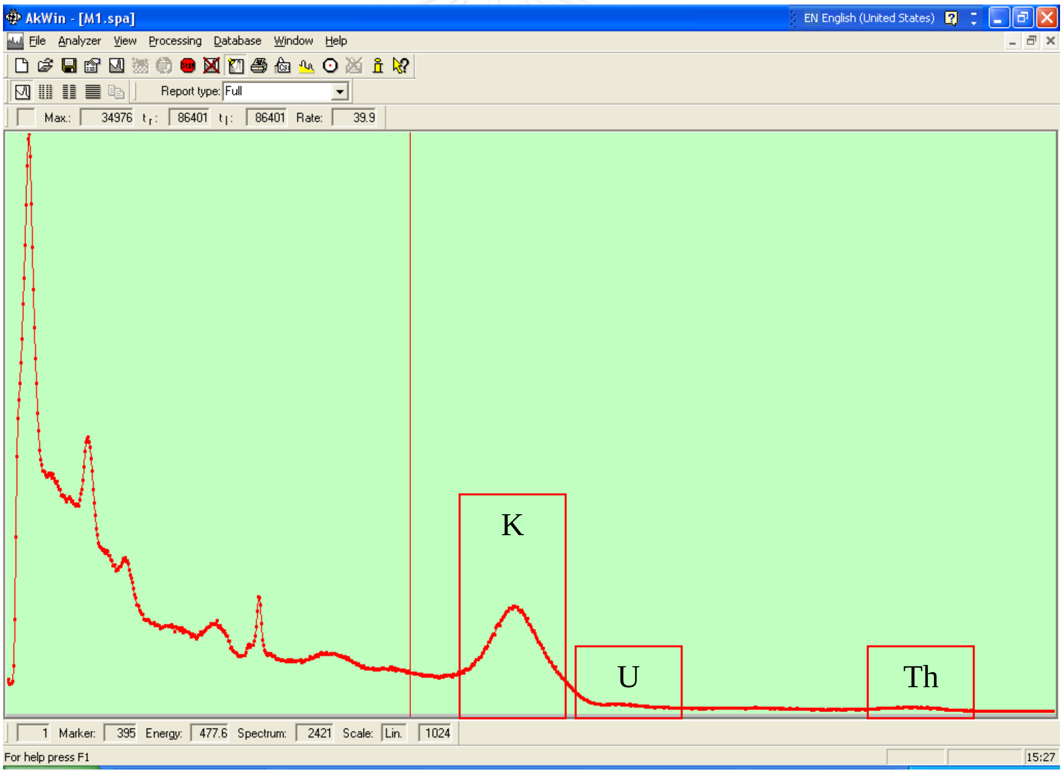


Figure A.9 Akwin program showing K, U and Th curve.

- Count K value by red line in center of K curve in Figure A.10, record Spectrum value by count from center of K curve to left direction 40 values and right direction 40 value totals are 81 values include center point.

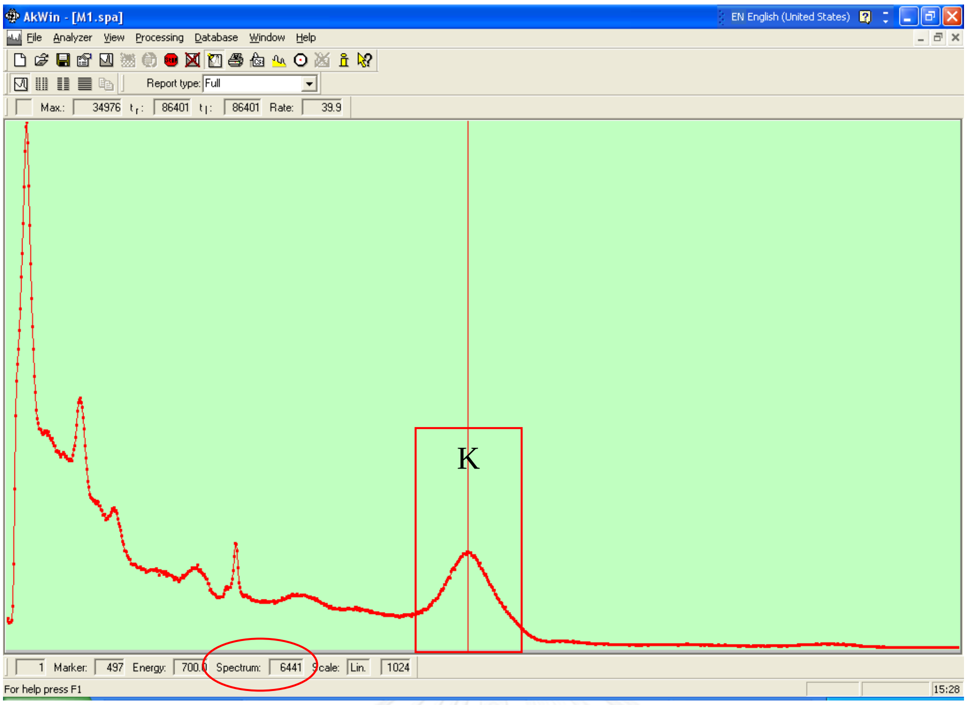


Figure A.10 Akwin program showing K curve.

- Count U value by red line in center of U curve in Figure A.11, record Spectrum value by count from center of U curve to left direction 20 values and right direction 20 value totals are 41 values include center point.

Figure A.11 Akwin program showing U curve.

- Count Th value by red line in center of Th curve in Figure A.12, record Spectrum value by count from center of Th curve to left direction 30 values and right direction 30 value totals are 61 values include center point.

Figure A.12 Akwin program showing Th curve.

- K, U and Th value from above, record in Excel program and count of total in Figure A.13.

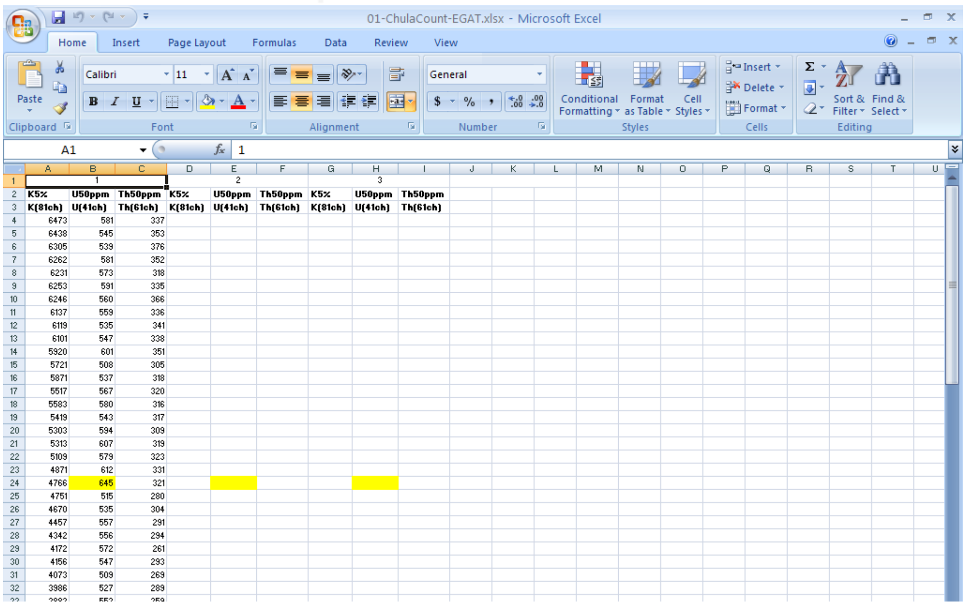


Figure A.13 Excel showing U (counts), Th (counts) and K (counts) value.

- Bring K, U and Th total value put in prepared Excel formula (red cycle) and get U, Th and K value (blue cycle), after that put this value to formula another Excel. (Figure A.14).

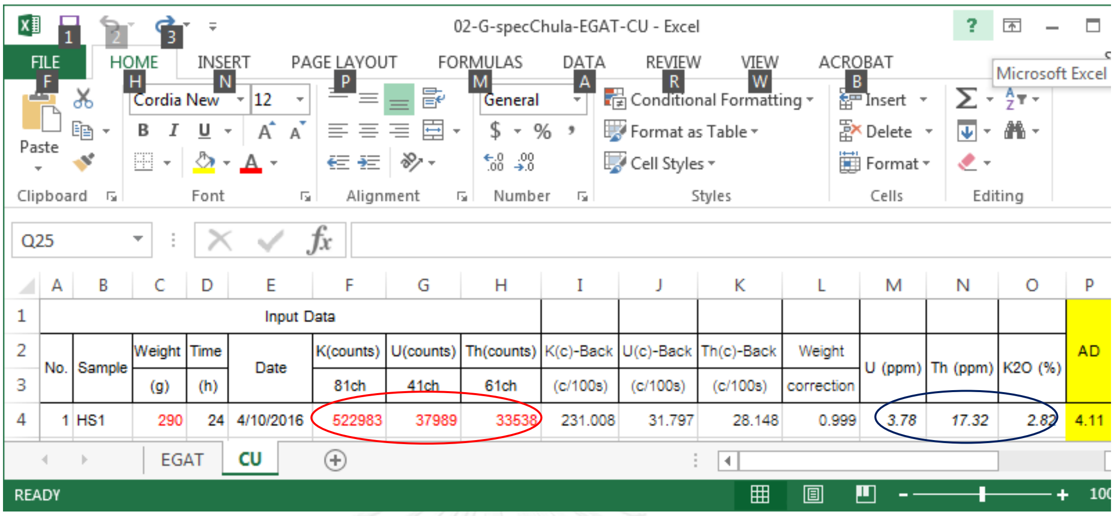


Figure A.14 Excel showing U (ppm), Th (ppm) and K (%) value.

- Bring U, Th and K value put Excel formula (blue cycle) after that get AD value (red cycle). (Figure A.15).

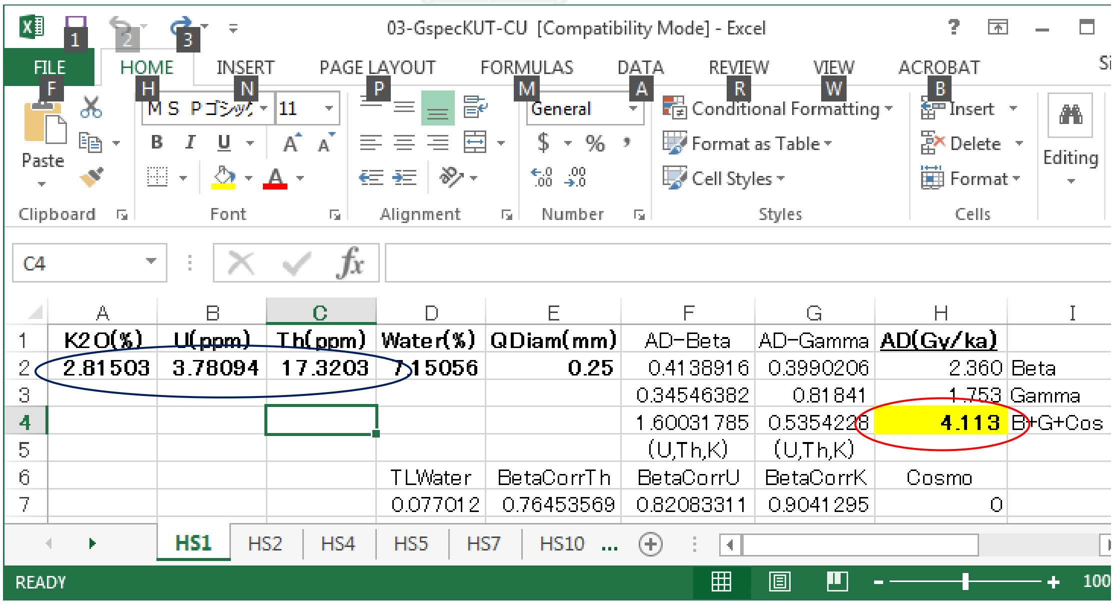


Figure A.15 Excel showing Annual dose value.

The annual dose calculation was done using the equation propost by Aitken (1985).

AD = (0.1148U+0.0514T+0.2069K) / (1+1.14W) + (0.1462U+0.0286T+0.6893K) B / (1+1.25W)…………………………………………………………………...…(eq.2)

Where,

U = concentration of uranium in ppm

T = concentration of thorium in ppm

K = concentration of potassium oxide (%)

B = beta dose attenuation in quartz grains (0.82)

W = water content (%/100)

Part II: Equivalent dose (ED) *all step to do in the dark room.*

OSL emission was measured by using the RISØ TL/OSL CONTROLLER MODEL DA-20.

1. Bringing quartz put in the tray and bring it in to the TL/OSL Controller by command as follows;

   + Step 1:

   - Running pre heat at temperature 220 ºC by 60 second.
   - Running OSL at temperature 125 ºC by 30 second (It is natural value: <u>N</u>).
   - Irradiating by beta 5 second.
   - Running pre heat at temperature 220 ºC by 10 second.
   - Running OSL at temperature 125 ºC by 30 second.

   + Step 2:

   - Irradiating by beta (e.g. 5, 10, 15 second), so that the value is lower than N.
   - Running pre heat at temperature 220 ºC by 10 second, to cut off the interference curve.
   - Running OSL at temperature 125 ºC by 30 second, will get the natural value plus beta1: <u>N+1β</u>.
   - Irradiating by beta 5 second.

- Running pre heat at temperature 220 ºC by 10 second.
- Running OSL at temperature 125 ºC by 30 second.

+ Step 3:

- Irradiating by double of N+1β (e.g. 10, 20, 30 second), so that the value is equal to N.
- Running pre heat at temperature 220 ºC by 10 second, to cut off the interference curve.
- Running OSL at temperature 125 ºC by 30 second, will get the natural value plus beta 2: N+2β.
- Irradiating by beta 5 second.
- Running pre heat at temperature 220 ºC by 10 second.
- Running OSL at temperature 125 ºC by 30 second.

+ Step 4:

- Irradiating by triple of N+1β (e.g. 15, 30, 45 second) so that the value is over than N.
- Running pre heat at temperature 220 ºC by 10 second, to cut off the interference curve.
- Running OSL at temperature 125 ºC by 40 second, will get the natural value plus beta 3: N+3β.
- Irradiating by beta 5 second.
- Running pre heat at temperature 220 ºC by 10 second.
- Running OSL at temperature 125 ºC by 30 second.

+ Step 5:

- Pause
- Running pre heat at temperature 220 ºC by 10 second, to cut off the interference curve.
- Running OSL at temperature 125 ºC by 40 second, to determine where the graph started.
- Irradiating by beta 5 second.
- Running pre heat at temperature 220 ºC by 10 second.
- Running OSL at temperature 125 ºC by 30 second.

+ Step 6:

- Irradiating by beta same step 2
- Running pre heat at temperature 220 °C by 10 second, to cut off the interference curve.
- Running OSL at temperature 125 ºC by 40 second, to check all previous steps. Does it affect the samples? If there is no or less than 10%, this analyze is acceptable.
- Irradiating by beta 5 second.
- Running pre heat at temperature 220 ºC by 10 second.
- Running OSL at temperature 125 ºC by 30 second.
- All step run in RISØ Sequence Editor program (Figure A.16)

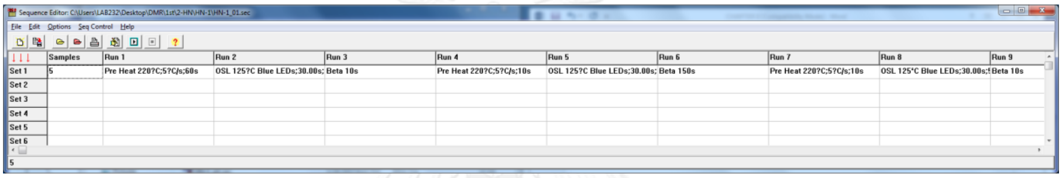


Figure A.16 Sequence Editor program.

- After Run all step will get OSL decay curve Figure A.17.

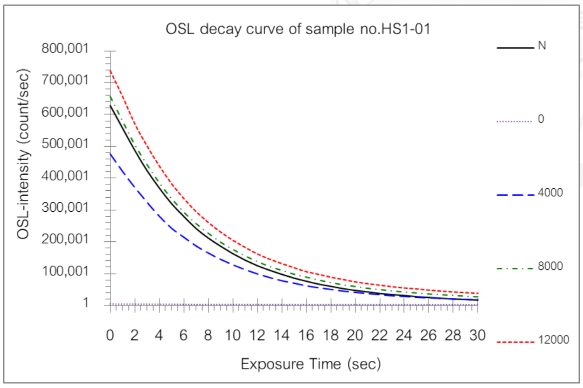


Figure A.17 OSL decay curve: Y axis = OSL-intensity (count/sec) and X axis = Exposure Time (second).

- Bring all value divide by N: N/N, N+1β/N, N+2β/N, N+3β/N after that gets Growth curve Figure A.18.

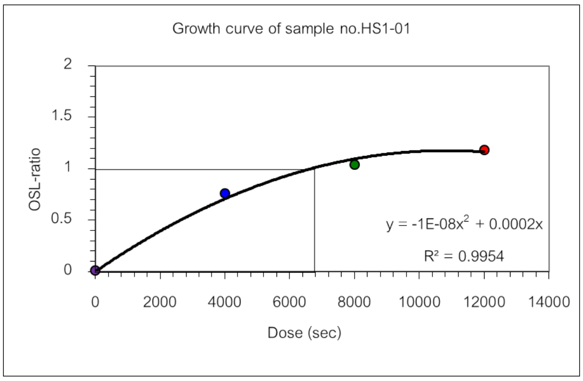


Figure A.18 Growth curve: Y axis = OSL-ratio and X axis = Dose (second).

- The result was open in RISØ Luminescence Analyst (Figure A.19), and left clicks at red cycle for open the curve.

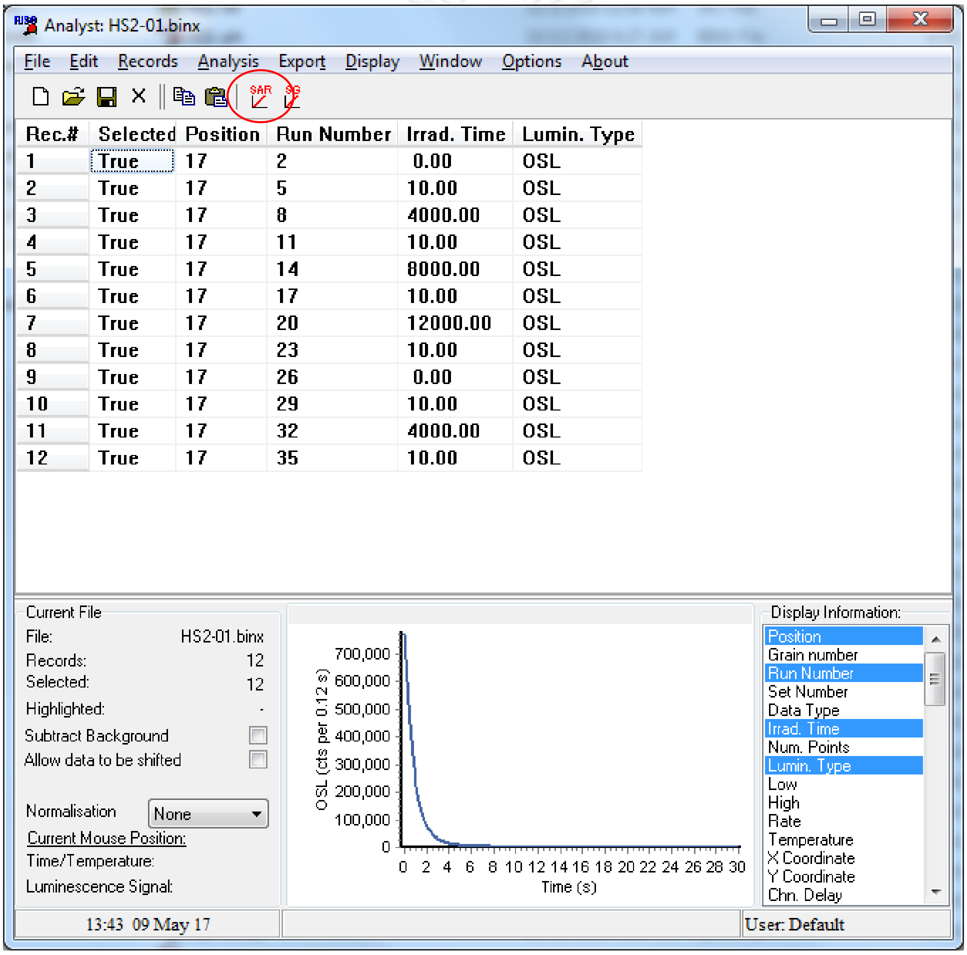


Figure A.19 RISØ Luminescence Analyst program showing the result.

- After left click at , in Disc number: (blue cycle) set to number Position in Figure A.19 and get ED value from ED (s): (red cycle) in Figure A.20.

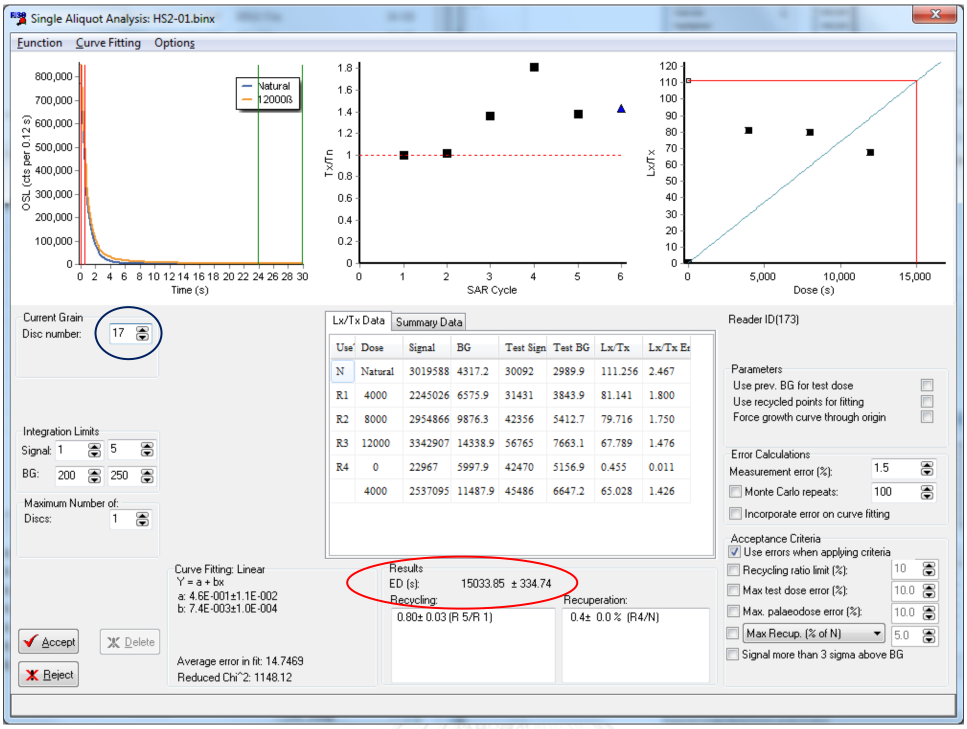


Figure A.20 RISØ Luminescence Analyst program showing the Equivalent dose value (red cycle).

OSL age = PD/AD……………………………………………………………...(eq.3)

Where,

PD = Equivalent dose (get from the RISØ Luminescence Analyst Figure A.20)

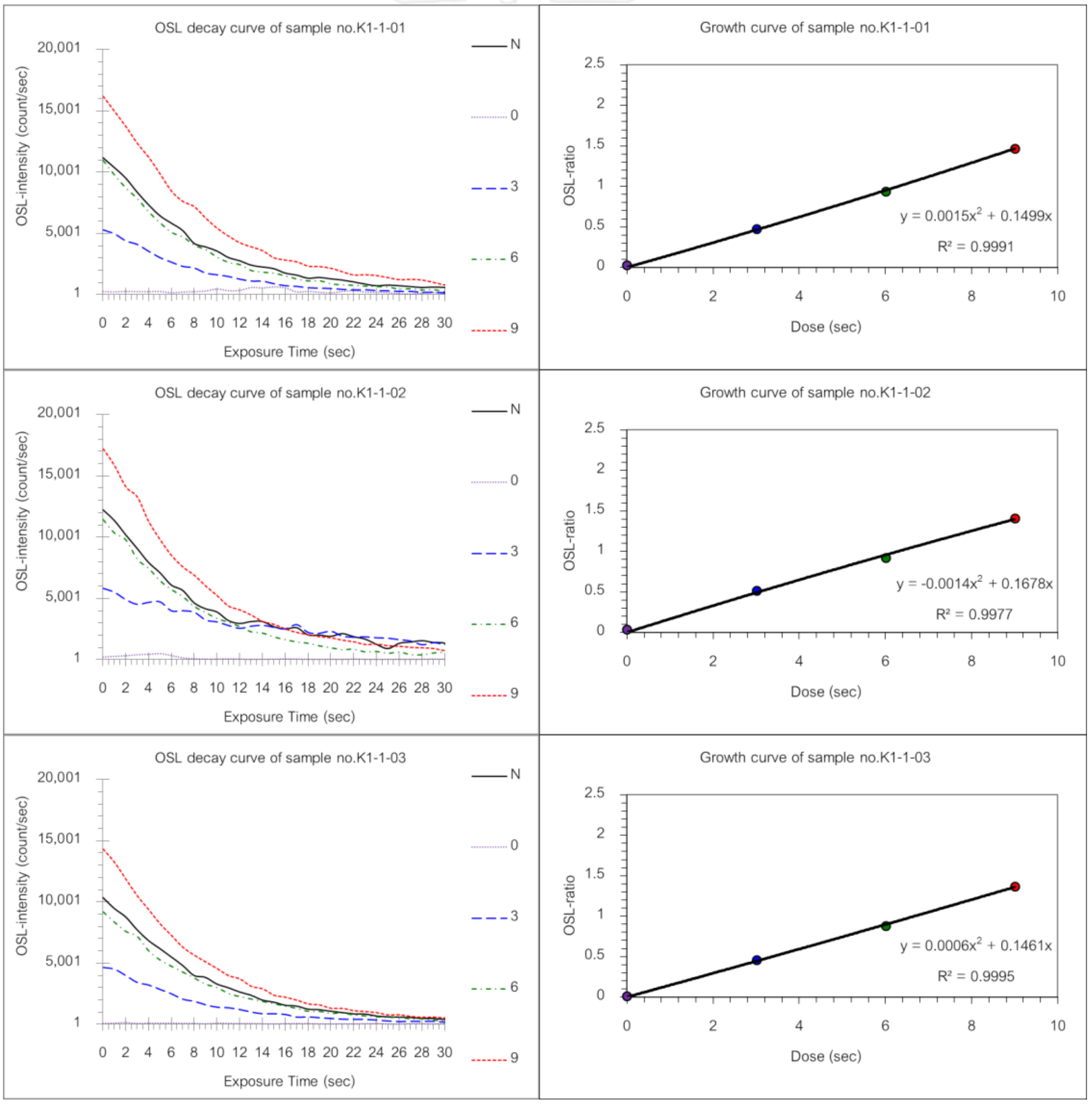
AD = Annual dose (get from Excel formula Figure A.15)

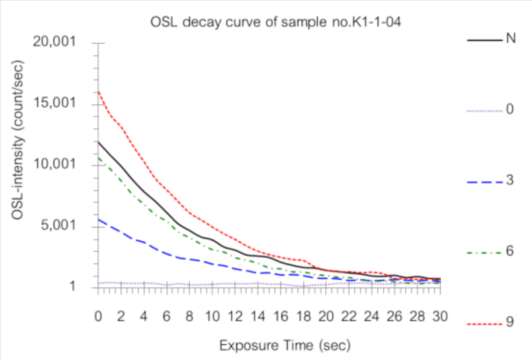
Appendix B OSL dating results

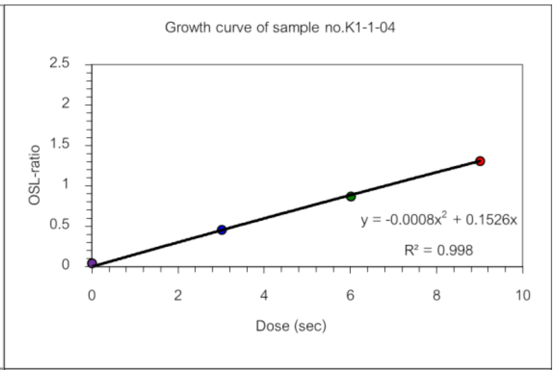
Show table of OSL dating results and figure of OSL decay curve (left) and Growth curve (right). Yellow highlight is select age.

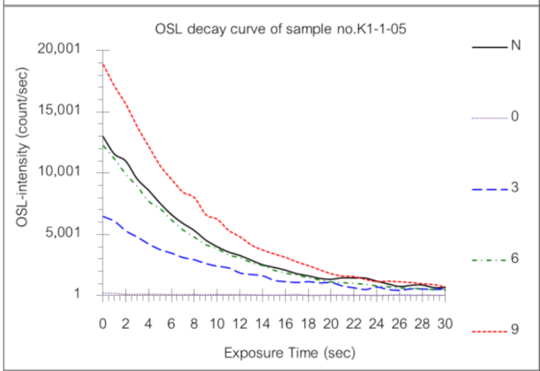
Table A.1 OSL dating results from beach ridge plain (Kui Buri, K1-1).

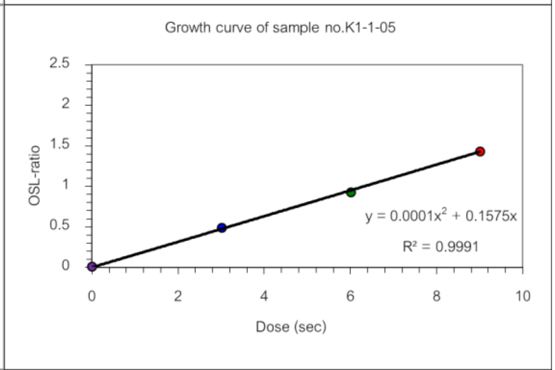
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K1-1-01	310	0.77±0.1	2.14±0.1	0.39±0.1	5.36	0.62±0.1	1.00±0.04	1,610±260
K1-1-02	310	0.77±0.1	2.14±0.1	0.39±0.1	5.36	0.62±0.1	0.68±0.02	1,220±210
K1-1-03	310	0.77±0.1	2.14±0.1	0.39±0.1	5.36	0.62±0.1	0.68±0.02	1,090±180
K1-1-04	310	0.77±0.1	2.14±0.1	0.39±0.1	5.36	0.62±0.1	0.68±0.02	1,580±280
K1-1-05	310	0.77±0.1	2.14±0.1	0.39±0.1	5.36	0.62±0.1	0.68±0.02	1,510±250
K1-1-06	310	0.77±0.1	2.14±0.1	0.39±0.1	5.36	0.62±0.1	0.68±0.02	1,680±280

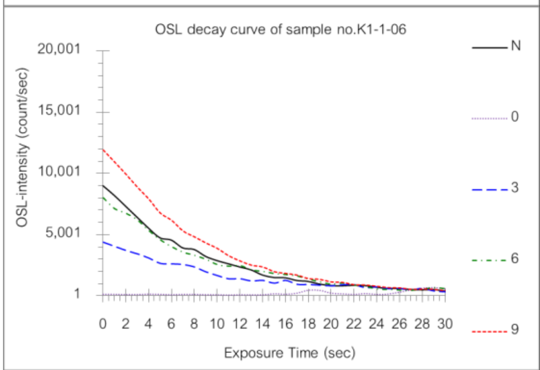



OSL decay curve of sample no.K1-1-04
OSL-intensity (count/sec)
Exposure Time (sec)
N
0
3
6
9


Growth curve of sample no.K1-1-04
OSL-ratio
Dose (sec)
y = -0.0008x2 + 0.1526x
R² = 0.998


OSL decay curve of sample no.K1-1-05
OSL-intensity (count/sec)
Exposure Time (sec)
N
0
3
6
9


Growth curve of sample no.K1-1-05
OSL-ratio
Dose (sec)
y = 0.0001x2 + 0.1575x
R² = 0.9991


OSL decay curve of sample no.K1-1-06
OSL-intensity (count/sec)
Exposure Time (sec)
N
0
3
6
9

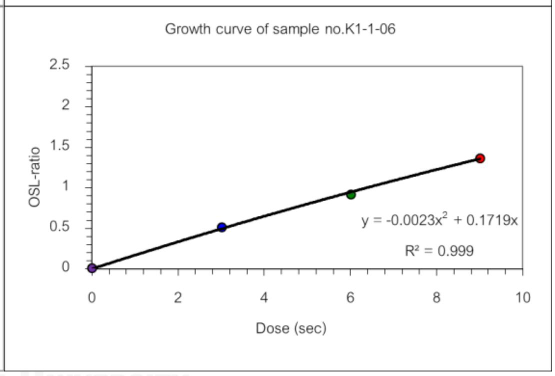
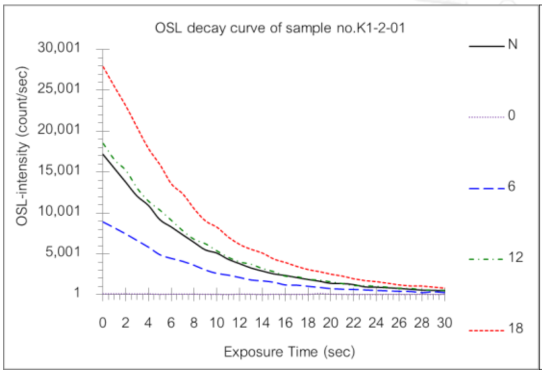
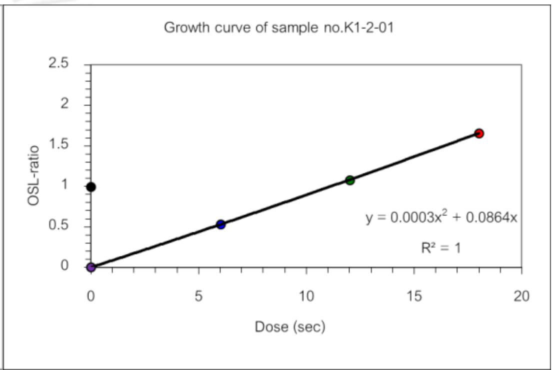
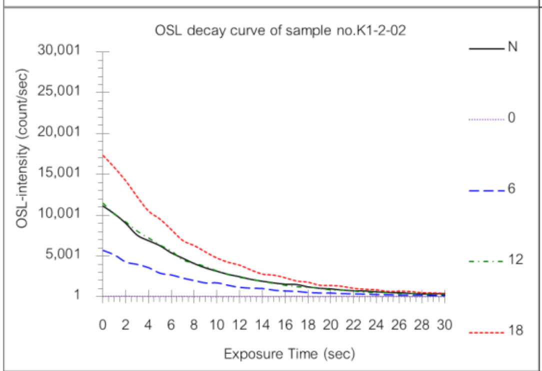

Growth curve of sample no.K1-1-06
OSL-ratio
Dose (sec)
y = -0.0023x2 + 0.1719x
R² = 0.999

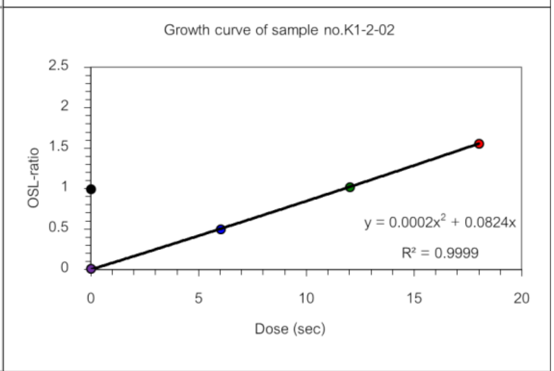
Table A.2 OSL dating results from beach ridge plain (Kui Buri, K1-2).

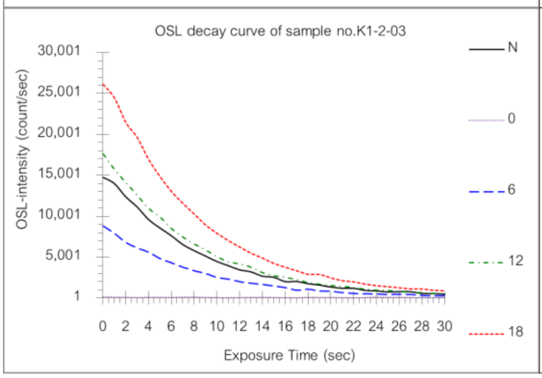
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K1-2-01	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	1.63±0.05	3,050±580
K1-2-02	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	1.73±0.09	3,250±630
K1-2-03	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	1.60±0.06	3,010±570
K1-2-04	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	1.29±0.04	2,410±450
K1-2-05	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	1.68±0.08	3,160±600
K1-2-06	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	2.05±0.07	3,840±730
K1-2-07	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	2.13±0.08	3,990±760
K1-2-08	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	1.36±0.05	2,560±480
K1-2-09	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	1.30±0.05	2,440±460
K1-2-10	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	1.44±0.05	2,700±510
K1-2-11	370	0.74±0.1	2.29±0.1	0.45±0.1	22.14	0.53±0.1	1.41±0.05	2,640±500

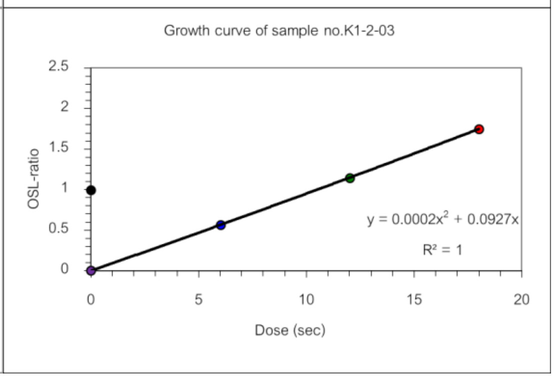


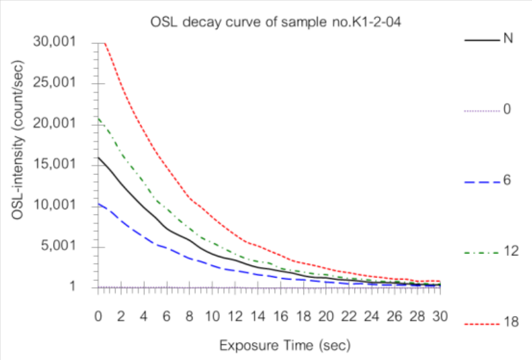


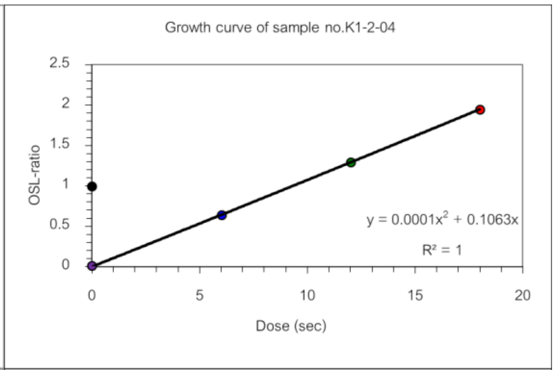


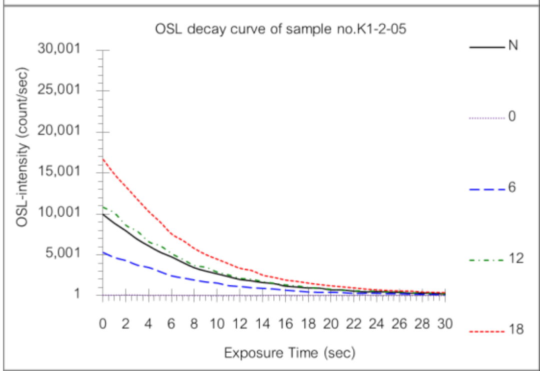


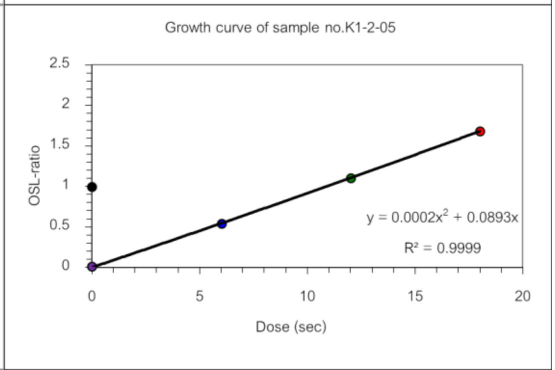


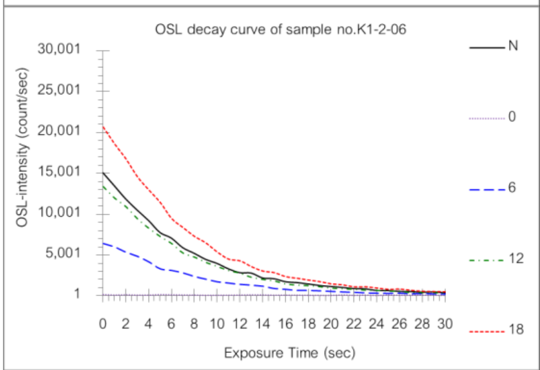


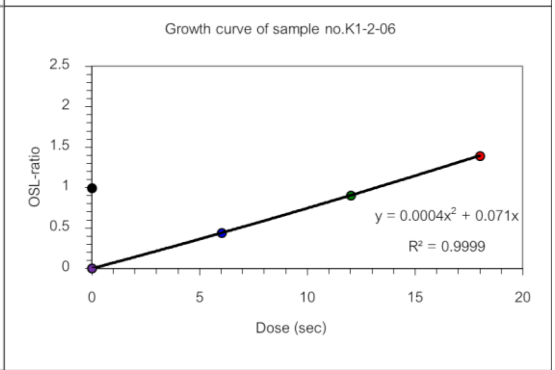

OSL decay curve of sample no.K1-2-04
OSL-intensity (count/sec)
Exposure Time (sec)
N
0
6
12
18

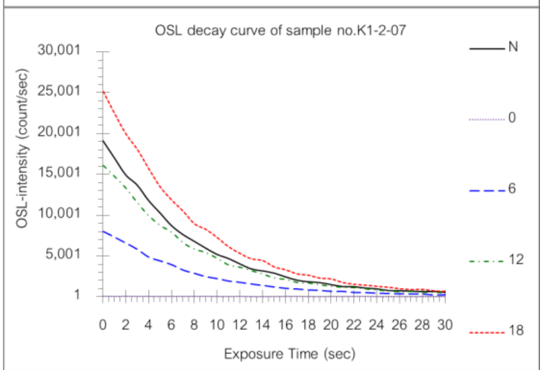

Growth curve of sample no.K1-2-04
OSL-ratio
Dose (sec)
y = 0.0001x2 + 0.1063x
R² = 1

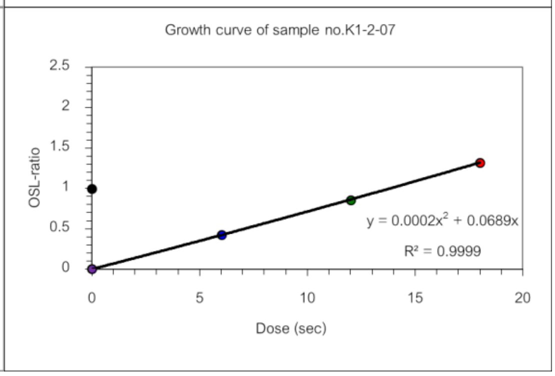

OSL decay curve of sample no.K1-2-05
OSL-intensity (count/sec)
Exposure Time (sec)
N
0
6
12
18


Growth curve of sample no.K1-2-05
OSL-ratio
Dose (sec)
y = 0.0002x2 + 0.0893x
R² = 0.9999


OSL decay curve of sample no.K1-2-06
OSL-intensity (count/sec)
Exposure Time (sec)
N
0
6
12
18


Growth curve of sample no.K1-2-06
OSL-ratio
Dose (sec)
y = 0.0004x2 + 0.071x
R² = 0.9999


OSL decay curve of sample no.K1-2-07
OSL-intensity (count/sec)
Exposure Time (sec)
N
0
6
12
18


Growth curve of sample no.K1-2-07
OSL-ratio
Dose (sec)
y = 0.0002x2 + 0.0689x
R² = 0.9999

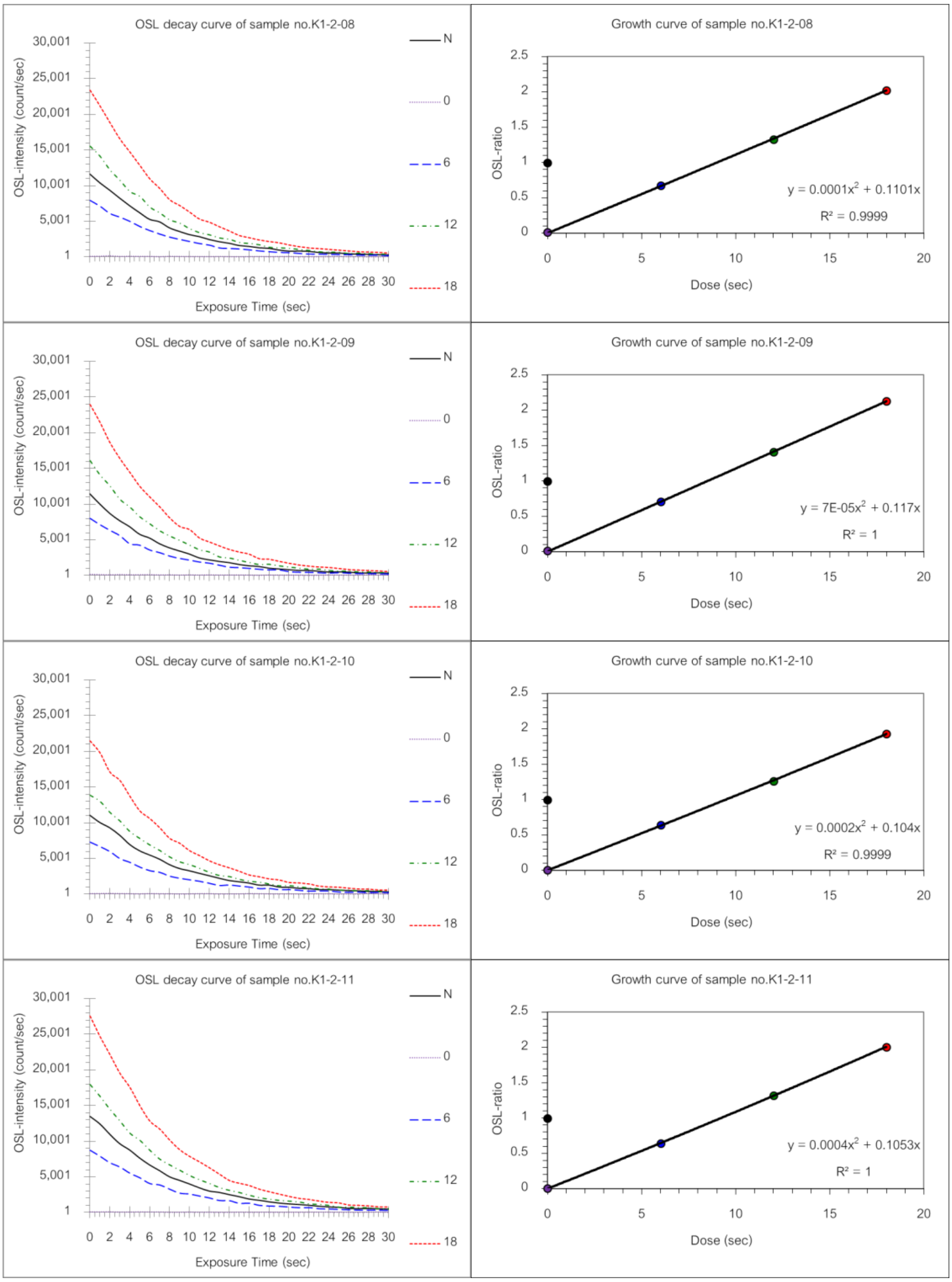
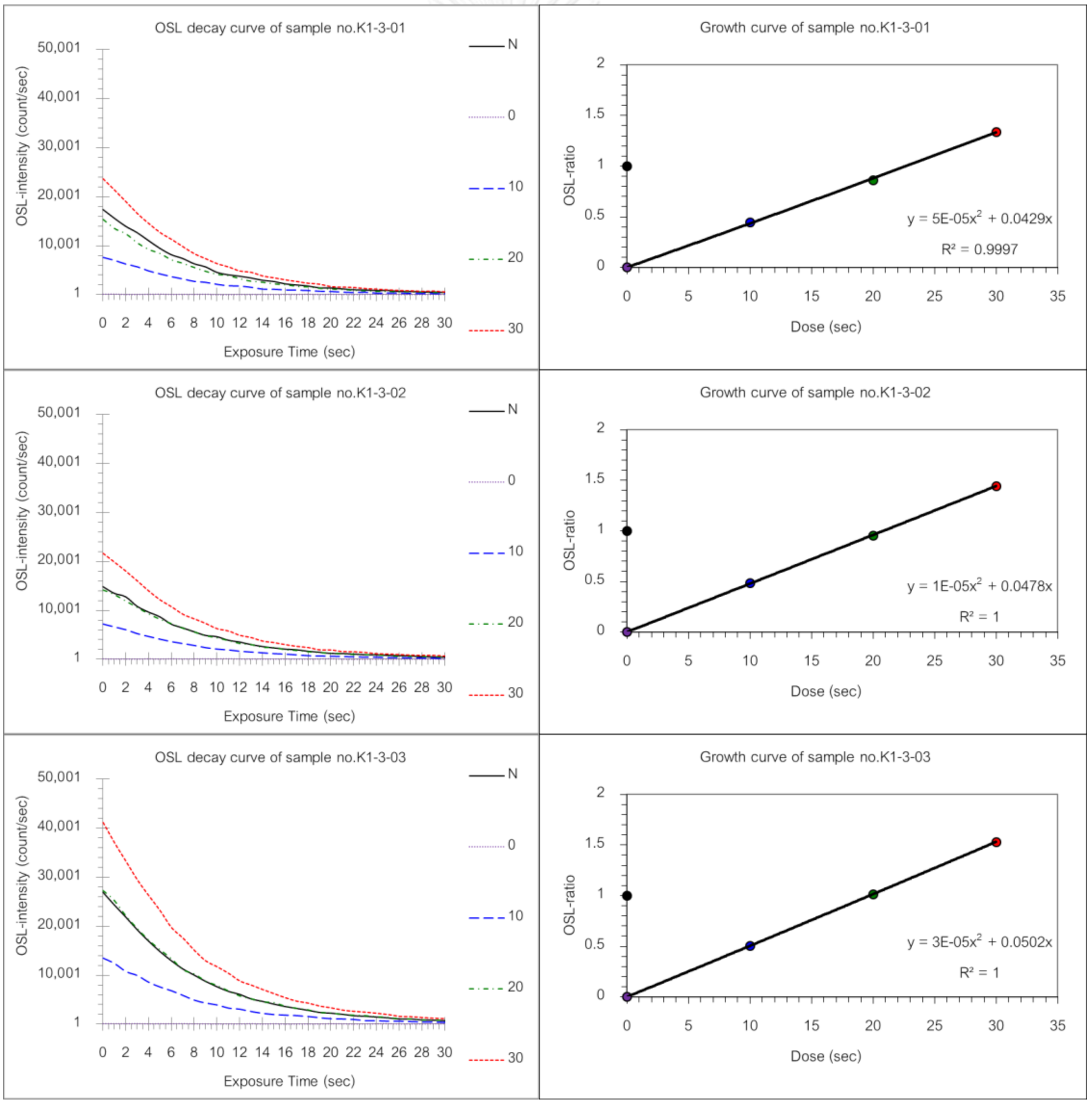
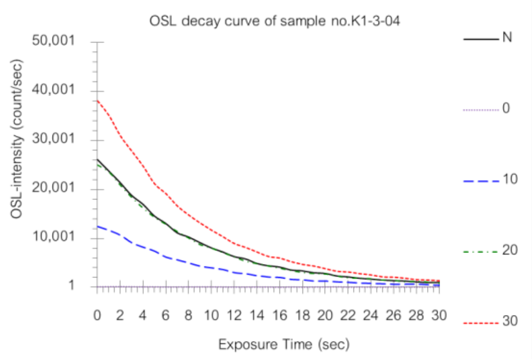
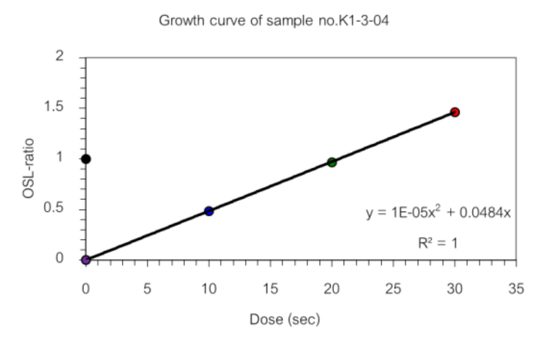

OSL decay curve of sample no.K1-2-08
OSL-intensity (count/sec)
30,001
25,001
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
6
12
18
Growth curve of sample no.K1-2-08
OSL-ratio
2.5
2
1.5
1
0.5
0
0 5 10 15 20
Dose (sec)
$y = 0.0001x^2 + 0.1101x$
$R^2 = 0.9999$
OSL decay curve of sample no.K1-2-09
OSL-intensity (count/sec)
30,001
25,001
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
6
12
18
Growth curve of sample no.K1-2-09
OSL-ratio
2.5
2
1.5
1
0.5
0
0 5 10 15 20
Dose (sec)
$y = 7E\text{-}05x^2 + 0.117x$
$R^2 = 1$
OSL decay curve of sample no.K1-2-10
OSL-intensity (count/sec)
30,001
25,001
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
6
12
18
Growth curve of sample no.K1-2-10
OSL-ratio
2.5
2
1.5
1
0.5
0
0 5 10 15 20
Dose (sec)
$y = 0.0002x^2 + 0.104x$
$R^2 = 0.9999$
OSL decay curve of sample no.K1-2-11
OSL-intensity (count/sec)
30,001
25,001
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
6
12
18
Growth curve of sample no.K1-2-11
OSL-ratio
2.5
2
1.5
1
0.5
0
0 5 10 15 20
Dose (sec)
$y = 0.0004x^2 + 0.1053x$
$R^2 = 1$

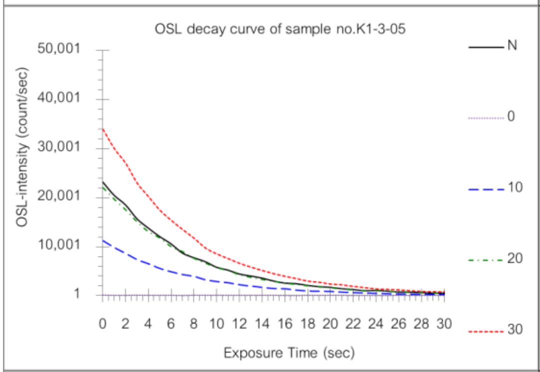
Table A.3 OSL dating results from beach ridge plain (Kui Buri, K1-3).

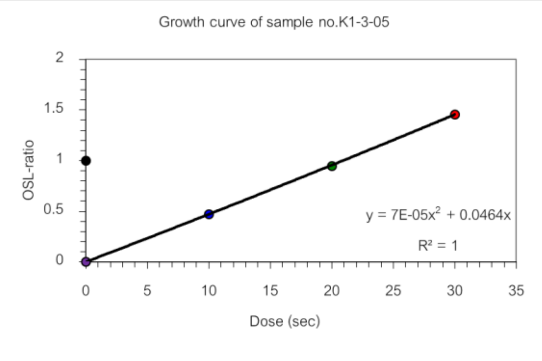
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K1-3-01	540	0.84±0.1	2.76±0.1	0.34±0.1	2.15	0.66±0.1	3.20±0.14	4,840±760
K1-3-02	540	0.84±0.1	2.76±0.1	0.34±0.1	2.15	0.66±0.1	3.30±0.19	4,980±800
K1-3-03	540	0.84±0.1	2.76±0.1	0.34±0.1	2.15	0.66±0.1	2.78±0.10	4,210±650
K1-3-04	540	0.84±0.1	2.76±0.1	0.34±0.1	2.15	0.66±0.1	2.77±0.11	4,180±650
K1-3-05	540	0.84±0.1	2.76±0.1	0.34±0.1	2.15	0.66±0.1	2.99±0.11	4,520±700
K1-3-06	540	0.84±0.1	2.76±0.1	0.34±0.1	2.15	0.66±0.1	2.87±0.10	4,330±670
K1-3-07	540	0.84±0.1	2.76±0.1	0.34±0.1	2.15	0.66±0.1	3.27±0.12	4,950±760
K1-3-08	540	0.84±0.1	2.76±0.1	0.34±0.1	2.15	0.66±0.1	3.37±0.10	5,090±780
K1-3-09	540	0.84±0.1	2.76±0.1	0.34±0.1	2.15	0.66±0.1	3.77±0.17	5,700±890
K1-3-10	540	0.84±0.1	2.76±0.1	0.34±0.1	2.15	0.66±0.1	2.49±0.16	3,760±610

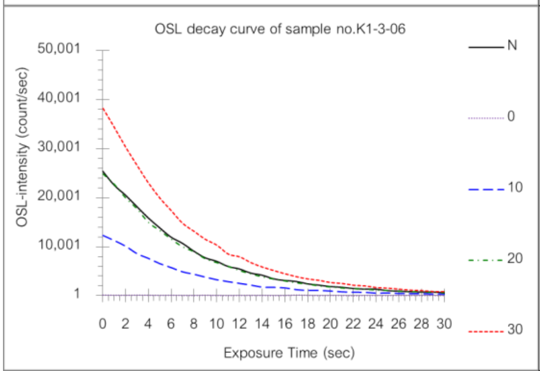


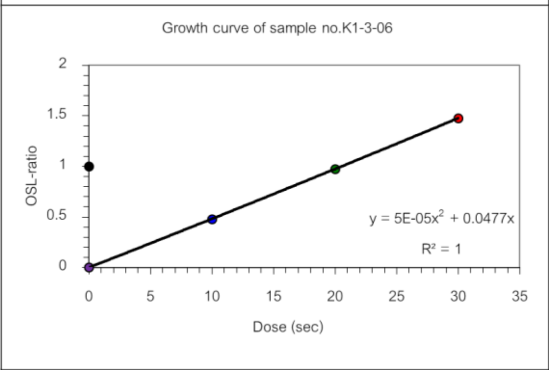

OSL decay curve of sample no.K1-3-04
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30

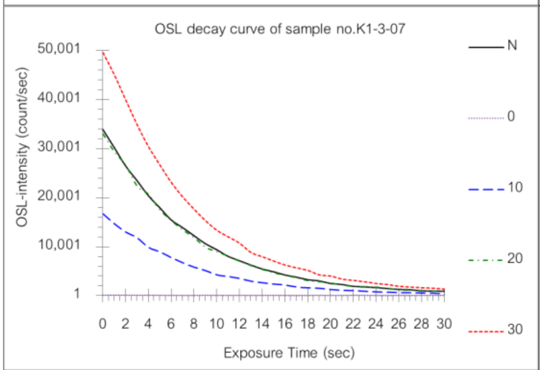

Growth curve of sample no.K1-3-04
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = 1E-05x2 + 0.0484x
R² = 1

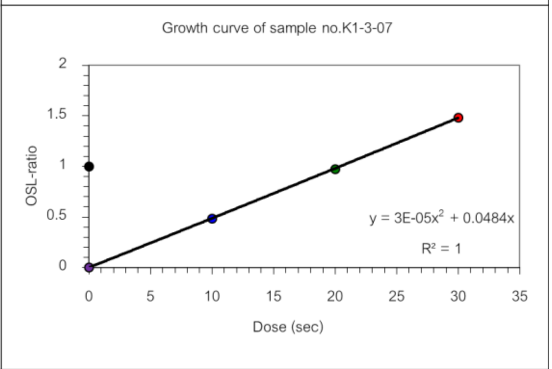

OSL decay curve of sample no.K1-3-05
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30

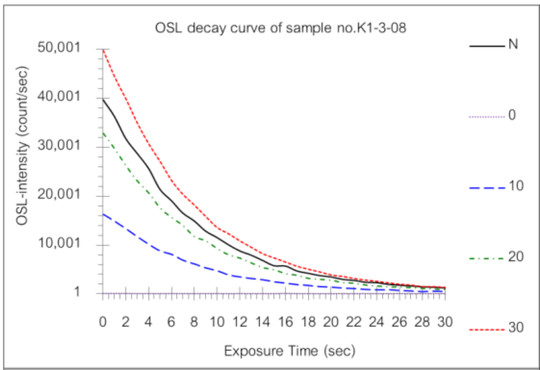

Growth curve of sample no.K1-3-05
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = 7E-05x2 + 0.0464x
R² = 1

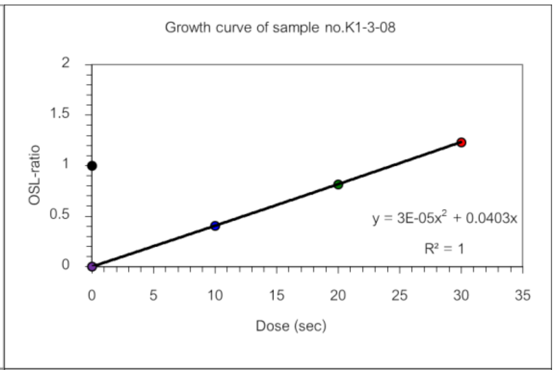

OSL decay curve of sample no.K1-3-06
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30

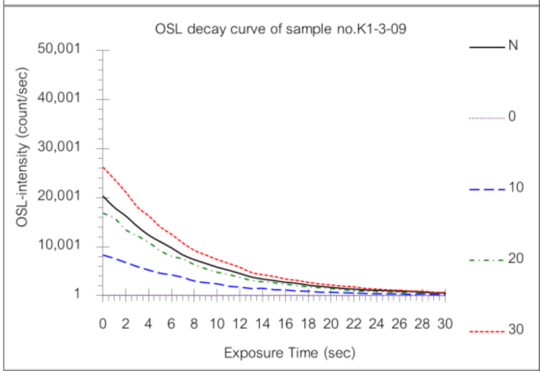

Growth curve of sample no.K1-3-06
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = 5E-05x2 + 0.0477x
R² = 1

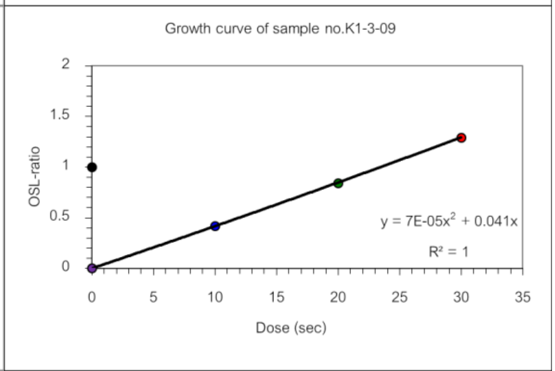

OSL decay curve of sample no.K1-3-07
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30

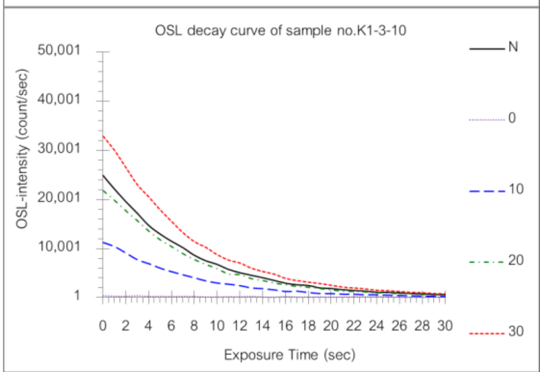

Growth curve of sample no.K1-3-07
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = 3E-05x2 + 0.0484x
R² = 1


OSL decay curve of sample no.K1-3-08
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30


Growth curve of sample no.K1-3-08
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = 3E-05x2 + 0.0403x
R² = 1


OSL decay curve of sample no.K1-3-09
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30


Growth curve of sample no.K1-3-09
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = 7E-05x2 + 0.041x
R² = 1


OSL decay curve of sample no.K1-3-10
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30

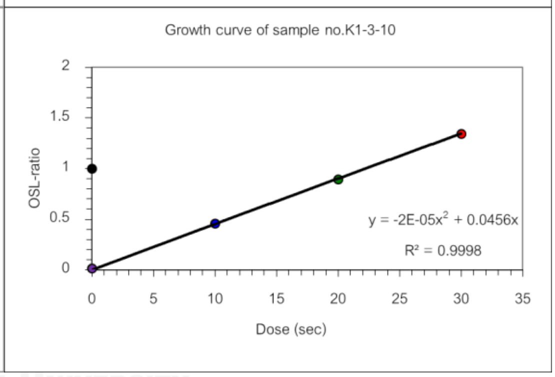
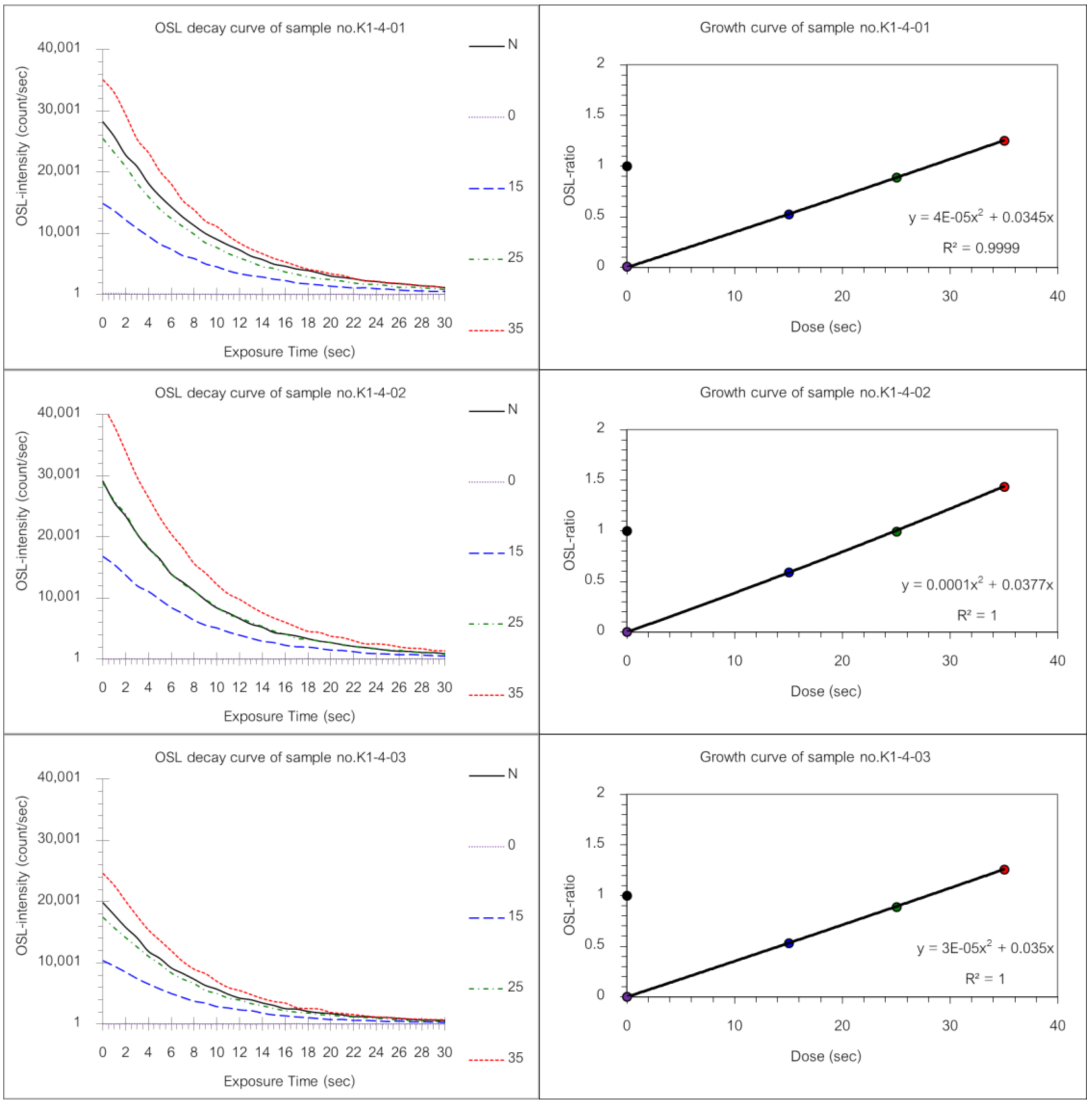

Growth curve of sample no.K1-3-10
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = -2E-05x2 + 0.0456x
R² = 0.9998

Table A.4 OSL dating results from beach ridge plain (Kui Buri, K1-4).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K1-4-01	890	0.73±0.1	2.40±0.1	0.34±0.1	1.17	0.55±0.1	4.11±0.16	6,650±1,100
K1-4-02	890	0.73±0.1	2.40±0.1	0.34±0.1	1.17	0.55±0.1	4.15±0.19	6,720±1,130
K1-4-03	890	0.73±0.1	2.40±0.1	0.34±0.1	1.17	0.55±0.1	4.17±0.21	6,740±1,140
K1-4-04	890	0.73±0.1	2.40±0.1	0.34±0.1	1.17	0.55±0.1	4.41±0.18	7,130±1,180



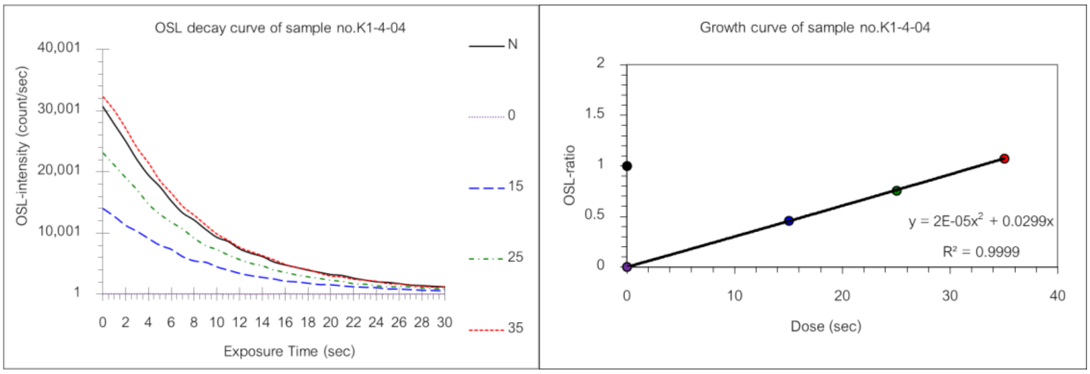
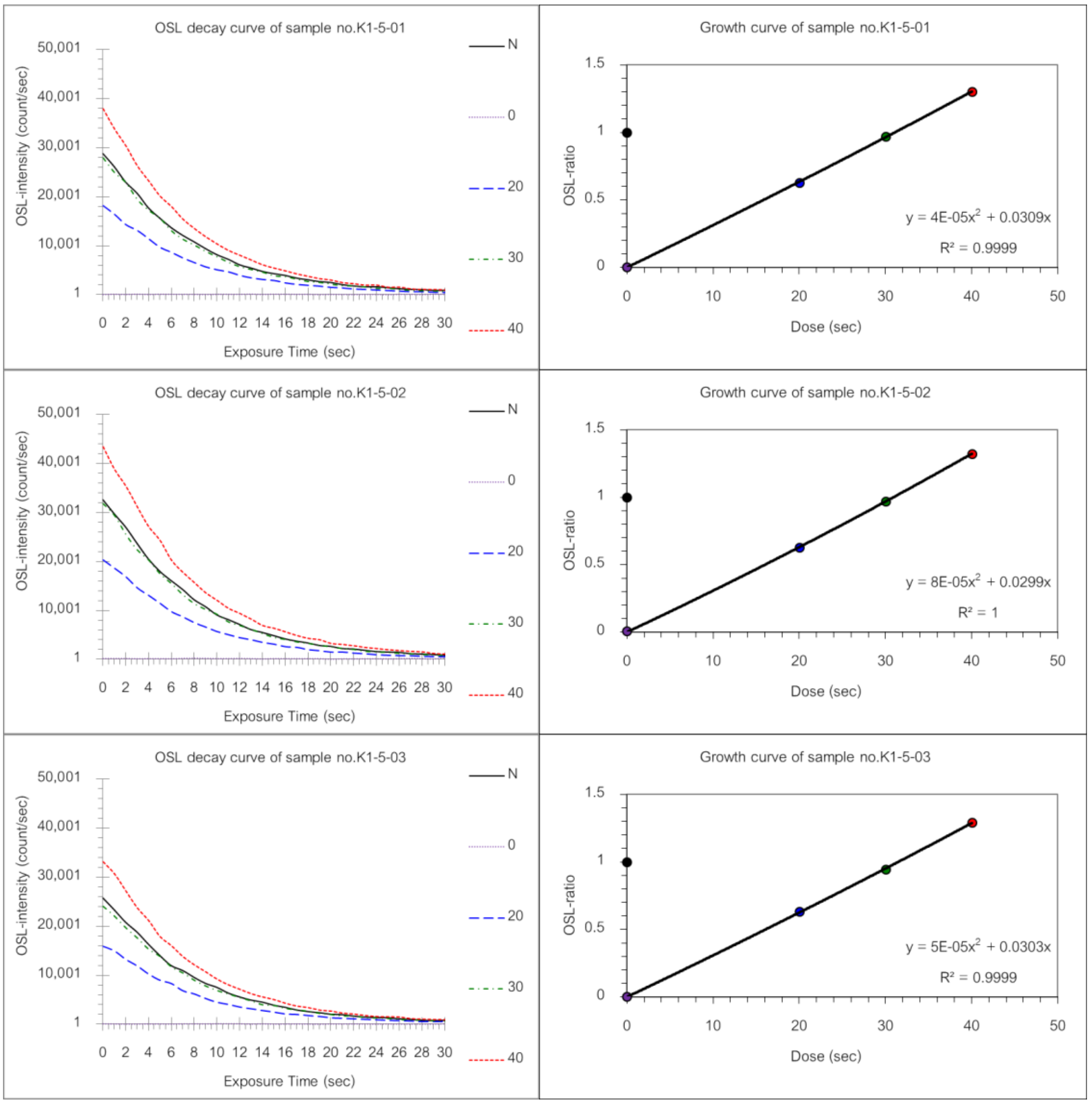

OSL decay curve of sample no.K1-4-04
OSL-intensity (count/sec)
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
15
25
35
Growth curve of sample no.K1-4-04
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40
Dose (sec)
y = 2E-05x2 + 0.0299x
R² = 0.9999

Table A.5 OSL dating results from beach ridge plain (Kui Buri, K1-5).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K1-5-01	1,070	0.82±0.1	1.71±0.1	0.32±0.1	4.92	0.62±0.1	4.31±0.20	7,860±1,480
K1-5-02	1,070	0.82±0.1	1.71±0.1	0.32±0.1	4.92	0.62±0.1	4.93±0.19	8,990±1,670
K1-5-03	1,070	0.82±0.1	1.71±0.1	0.32±0.1	4.92	0.62±0.1	4.55±0.20	8,290±1,550
K1-5-04	1,070	0.82±0.1	1.71±0.1	0.32±0.1	4.92	0.62±0.1	4.41±0.19	8,040±1,500
K1-5-05	1,070	0.82±0.1	1.71±0.1	0.32±0.1	4.92	0.62±0.1	5.11±0.20	9,310±1,730



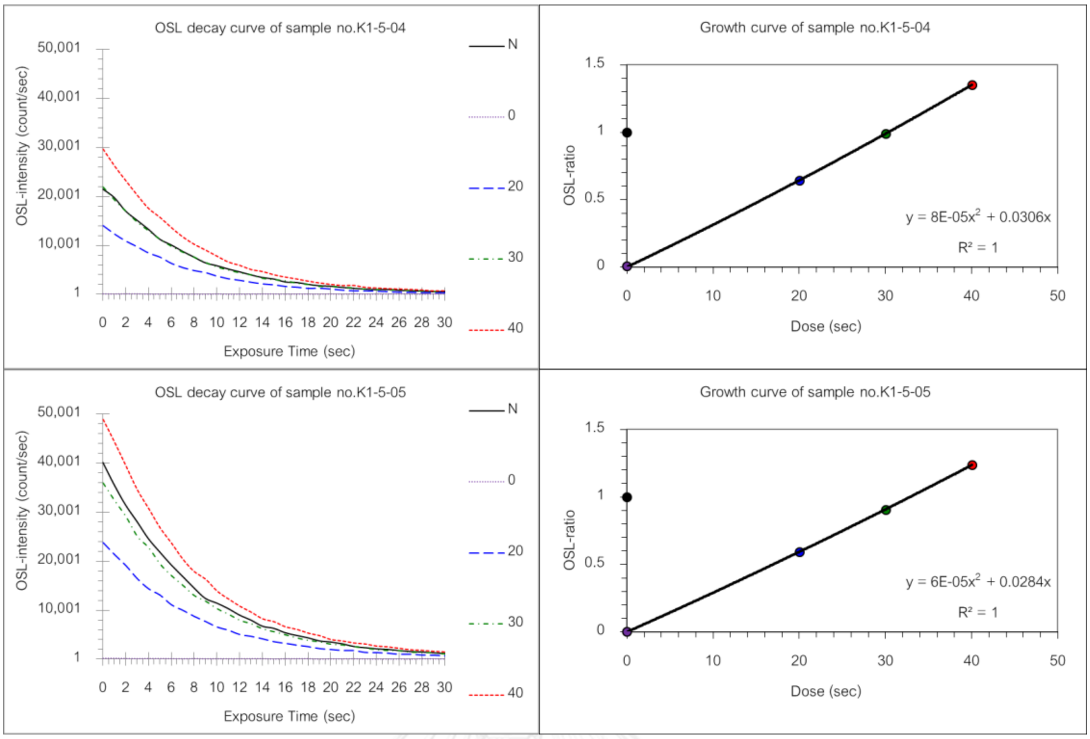
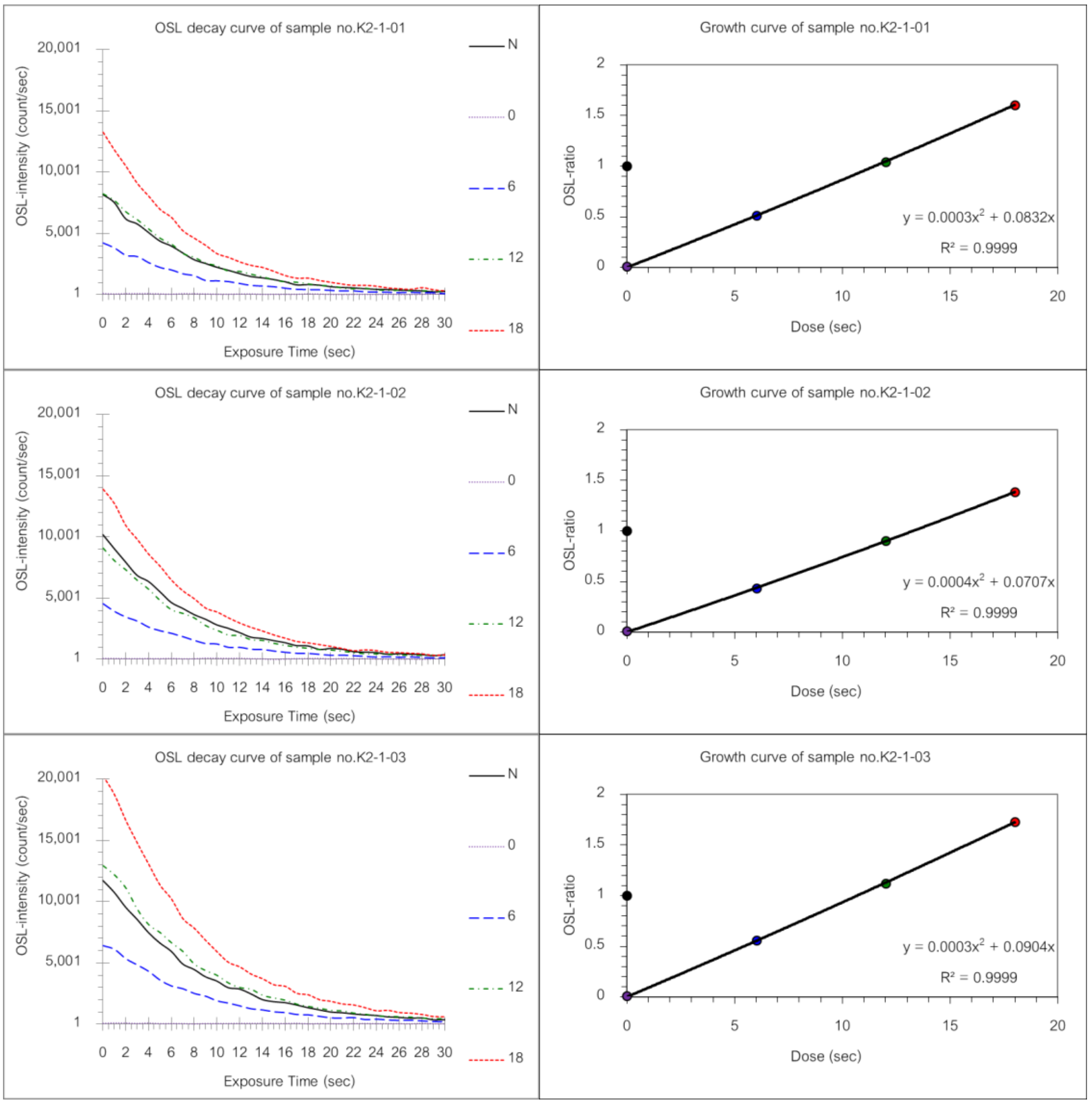

OSL decay curve of sample no.K1-5-04
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
20
30
40
Growth curve of sample no.K1-5-04
OSL-ratio
1.5
1
0.5
0
0 10 20 30 40 50
Dose (sec)
y = 8E-05x2 + 0.0306x
R² = 1
OSL decay curve of sample no.K1-5-05
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
20
30
40
Growth curve of sample no.K1-5-05
OSL-ratio
1.5
1
0.5
0
0 10 20 30 40 50
Dose (sec)
y = 6E-05x2 + 0.0284x
R² = 1

Table A.6 OSL dating results from beach ridge plain (Kui Buri, K2-1).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K2-1-01	540	0.77±0.1	2.49±0.1	0.35±0.1	2.07	0.63±0.1	1.72±0.08	2,710±440
K2-1-02	540	0.77±0.1	2.49±0.1	0.35±0.1	2.07	0.63±0.1	2.23±0.10	3,510±570
K2-1-03	540	0.77±0.1	2.49±0.1	0.35±0.1	2.07	0.63±0.1	1.71±0.10	2,680±450
K2-1-04	540	0.77±0.1	2.49±0.1	0.35±0.1	2.07	0.63±0.1	1.84±0.07	2,890±460
K2-1-05	540	0.77±0.1	2.49±0.1	0.35±0.1	2.07	0.63±0.1	1.50±0.07	2,370±380



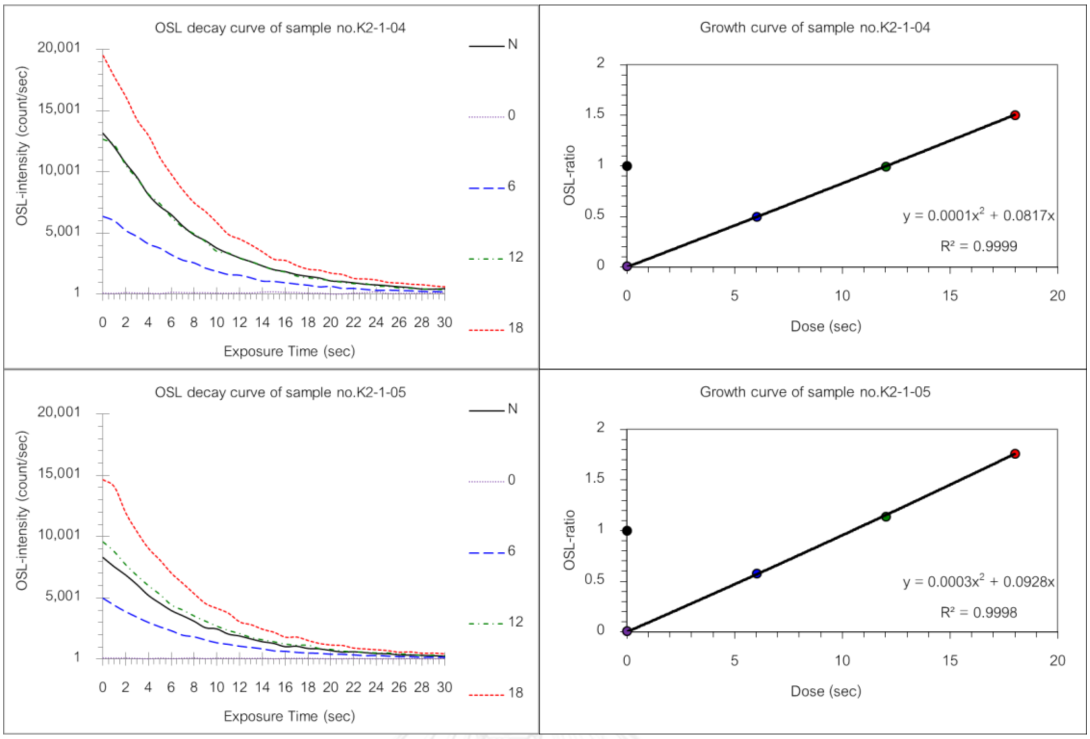
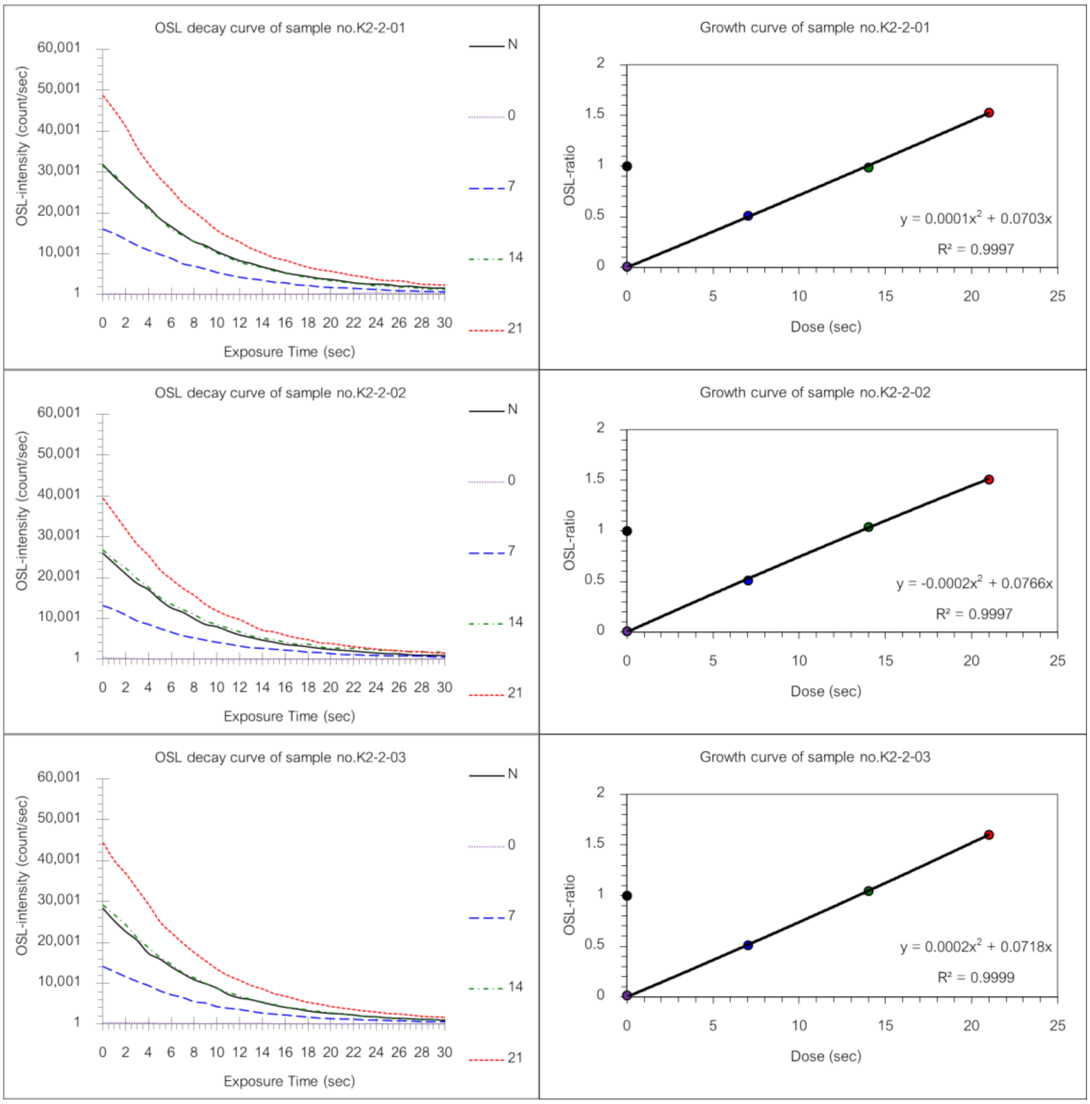
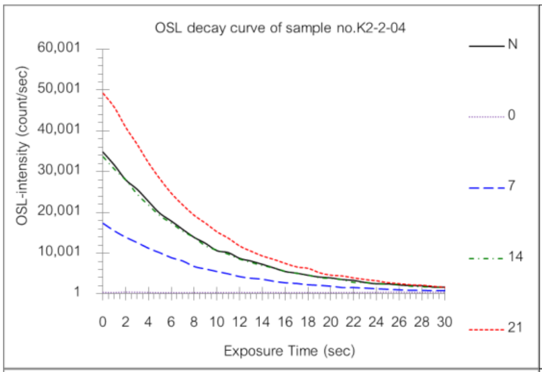
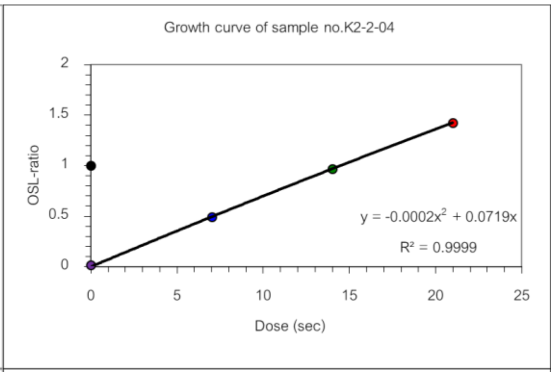

OSL decay curve of sample no.K2-1-04
OSL-intensity (count/sec)
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
6
12
18
Growth curve of sample no.K2-1-04
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20
Dose (sec)
y = 0.0001x² + 0.0817x
R² = 0.9999
OSL decay curve of sample no.K2-1-05
OSL-intensity (count/sec)
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
6
12
18
Growth curve of sample no.K2-1-05
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20
Dose (sec)
y = 0.0003x² + 0.0928x
R² = 0.9998

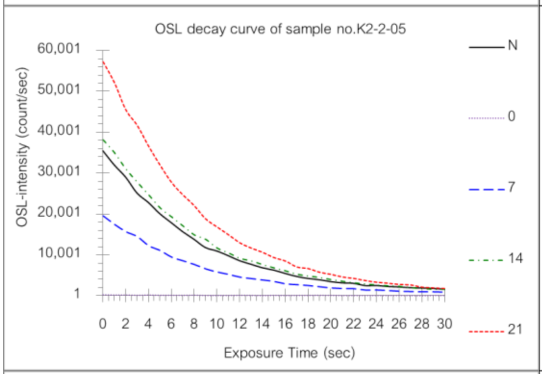
Table A.7 OSL dating results from beach ridge plain (Kui Buri, K2-2).

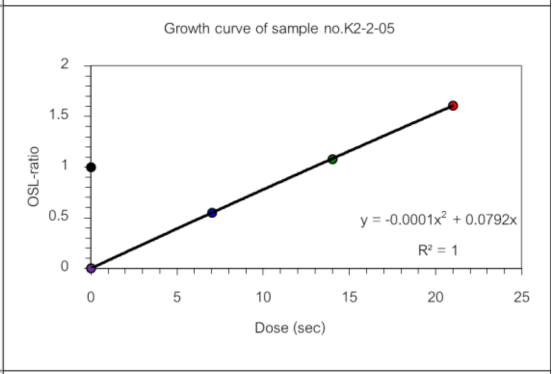
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K2-2-01	600	0.75±0.1	2.31±0.1	0.35±0.1	7.29	0.58±0.1	1.86±0.08	3,210±570
K2-2-02	600	0.75±0.1	2.31±0.1	0.35±0.1	7.29	0.58±0.1	2.00±0.12	3,450±620
K2-2-03	600	0.75±0.1	2.31±0.1	0.35±0.1	7.29	0.58±0.1	2.26±0.08	3,890±680
K2-2-04	600	0.75±0.1	2.31±0.1	0.35±0.1	7.29	0.58±0.1	2.13±0.09	3,660±650
K2-2-05	600	0.75±0.1	2.31±0.1	0.35±0.1	7.29	0.58±0.1	1.85±0.10	3,180±570
K2-2-06	600	0.75±0.1	2.31±0.1	0.35±0.1	7.29	0.58±0.1	2.29±0.08	3,950±690

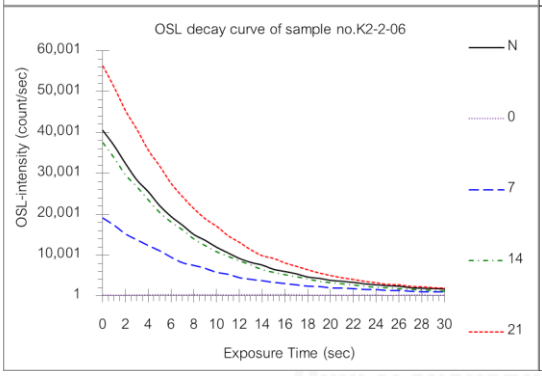



OSL decay curve of sample no.K2-2-04
OSL-intensity (count/sec)
60,001
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
7
14
21


Growth curve of sample no.K2-2-04
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25
Dose (sec)
y = -0.0002x2 + 0.0719x
R² = 0.9999


OSL decay curve of sample no.K2-2-05
OSL-intensity (count/sec)
60,001
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
7
14
21


Growth curve of sample no.K2-2-05
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25
Dose (sec)
y = -0.0001x2 + 0.0792x
R² = 1


OSL decay curve of sample no.K2-2-06
OSL-intensity (count/sec)
60,001
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
7
14
21

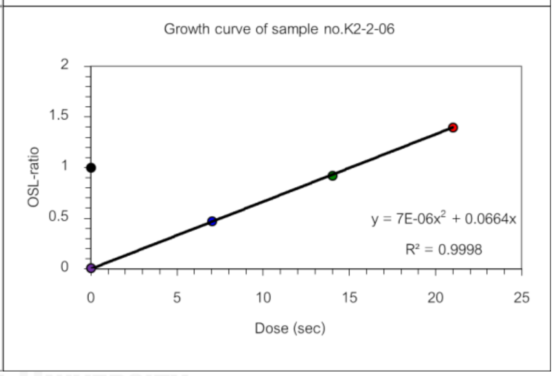
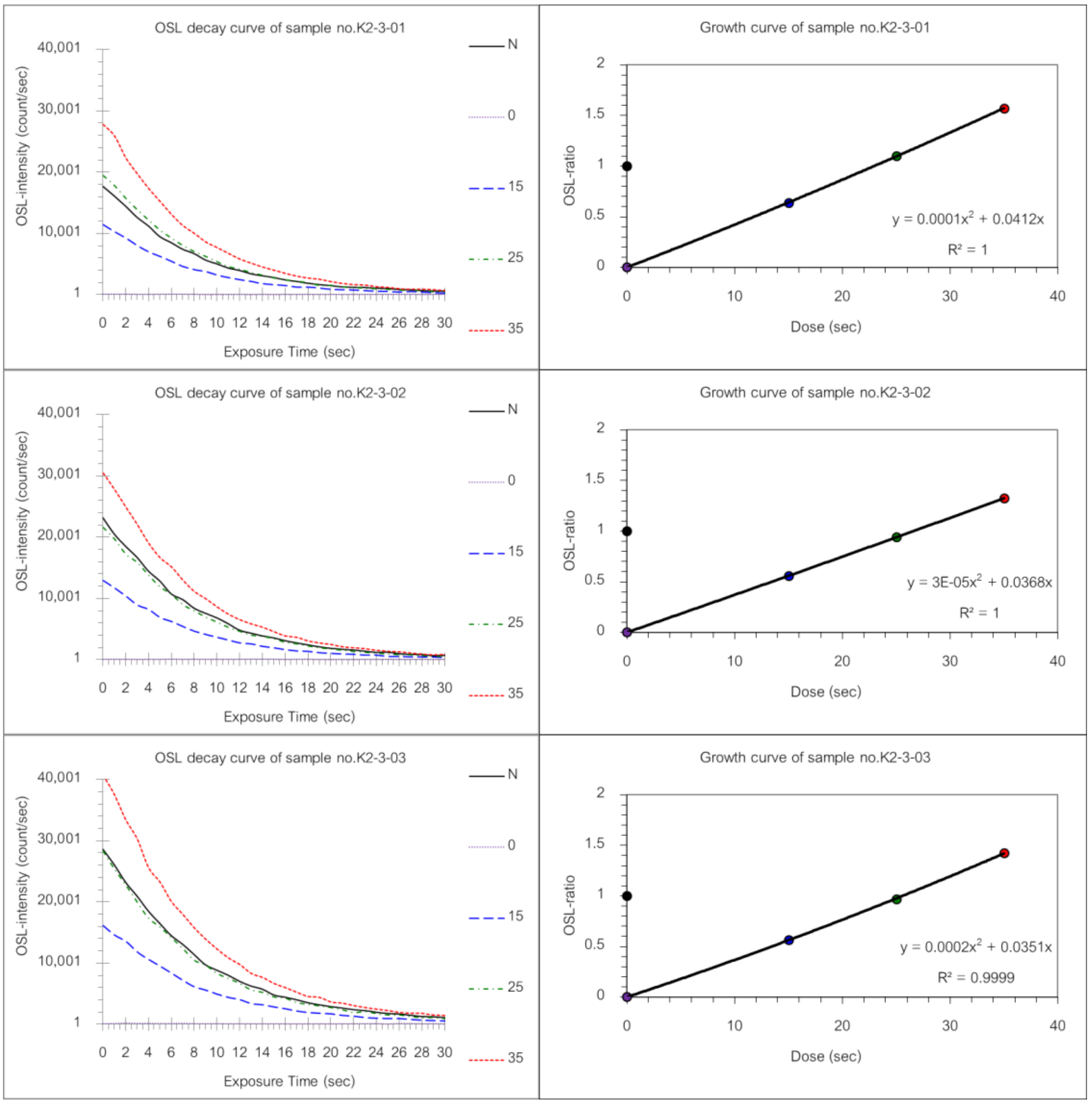

Growth curve of sample no.K2-2-06
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25
Dose (sec)
y = 7E-06x2 + 0.0664x
R² = 0.9998

Table A.8 OSL dating results from beach ridge plain (Kui Buri, K2-3).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K2-3-01	970	0.71±0.1	2.07±0.1	0.31±0.1	1.05	0.56±0.1	3.12±0.17	5,520±1,020
K2-3-02	970	0.71±0.1	2.07±0.1	0.31±0.1	1.05	0.56±0.1	4.10±0.17	7,250±1,320
K2-3-03	970	0.71±0.1	2.07±0.1	0.31±0.1	1.05	0.56±0.1	3.90±0.14	6,900±1,240
K2-3-04	970	0.71±0.1	2.07±0.1	0.31±0.1	1.05	0.56±0.1	3.60±0.16	6,360±1,150



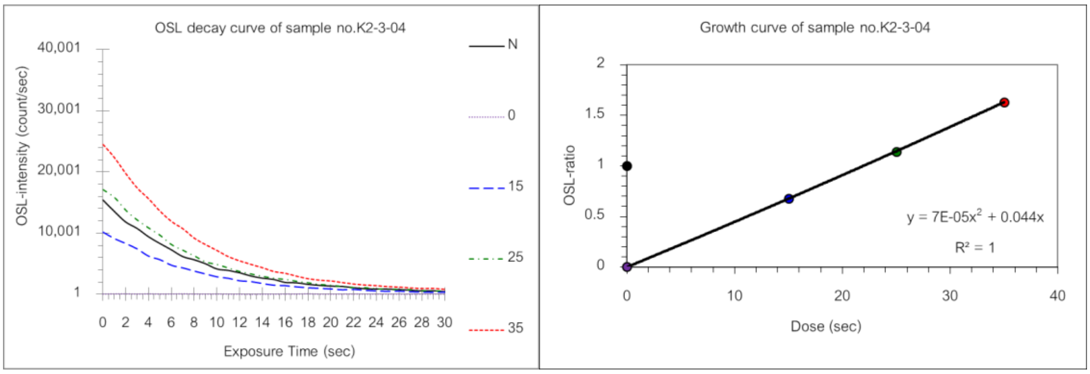
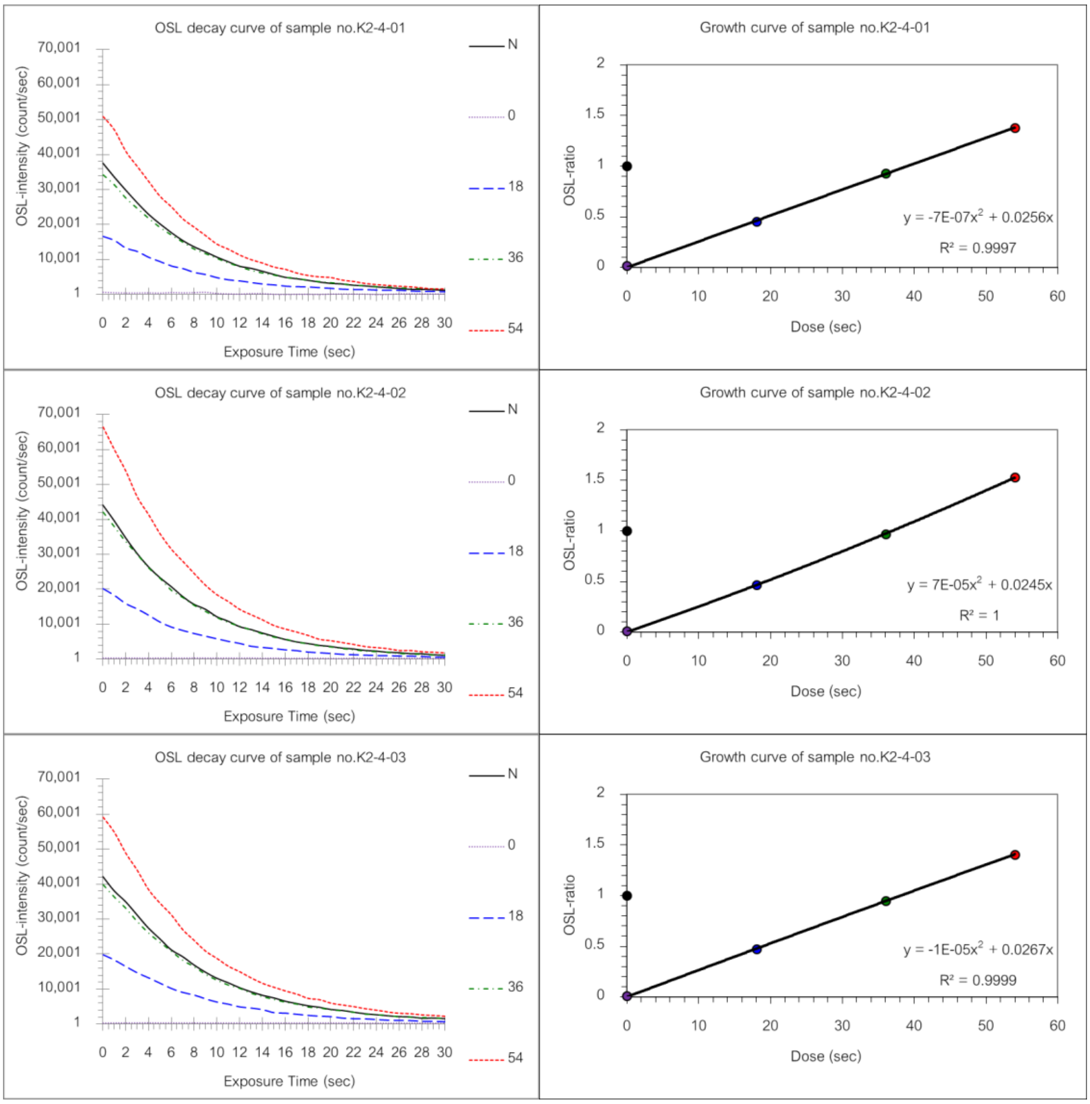

OSL decay curve of sample no.K2-3-04
OSL-intensity (count/sec)
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
15
25
35
Growth curve of sample no.K2-3-04
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40
Dose (sec)
y = 7E-05x2 + 0.044x
R² = 1

Table A.9 OSL dating results from beach ridge plain (Kui Buri, K2-4).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K2-4-01	1,350	0.68±0.1	2.11±0.1	0.41±0.1	4.06	0.62±0.1	8.02±0.580	12,840±2,250
K2-4-02	1,350	0.68±0.1	2.11±0.1	0.41±0.1	4.06	0.62±0.1	7.61±0.35	12,190±2,030
K2-4-03	1,350	0.68±0.1	2.11±0.1	0.41±0.1	4.06	0.62±0.1	9.68±0.67	15,490±2,700
K2-4-04	1,350	0.68±0.1	2.11±0.1	0.41±0.1	4.06	0.62±0.1	4.88±0.30	7,810±1,340
K2-4-05	1,350	0.68±0.1	2.11±0.1	0.41±0.1	4.06	0.62±0.1	7.34±0.60	11,750±2,110
K2-4-06	1,350	0.68±0.1	2.11±0.1	0.41±0.1	4.06	0.62±0.1	5.95±0.86	9,530±2,050



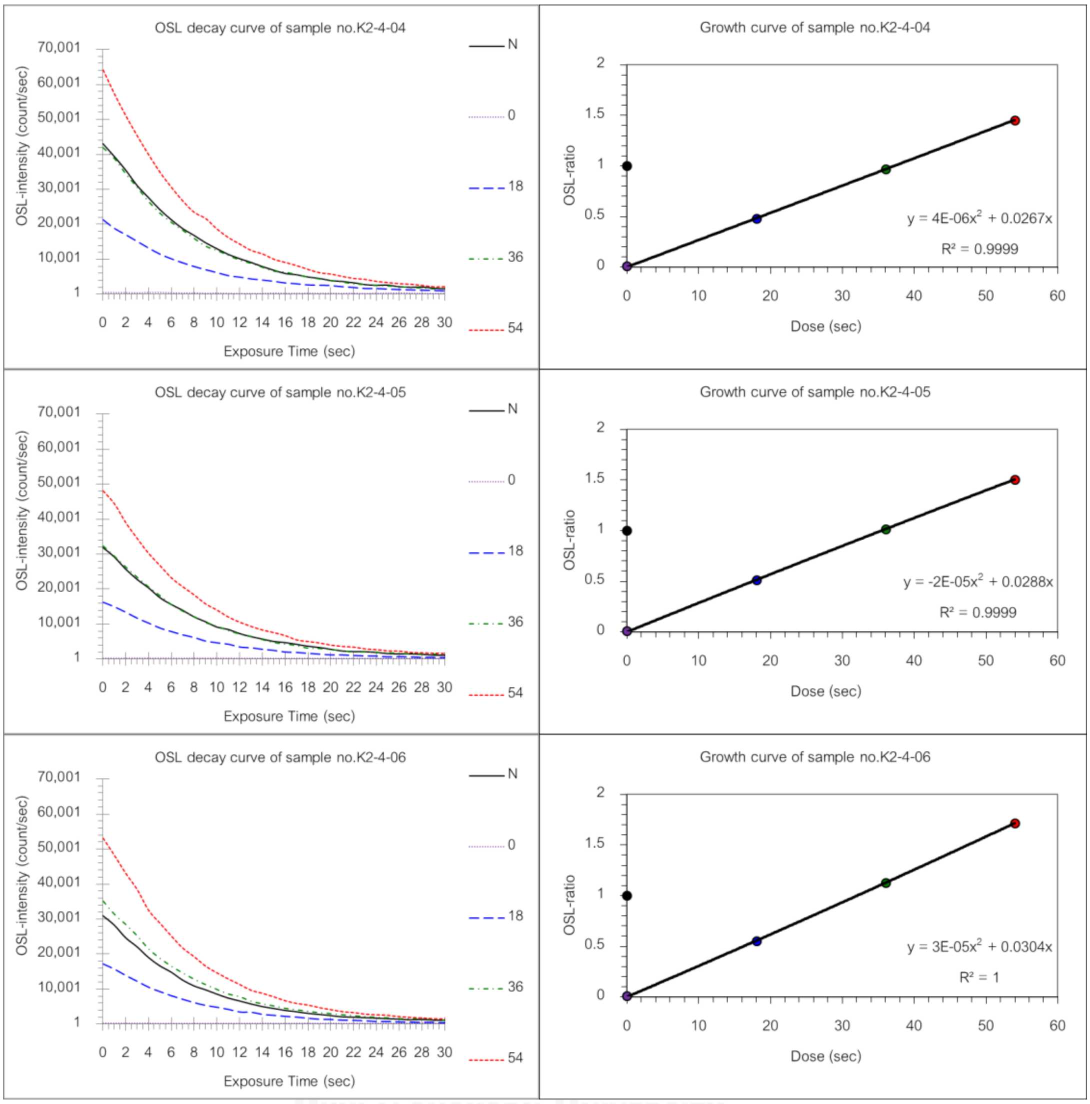
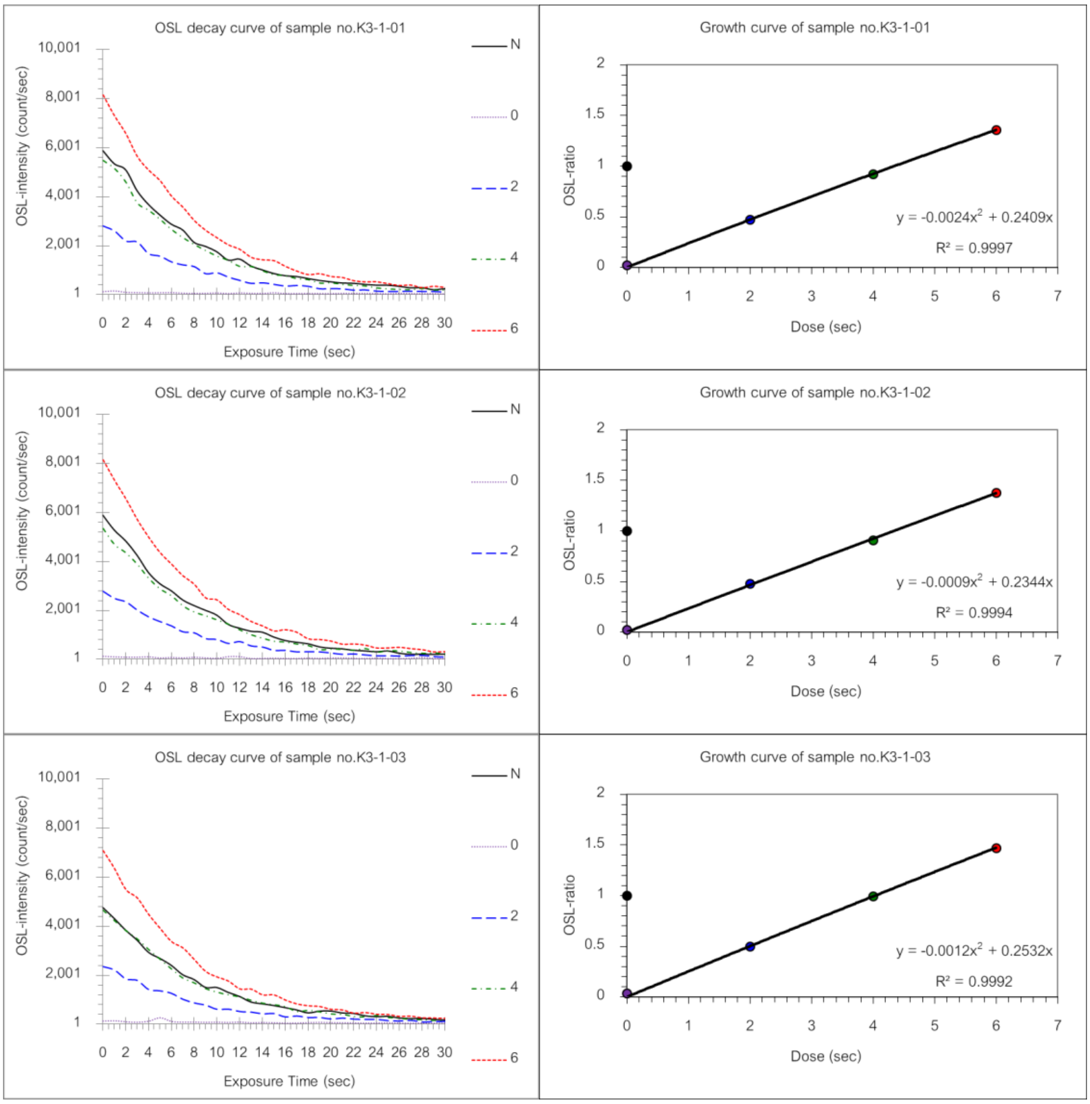

OSL decay curve of sample no.K2-4-04
OSL-intensity (count/sec)
70,001
60,001
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
18
36
54
Growth curve of sample no.K2-4-04
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60
Dose (sec)
y = 4E-06x^2 + 0.0267x
R² = 0.9999
OSL decay curve of sample no.K2-4-05
Exposure Time (sec)
Growth curve of sample no.K2-4-05
y = -2E-05x^2 + 0.0288x
R² = 0.9999
OSL decay curve of sample no.K2-4-06
Exposure Time (sec)
Growth curve of sample no.K2-4-06
y = 3E-05x^2 + 0.0304x
R² = 1

Table A.10 OSL dating results from beach ridge plain (Kui Buri, K3-1).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K3-1-01	285	0.65±0.1	1.81±0.1	0.41±0.1	9.34	0.56±0.1	0.61±0.03	1,090±200
K3-1-02	285	0.65±0.1	1.81±0.1	0.41±0.1	9.34	0.56±0.1	0.62±0.02	1,110±200
K3-1-03	285	0.65±0.1	1.81±0.1	0.41±0.1	9.34	0.56±0.1	0.68±0.03	1,210±220
K3-1-04	285	0.65±0.1	1.81±0.1	0.41±0.1	9.34	0.56±0.1	0.54±0.02	960±170
K3-1-05	285	0.65±0.1	1.81±0.1	0.41±0.1	9.34	0.56±0.1	0.78±0.05	1,400±260



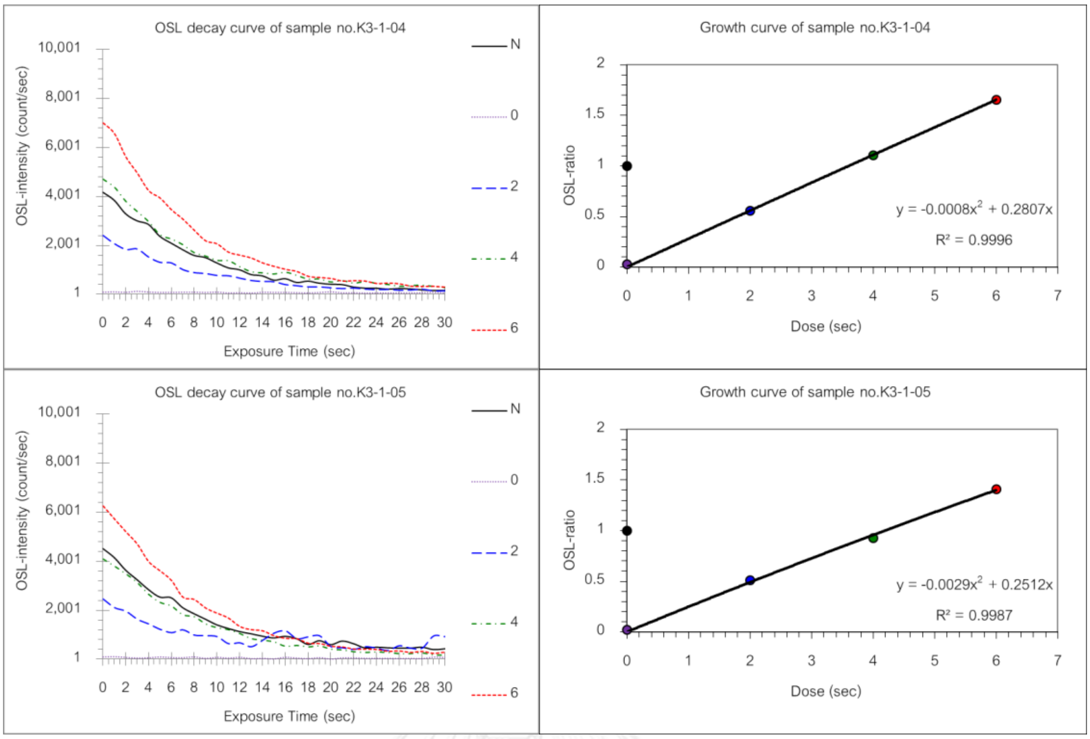
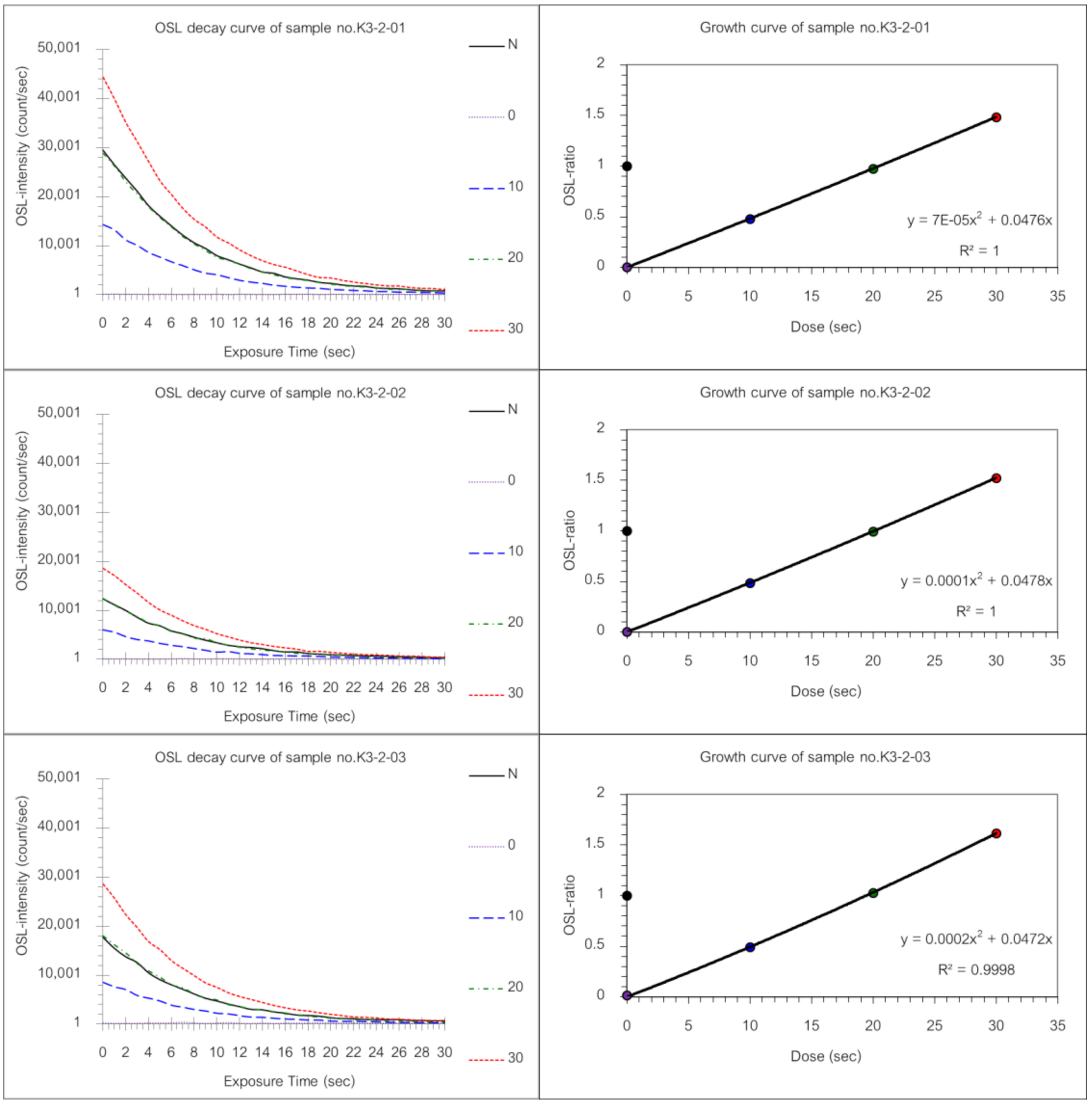
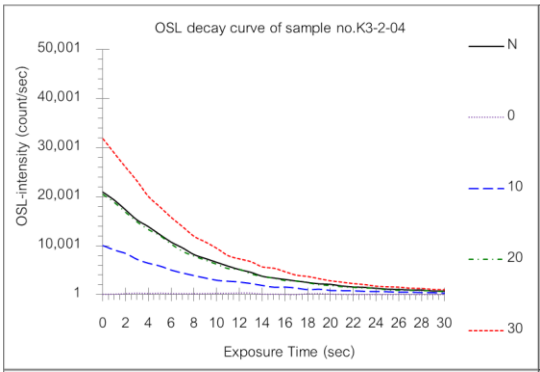
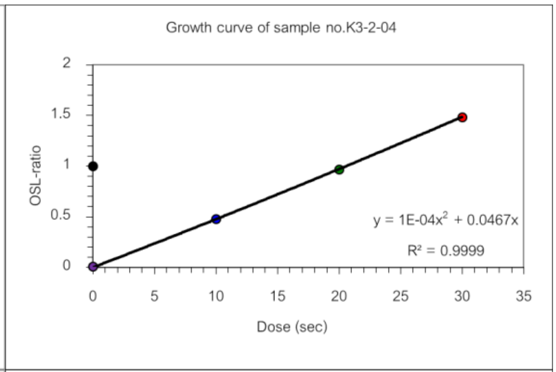

OSL decay curve of sample no.K3-1-04
OSL-intensity (count/sec)
10,001
8,001
6,001
4,001
2,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
2
4
6
Growth curve of sample no.K3-1-04
OSL-ratio
2
1.5
1
0.5
0
0 1 2 3 4 5 6 7
Dose (sec)
y = -0.0008x2 + 0.2807x
R² = 0.9996
OSL decay curve of sample no.K3-1-05
OSL-intensity (count/sec)
10,001
8,001
6,001
4,001
2,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
2
4
6
Growth curve of sample no.K3-1-05
OSL-ratio
2
1.5
1
0.5
0
0 1 2 3 4 5 6 7
Dose (sec)
y = -0.0029x2 + 0.2512x
R² = 0.9987

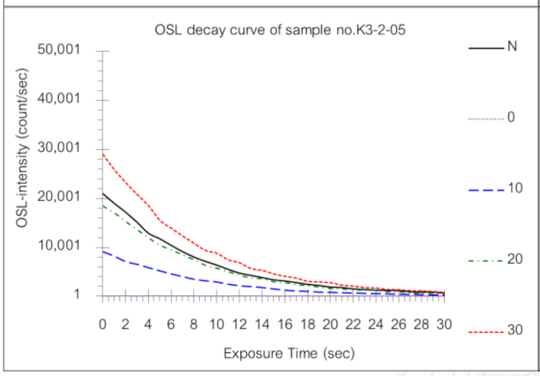
Table A.11 OSL dating results from beach ridge plain (Kui Buri, K3-2).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K3-2-01	1,100	0.82±0.1	3.51±0.1	0.44±0.1	1.98	0.80±0.1	2.84±0.10	3,560±460
K3-2-02	1,100	0.82±0.1	3.51±0.1	0.44±0.1	1.98	0.80±0.1	2.90±0.16	3,640±500
K3-2-03	1,100	0.82±0.1	3.51±0.1	0.44±0.1	1.98	0.80±0.1	3.26±0.14	4,080±540
K3-2-04	1,100	0.82±0.1	3.51±0.1	0.44±0.1	1.98	0.80±0.1	2.91±0.12	3,650±480
K3-2-05	1,100	0.82±0.1	3.51±0.1	0.44±0.1	1.98	0.80±0.1	3.53±0.14	4,430±580




OSL decay curve of sample no.K3-2-04
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30


Growth curve of sample no.K3-2-04
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = 1E-04x^2 + 0.0467x
R² = 0.9999


OSL decay curve of sample no.K3-2-05
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30

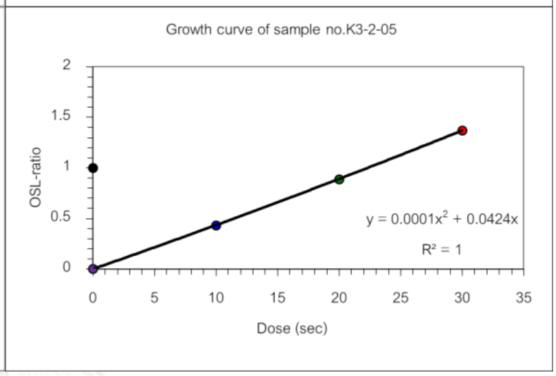
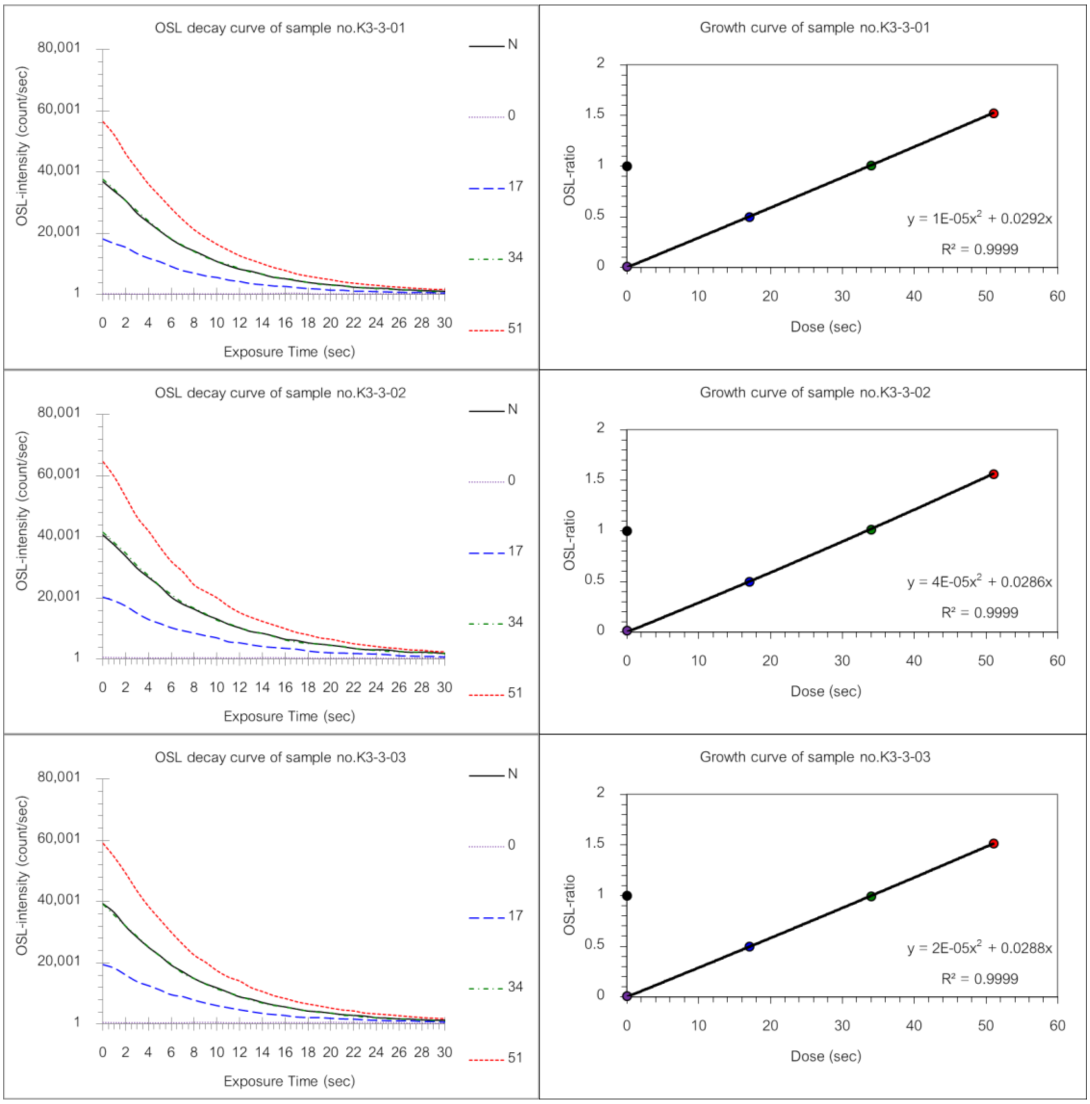
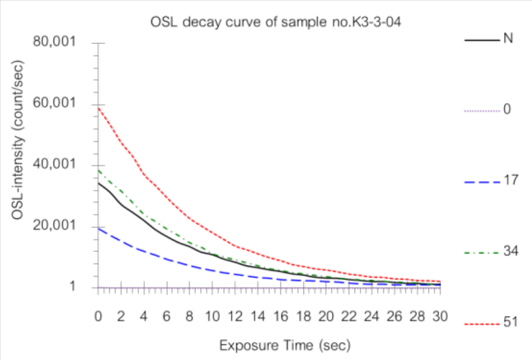
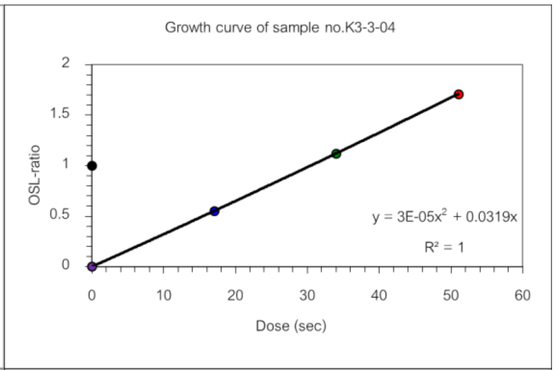

Growth curve of sample no.K3-2-05
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = 0.0001x^2 + 0.0424x
R² = 1

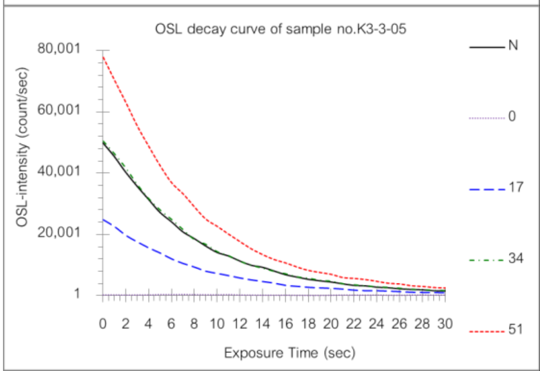
Table A.12 OSL dating results from beach ridge plain (Kui Buri, K3-3).

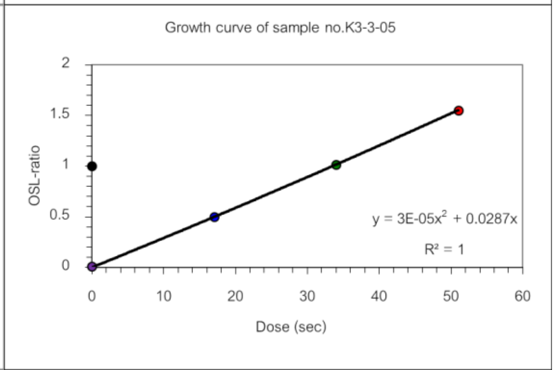
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K3-3-01	1,600	0.77±0.1	2.09±0.1	0.43±0.1	1.85	0.68±0.1	4.19±0.43	6,170±1,100
K3-3-02	1,600	0.77±0.1	2.09±0.1	0.43±0.1	1.85	0.68±0.1	5.32±0.23	7,830±1,200
K3-3-03	1,600	0.77±0.1	2.09±0.1	0.43±0.1	1.85	0.68±0.1	5.21±0.47	7,670±1,320
K3-3-04	1,600	0.77±0.1	2.09±0.1	0.43±0.1	1.85	0.68±0.1	5.32±0.49	7,830±1,360
K3-3-05	1,600	0.77±0.1	2.09±0.1	0.43±0.1	1.85	0.68±0.1	5.14±0.29	7,570±1,190
K3-3-06	1,600	0.77±0.1	2.09±0.1	0.43±0.1	1.85	0.68±0.1	4.47±0.23	6,590±1,020

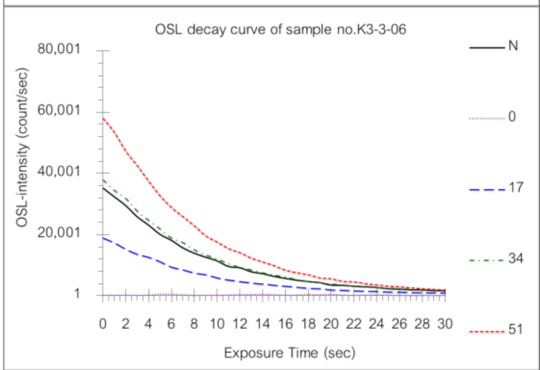



OSL decay curve of sample no.K3-3-04
OSL-intensity (count/sec)
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
17
34
51


Growth curve of sample no.K3-3-04
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60
Dose (sec)
y = 3E-05x2 + 0.0319x
R² = 1


OSL decay curve of sample no.K3-3-05
OSL-intensity (count/sec)
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
17
34
51


Growth curve of sample no.K3-3-05
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60
Dose (sec)
y = 3E-05x2 + 0.0287x
R² = 1


OSL decay curve of sample no.K3-3-06
OSL-intensity (count/sec)
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
17
34
51

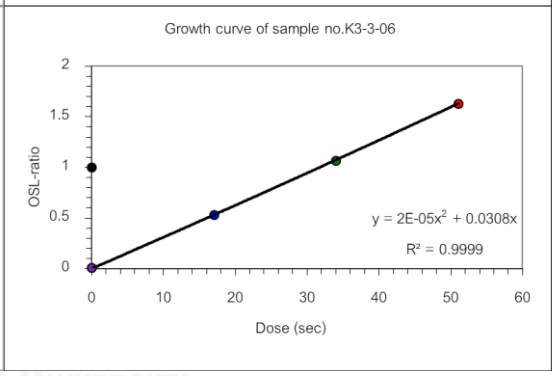
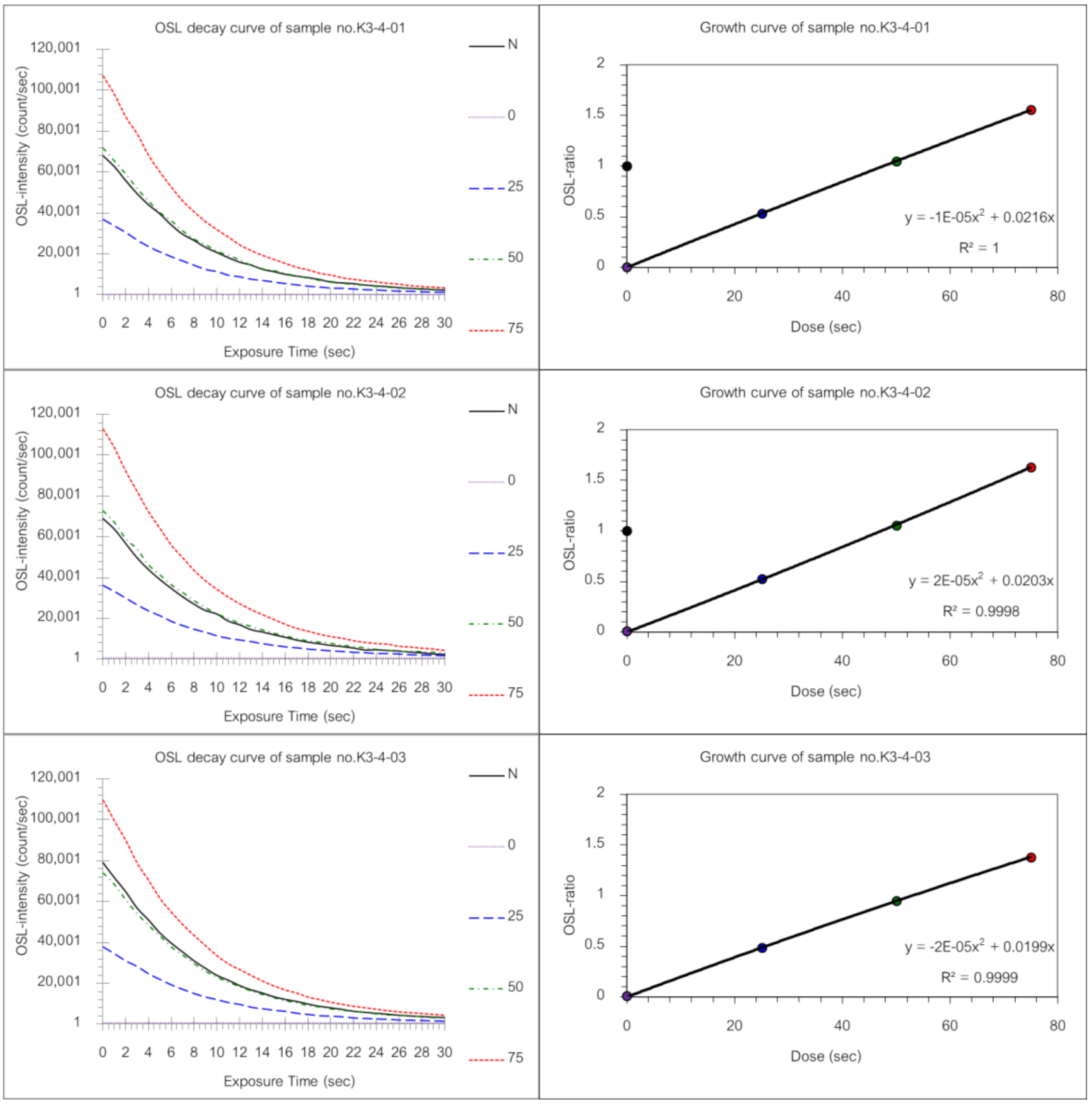
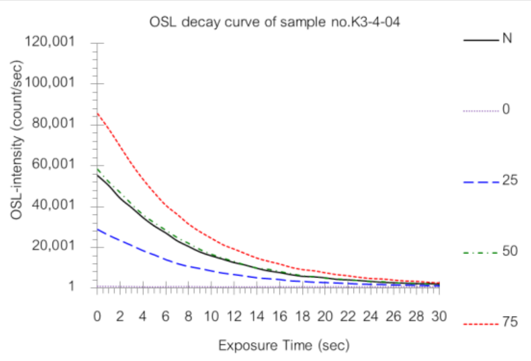
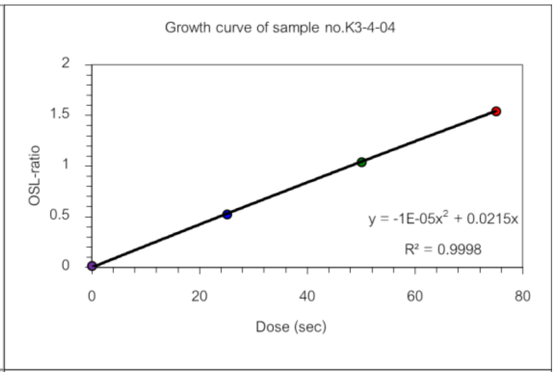

Growth curve of sample no.K3-3-06
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60
Dose (sec)
y = 2E-05x2 + 0.0308x
R² = 0.9999

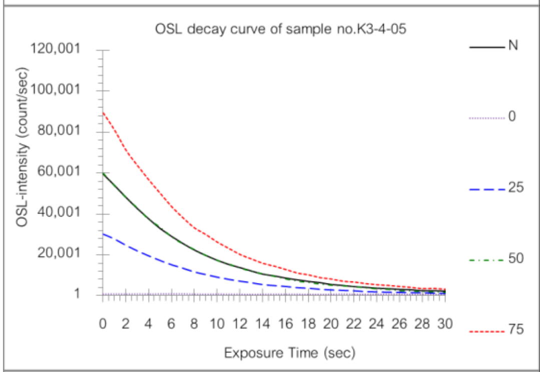
Table A.13 OSL dating results from beach ridge plain (Kui Buri, K3-4).

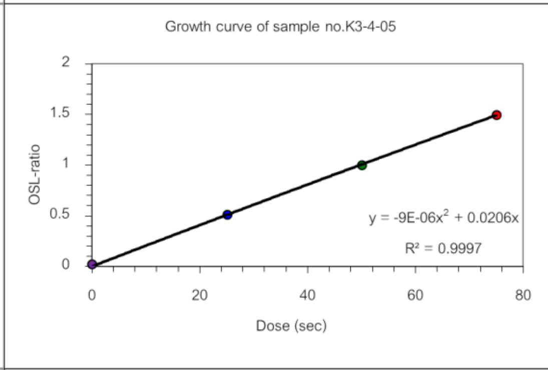
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K3-4-01	1,700	0.84±0.1	2.64±0.1	0.56±0.1	2.83	0.82±0.1	7.05±0.25	8,570±1,080
K3-4-02	1,700	0.84±0.1	2.64±0.1	0.56±0.1	2.83	0.82±0.1	9.27±0.41	11,270±1,450
K3-4-03	1,700	0.84±0.1	2.64±0.1	0.56±0.1	2.83	0.82±0.1	6.97±0.30	8,470±1,090
K3-4-04	1,700	0.84±0.1	2.64±0.1	0.56±0.1	2.83	0.82±0.1	6.82±0.45	8,290±1,140
K3-4-05	1,700	0.84±0.1	2.64±0.1	0.56±0.1	2.83	0.82±0.1	7.43±0.35	9,030±1,170
K3-4-06	1,700	0.84±0.1	2.64±0.1	0.56±0.1	2.83	0.82±0.1	6.86±0.52	8,340±1,190
K3-4-07	1,700	0.84±0.1	2.64±0.1	0.56±0.1	2.83	0.82±0.1	5.67±0.39	6,890±960
K3-4-08	1,700	0.84±0.1	2.64±0.1	0.56±0.1	2.83	0.82±0.1	6.62±0.36	8,040±1,060

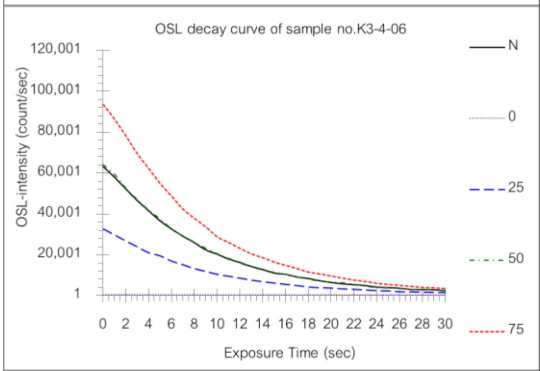


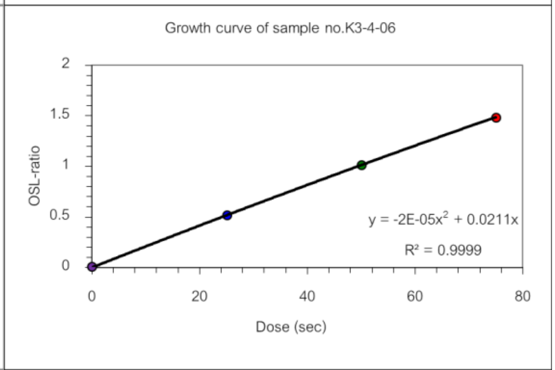

OSL decay curve of sample no.K3-4-04
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75

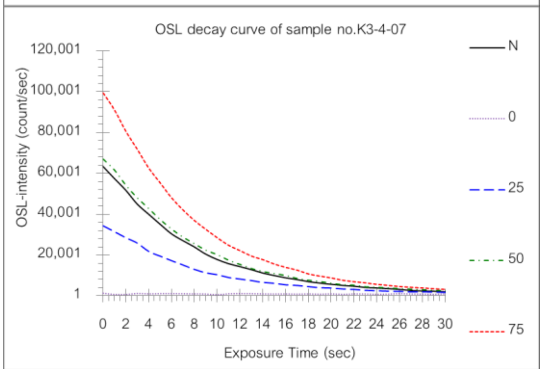

Growth curve of sample no.K3-4-04
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -1E-05x2 + 0.0215x
R² = 0.9998

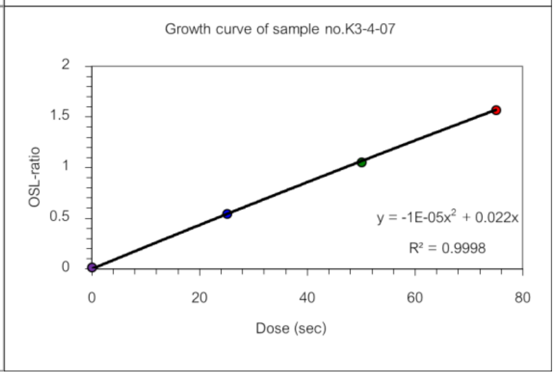

OSL decay curve of sample no.K3-4-05
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75

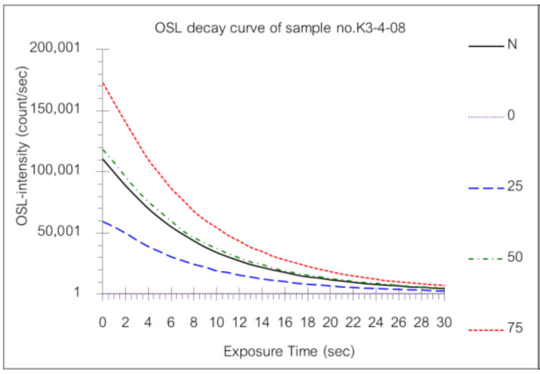

Growth curve of sample no.K3-4-05
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -9E-06x2 + 0.0206x
R² = 0.9997


OSL decay curve of sample no.K3-4-06
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75


Growth curve of sample no.K3-4-06
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -2E-05x2 + 0.0211x
R² = 0.9999


OSL decay curve of sample no.K3-4-07
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75


Growth curve of sample no.K3-4-07
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -1E-05x2 + 0.022x
R² = 0.9998


OSL decay curve of sample no.K3-4-08
OSL-intensity (count/sec)
200,001
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75

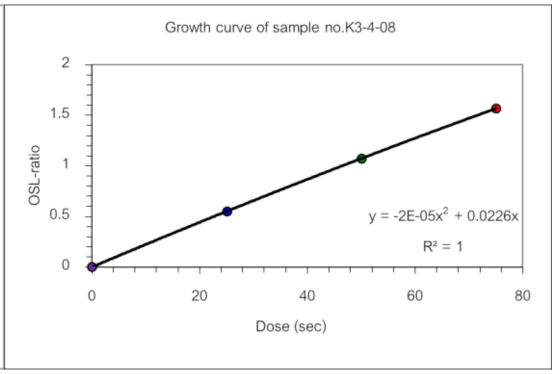
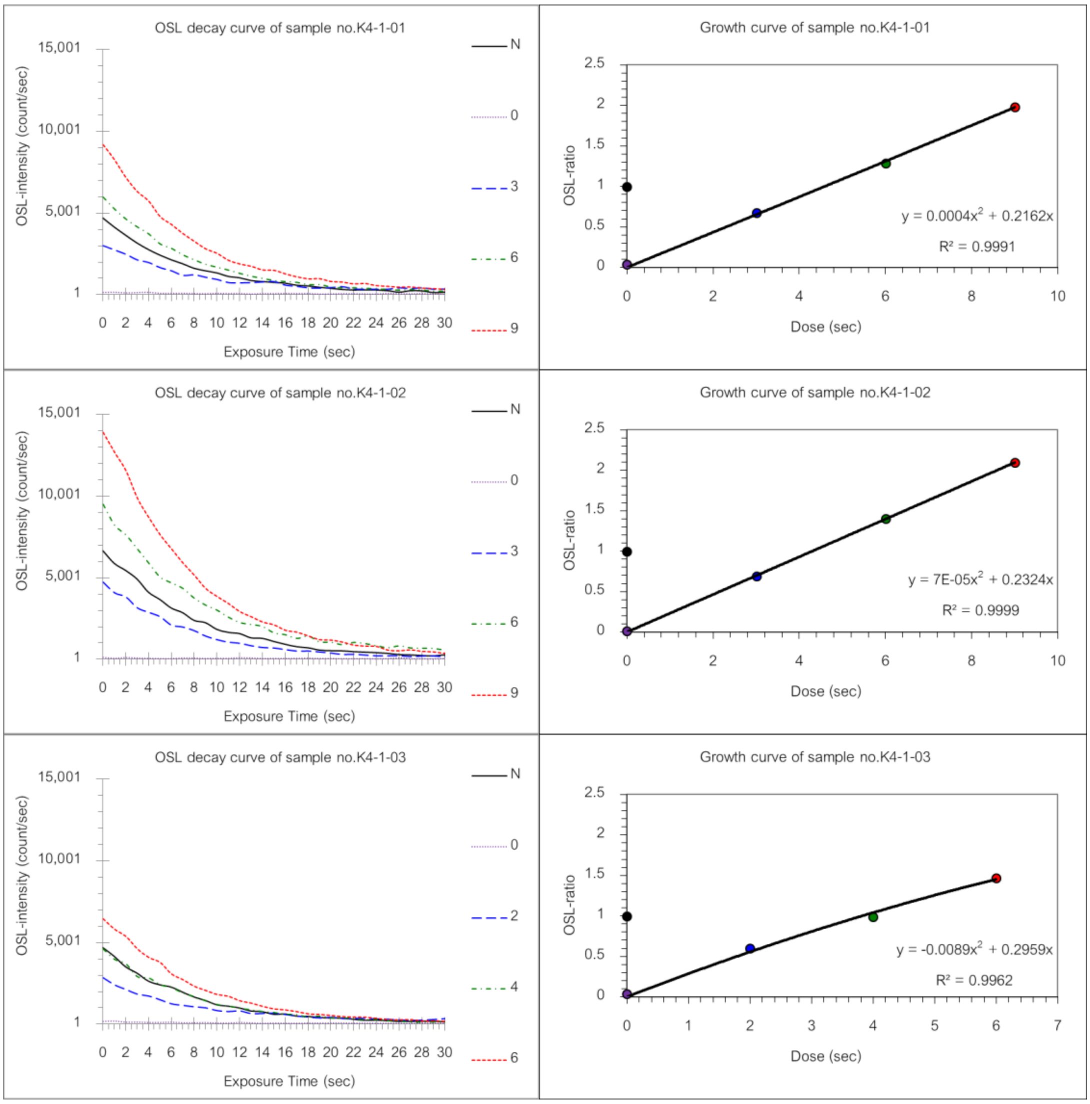

Growth curve of sample no.K3-4-08
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -2E-05x2 + 0.0226x
R² = 1

Table A.14 OSL dating results from beach ridge plain (Kui Buri, K4-1).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K4-1-01	170	0.69±0.1	1.91±0.1	0.35±0.1	2.40	0.58±0.1	0.68±0.04	1,180±210
K4-1-02	170	0.69±0.1	1.91±0.1	0.35±0.1	2.40	0.58±0.1	0.59±0.04	1,020±180
K4-1-03	170	0.69±0.1	1.91±0.1	0.35±0.1	2.40	0.58±0.1	0.51±0.04	880±160
K4-1-04	170	0.69±0.1	1.91±0.1	0.35±0.1	2.40	0.58±0.1	0.67±0.04	1,160±200
K4-1-05	170	0.69±0.1	1.91±0.1	0.35±0.1	2.40	0.58±0.1	0.70±0.04	1,210±210



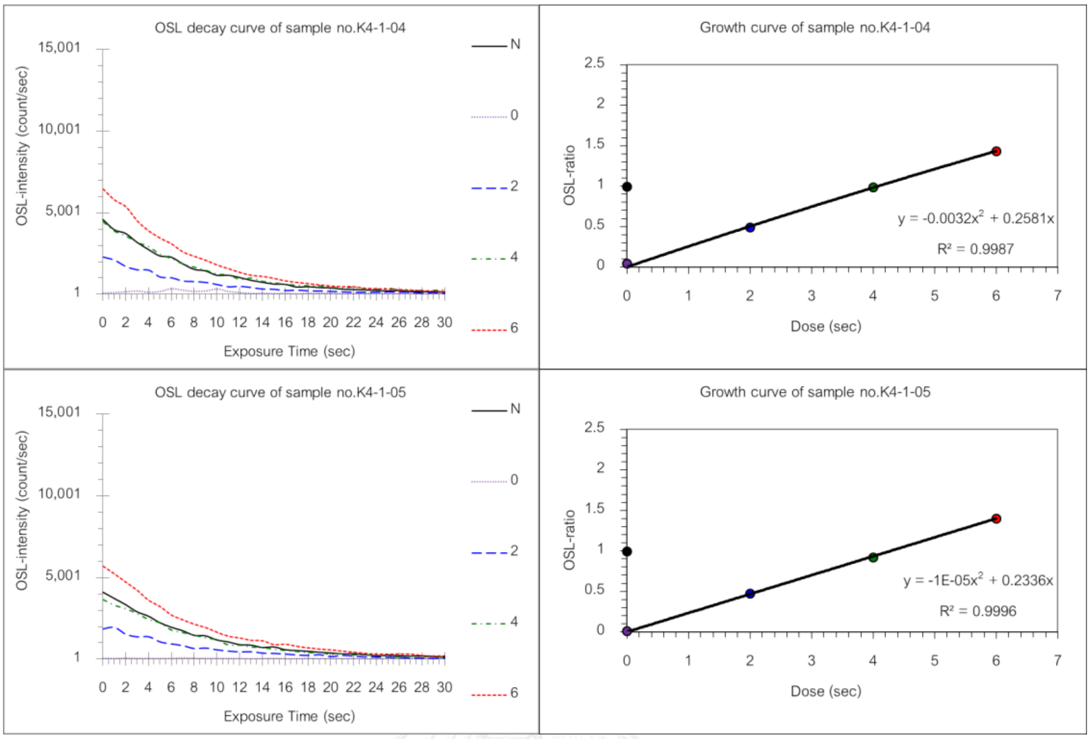
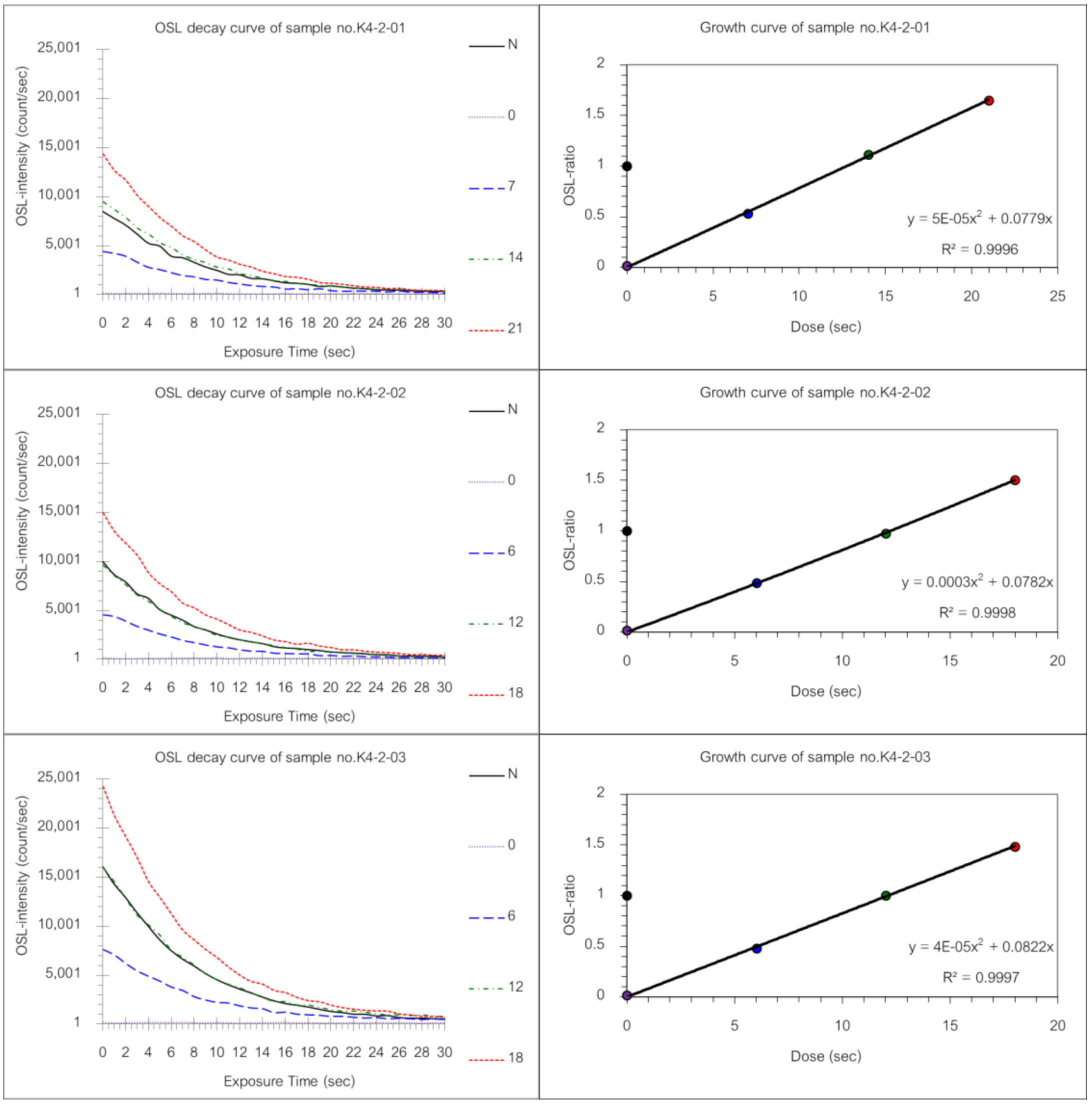
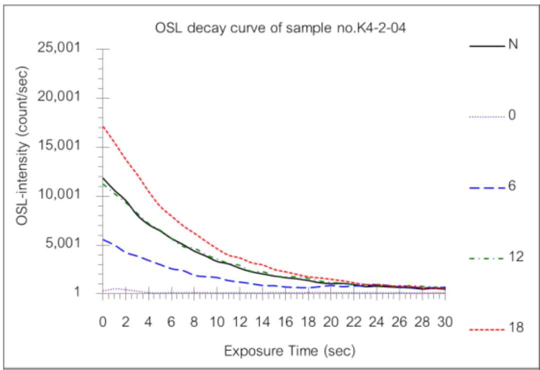
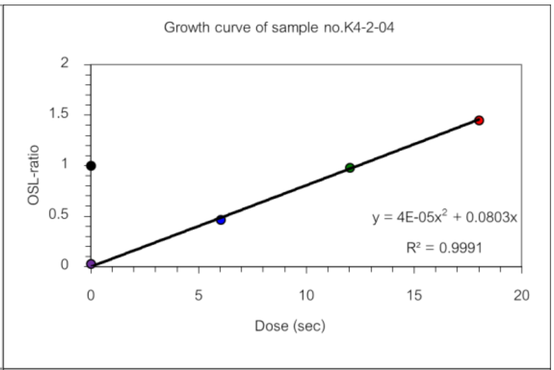

OSL decay curve of sample no.K4-1-04
OSL-intensity (count/sec)
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
2
4
6
Growth curve of sample no.K4-1-04
OSL-ratio
2.5
2
1.5
1
0.5
0
0 1 2 3 4 5 6 7
Dose (sec)
y = -0.0032x2 + 0.2581x
R² = 0.9987
OSL decay curve of sample no.K4-1-05
OSL-intensity (count/sec)
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
2
4
6
Growth curve of sample no.K4-1-05
OSL-ratio
2.5
2
1.5
1
0.5
0
0 1 2 3 4 5 6 7
Dose (sec)
y = -1E-05x2 + 0.2336x
R² = 0.9996

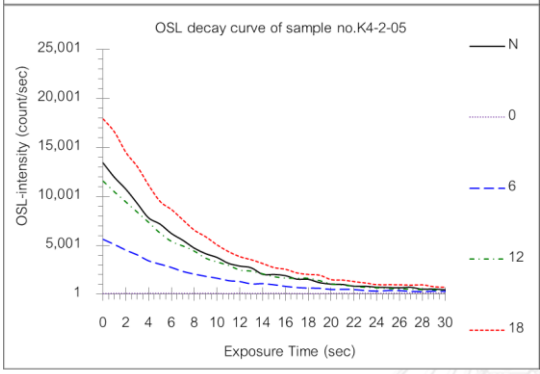
Table A.15 OSL dating results from beach ridge plain (Kui Buri, K4-2).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K4-2-01	450	0.70±0.1	2.48±0.1	0.53±0.1	12.36	0.67±0.1	1.71±0.08	2,540±390
K4-2-02	450	0.70±0.1	2.48±0.1	0.53±0.1	12.36	0.67±0.1	1.55±0.08	2,300±350
K4-2-03	450	0.70±0.1	2.48±0.1	0.53±0.1	12.36	0.67±0.1	2.15±0.13	3,200±510
K4-2-04	450	0.70±0.1	2.48±0.1	0.53±0.1	12.36	0.67±0.1	2.18±0.12	3,230±510
K4-2-05	450	0.70±0.1	2.48±0.1	0.53±0.1	12.36	0.67±0.1	1.77±0.07	2,630±400




OSL decay curve of sample no.K4-2-04
OSL-intensity (count/sec)
25,001
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
6
12
18


Growth curve of sample no.K4-2-04
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20
Dose (sec)
y = 4E-05x^2 + 0.0803x
R² = 0.9991


OSL decay curve of sample no.K4-2-05
OSL-intensity (count/sec)
25,001
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
6
12
18

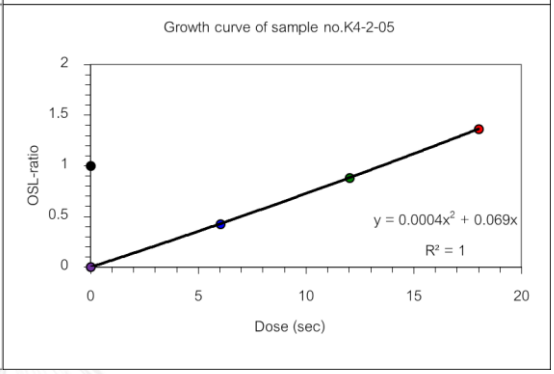
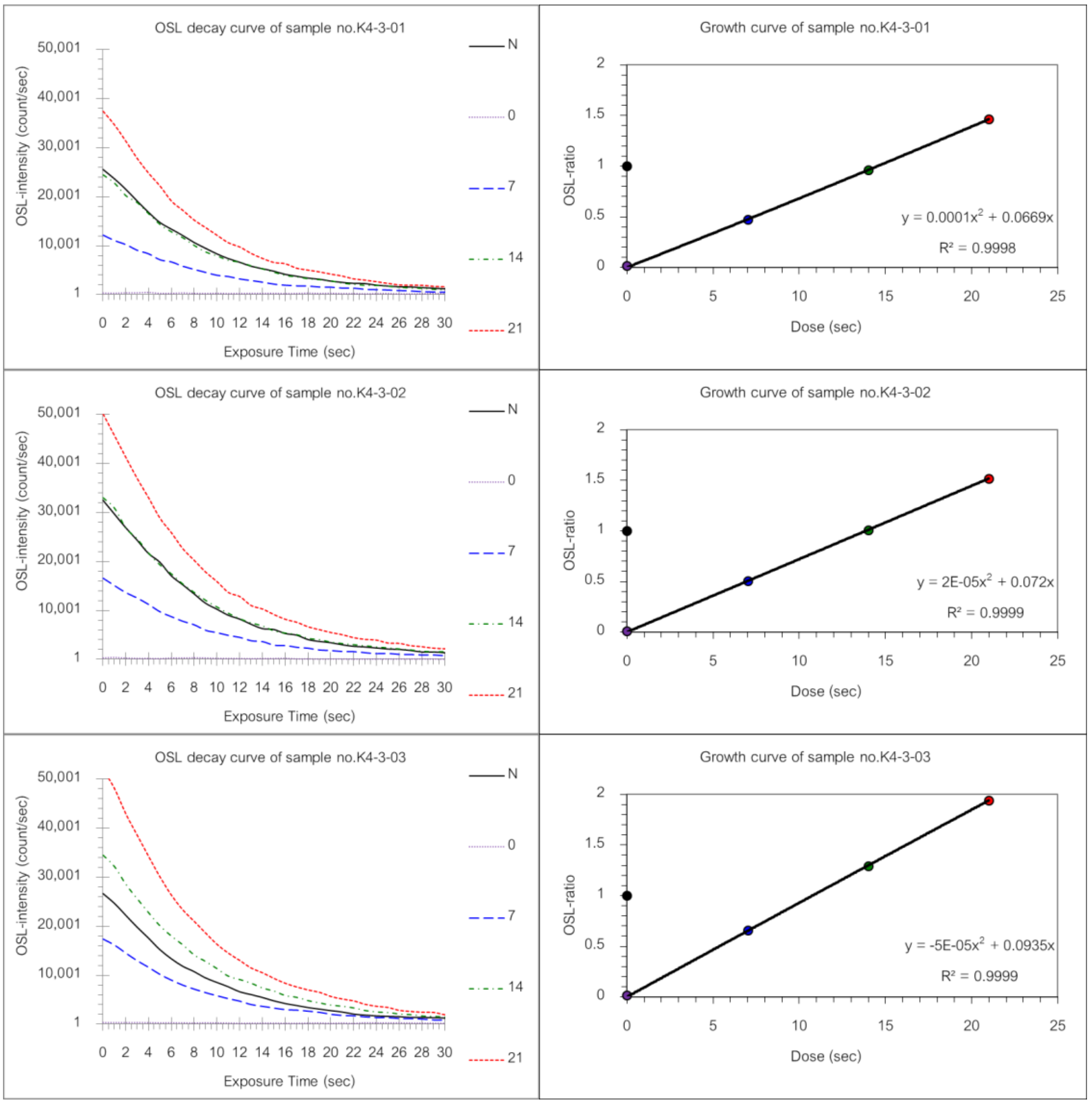
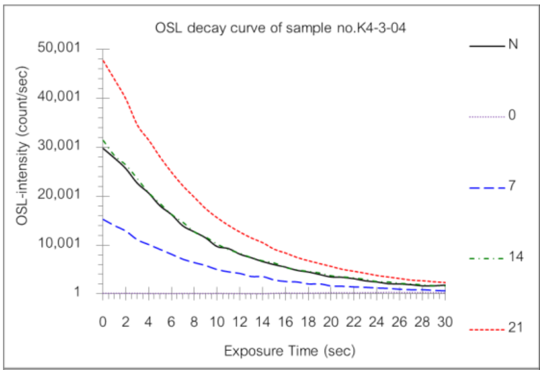
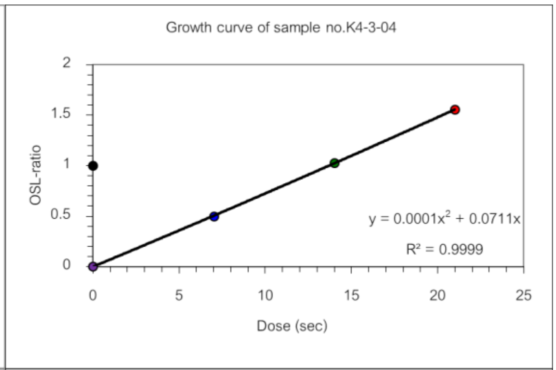

Growth curve of sample no.K4-2-05
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20
Dose (sec)
y = 0.0004x^2 + 0.069x
R² = 1

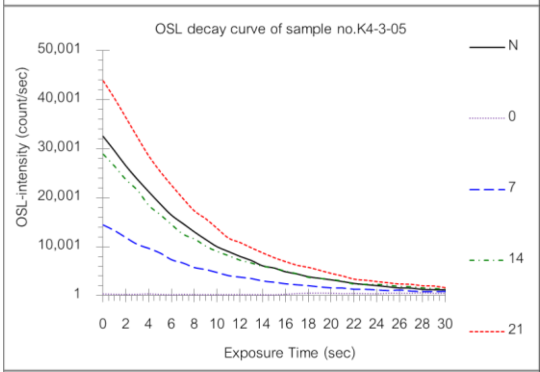
Table A.16 OSL dating results from beach ridge plain (Kui Buri, K4-3).

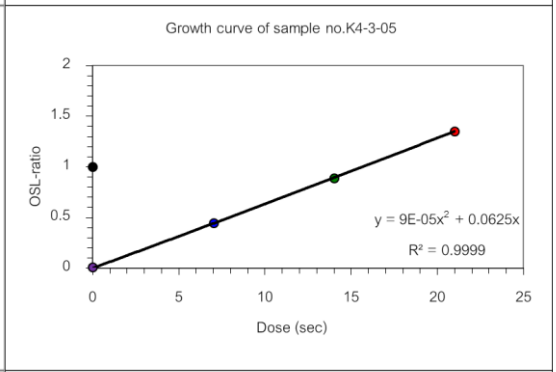
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K4-3-01	1,180	1.04±0.1	2.62±0.1	0.53±0.1	3.20	0.84±0.1	1.98±0.08	2,350±290
K4-3-02	1,180	1.04±0.1	2.62±0.1	0.53±0.1	3.20	0.84±0.1	2.11±0.07	2,510±300
K4-3-03	1,180	1.04±0.1	2.62±0.1	0.53±0.1	3.20	0.84±0.1	1.67±0.06	1,980±240
K4-3-04	1,180	1.04±0.1	2.62±0.1	0.53±0.1	3.20	0.84±0.1	2.29±0.10	2,720±340
K4-3-05	1,180	1.04±0.1	2.62±0.1	0.53±0.1	3.20	0.84±0.1	2.37±0.10	2,810±350
K4-3-06	1,180	1.04±0.1	2.62±0.1	0.53±0.1	3.20	0.84±0.1	1.93±0.07	2,290±280

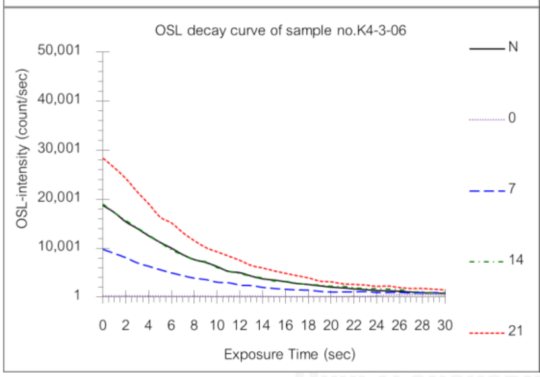



OSL decay curve of sample no.K4-3-04
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
7
14
21


Growth curve of sample no.K4-3-04
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25
Dose (sec)
y = 0.0001x2 + 0.0711x
R² = 0.9999


OSL decay curve of sample no.K4-3-05
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
7
14
21


Growth curve of sample no.K4-3-05
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25
Dose (sec)
y = 9E-05x2 + 0.0625x
R² = 0.9999


OSL decay curve of sample no.K4-3-06
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
7
14
21

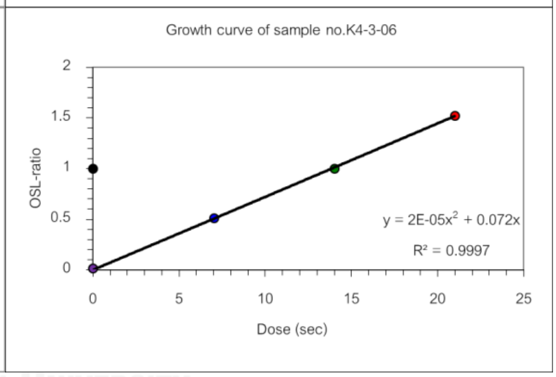
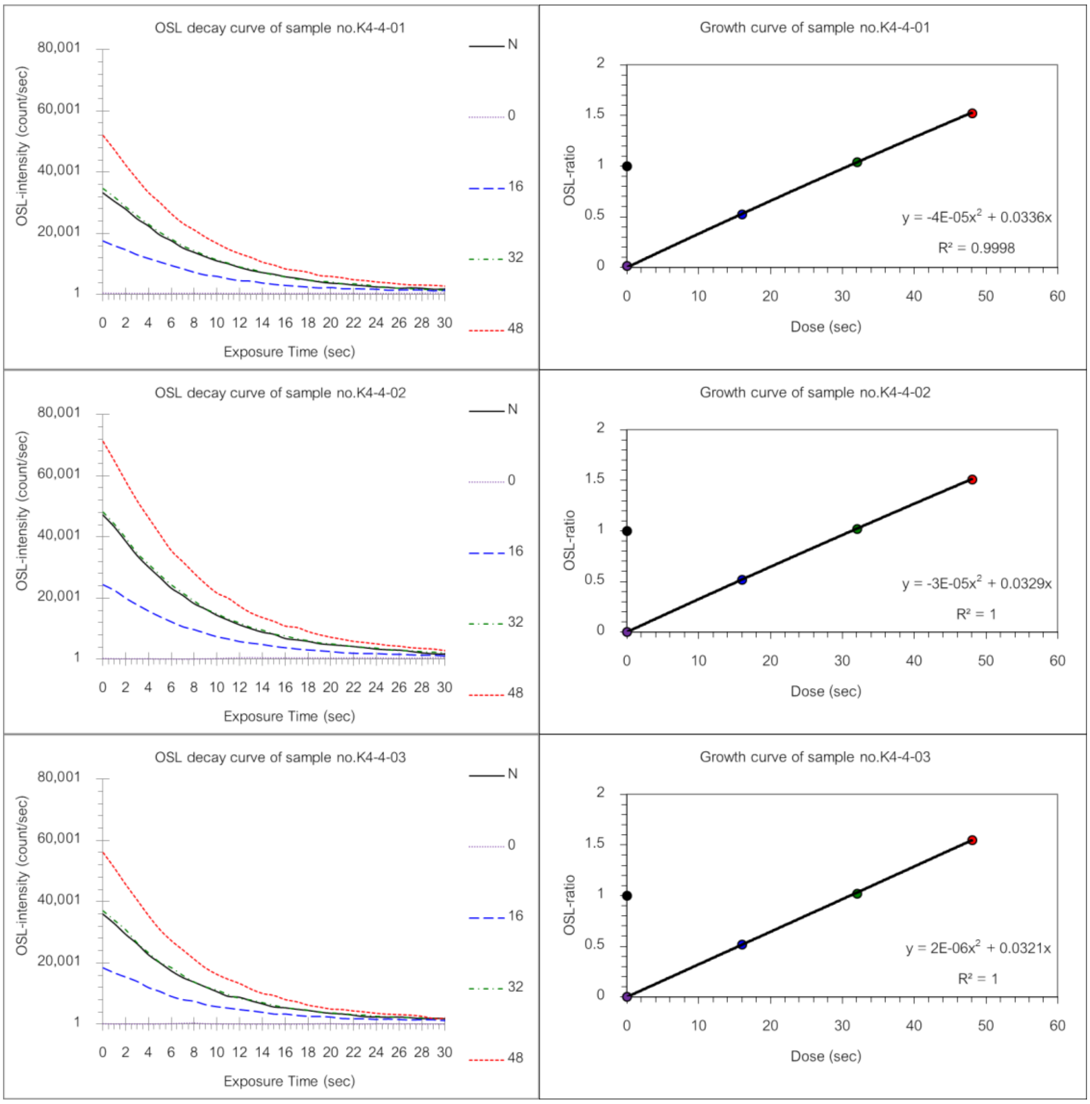
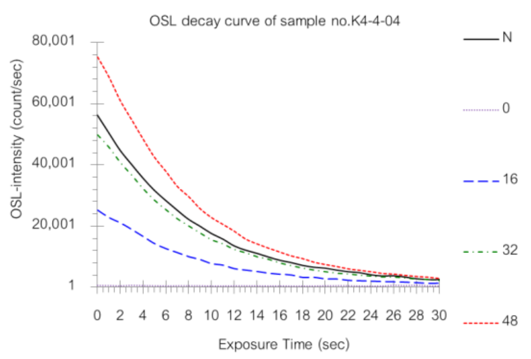
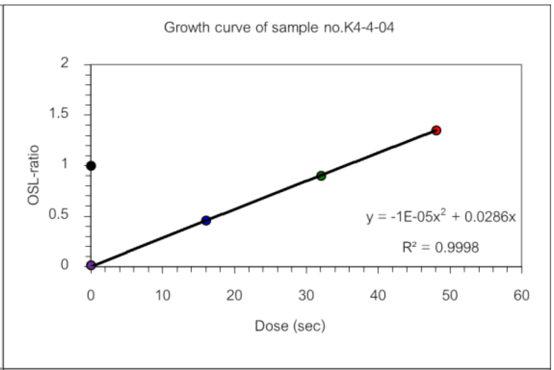

Growth curve of sample no.K4-3-06
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25
Dose (sec)
y = 2E-05x2 + 0.072x
R² = 0.9997

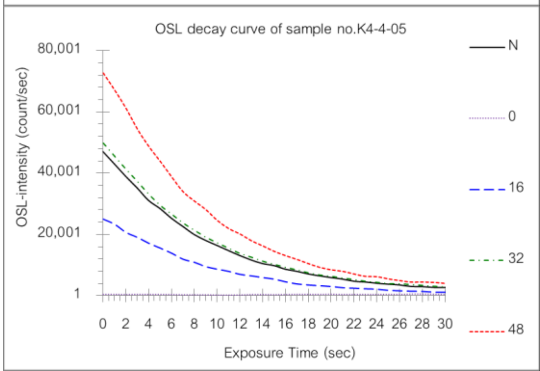
Table A.17 OSL dating results from beach ridge plain (Kui Buri, K4-4).

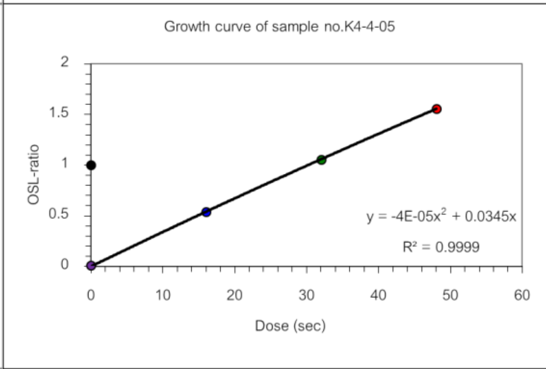
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K4-4-01	1,500	0.79±0.1	2.63±0.1	0.57±0.1	0.34	0.84±0.1	4.93±0.29	5,820±760
K4-4-02	1,500	0.79±0.1	2.63±0.1	0.57±0.1	0.34	0.84±0.1	5.04±0.22	5,960±750
K4-4-03	1,500	0.79±0.1	2.63±0.1	0.57±0.1	0.34	0.84±0.1	4.19±0.86	4,960±1,170
K4-4-04	1,500	0.79±0.1	2.63±0.1	0.57±0.1	0.34	0.84±0.1	4.82±0.20	5,700±710
K4-4-05	1,500	0.79±0.1	2.63±0.1	0.57±0.1	0.34	0.84±0.1	4.16±0.25	4,920±650
K4-4-06	1,500	0.79±0.1	2.63±0.1	0.57±0.1	0.34	0.84±0.1	4.30±0.15	5,090±620

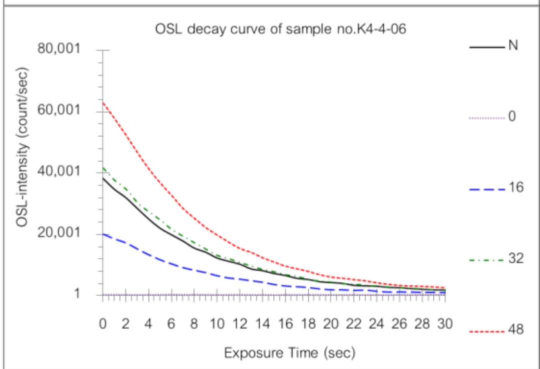



OSL decay curve of sample no.K4-4-04
OSL-intensity (count/sec)
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
16
32
48


Growth curve of sample no.K4-4-04
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60
Dose (sec)
y = -1E-05x^2 + 0.0286x
R² = 0.9998


OSL decay curve of sample no.K4-4-05
OSL-intensity (count/sec)
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
16
32
48


Growth curve of sample no.K4-4-05
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60
Dose (sec)
y = -4E-05x^2 + 0.0345x
R² = 0.9999


OSL decay curve of sample no.K4-4-06
OSL-intensity (count/sec)
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
16
32
48

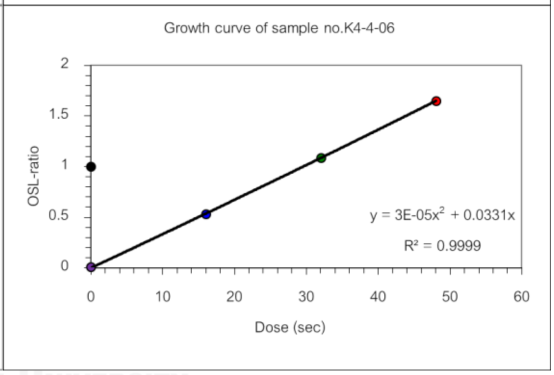
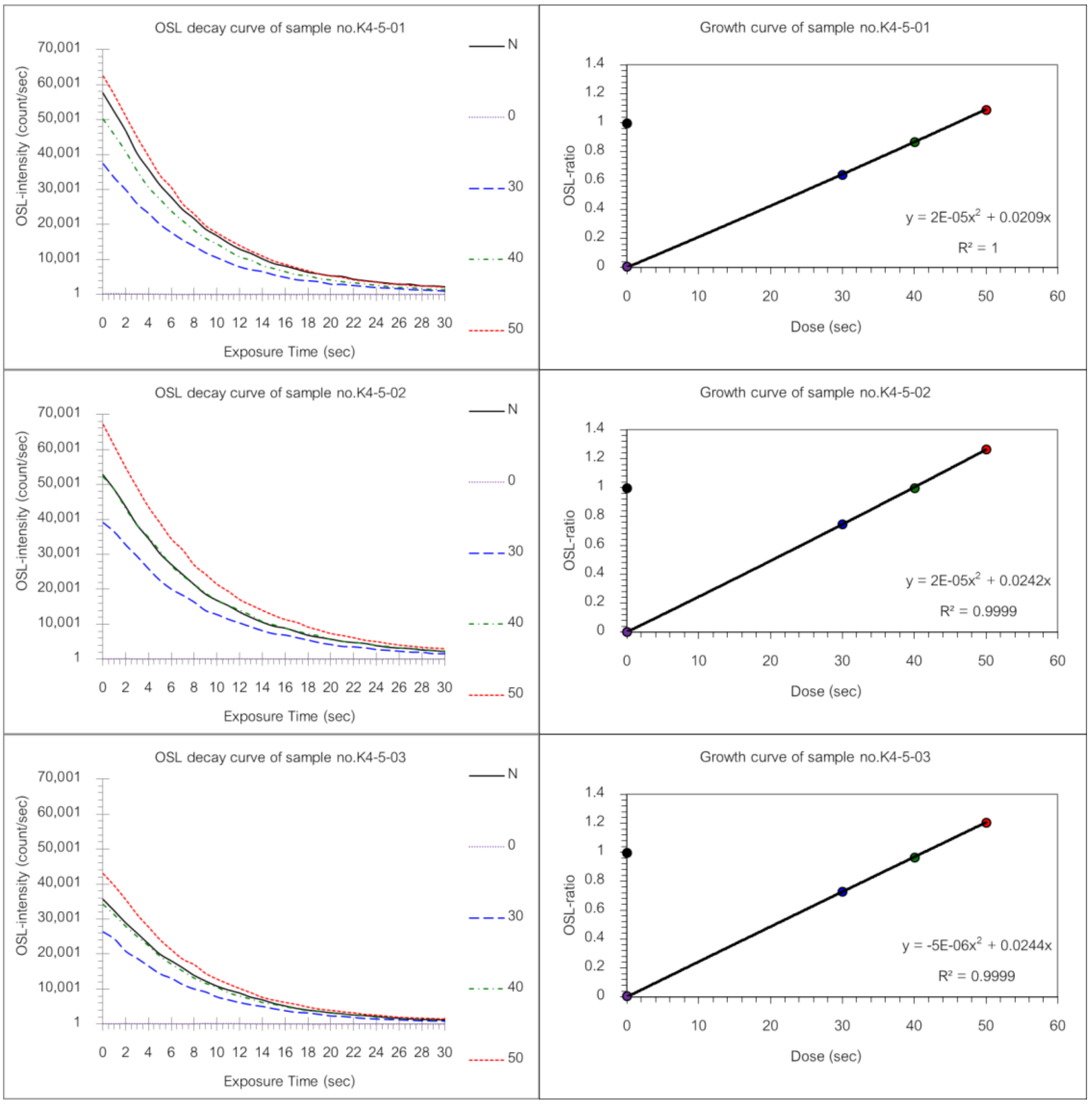
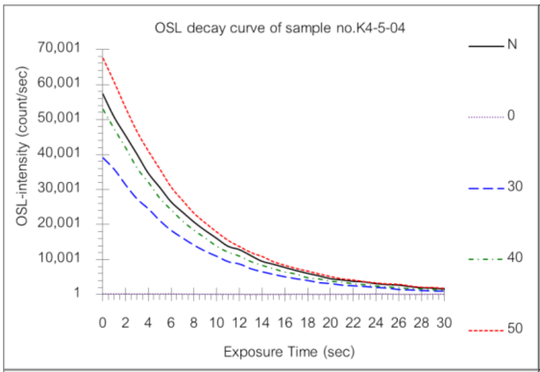

Growth curve of sample no.K4-4-06
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60
Dose (sec)
y = 3E-05x^2 + 0.0331x
R² = 0.9999

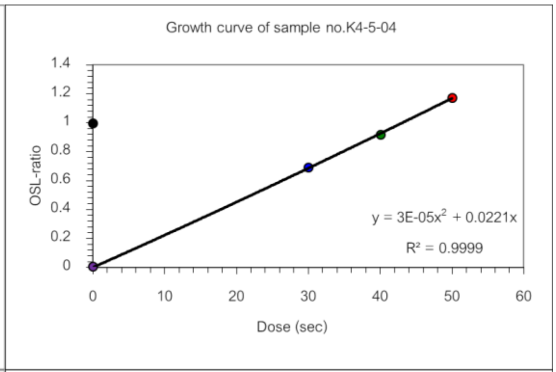
Table A.18 OSL dating results from beach ridge plain (Kui Buri, K4-5).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K4-5-01	1,900	0.75±0.1	2.53±0.1	0.54±0.1	1.43	0.80±0.1	6.57±0.45	8,220±1,170
K4-5-02	1,900	0.75±0.1	2.53±0.1	0.54±0.1	1.43	0.80±0.1	5.32±0.24	6,650±880
K4-5-03	1,900	0.75±0.1	2.53±0.1	0.54±0.1	1.43	0.80±0.1	6.63±0.64	8,300±1,310
K4-5-04	1,900	0.75±0.1	2.53±0.1	0.54±0.1	1.43	0.80±0.1	5.69±0.19	7,120±920
K4-5-05	1,900	0.75±0.1	2.53±0.1	0.54±0.1	1.43	0.80±0.1	6.77±0.31	8,470±1,120

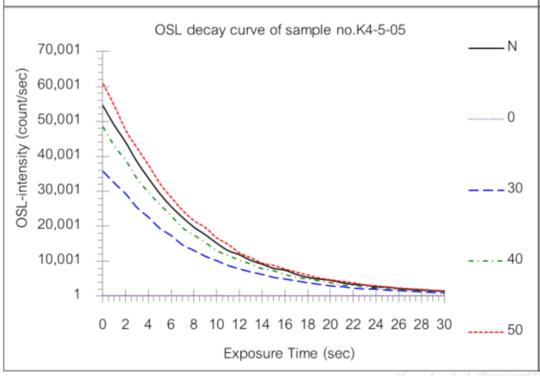




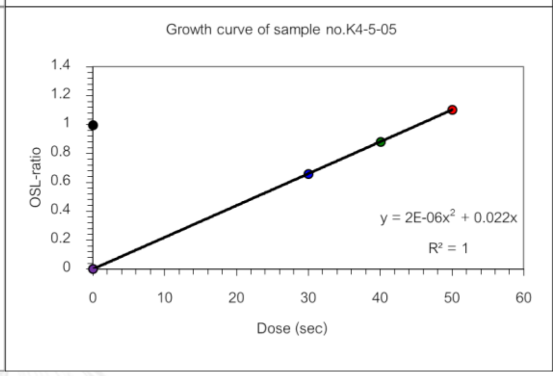
OSL decay curve of sample no.K4-5-04
OSL-intensity (count/sec)
70,001
60,001
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
30
40
50



Growth curve of sample no.K4-5-04
OSL-ratio
1.4
1.2
1
0.8
0.6
0.4
0.2
0
y = 3E-05x2 + 0.0221x
R² = 0.9999
0 10 20 30 40 50 60
Dose (sec)



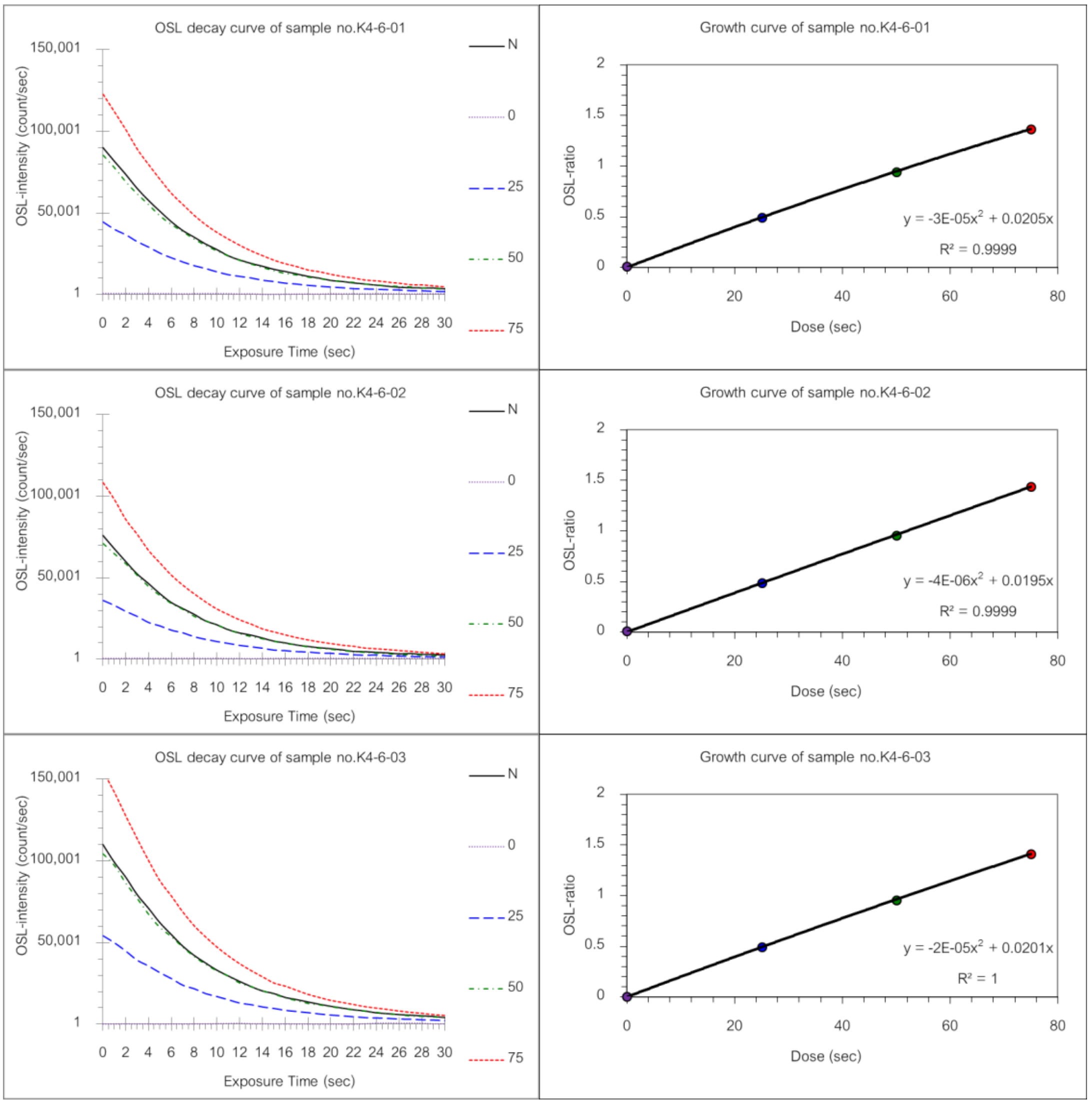
OSL decay curve of sample no.K4-5-05
OSL-intensity (count/sec)
70,001
60,001
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
30
40
50

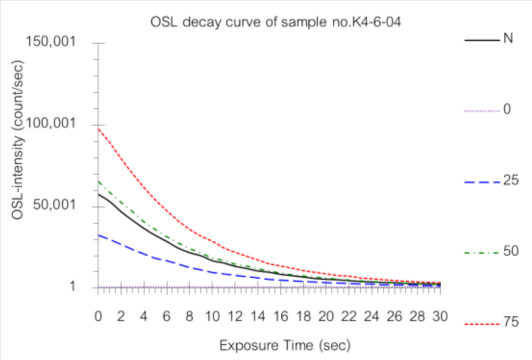


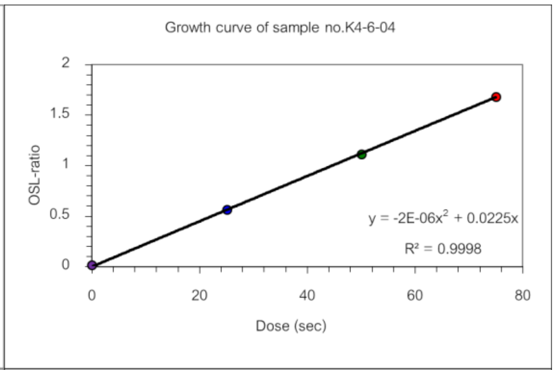
Growth curve of sample no.K4-5-05
OSL-ratio
1.4
1.2
1
0.8
0.6
0.4
0.2
0
y = 2E-06x2 + 0.022x
R² = 1
0 10 20 30 40 50 60
Dose (sec)

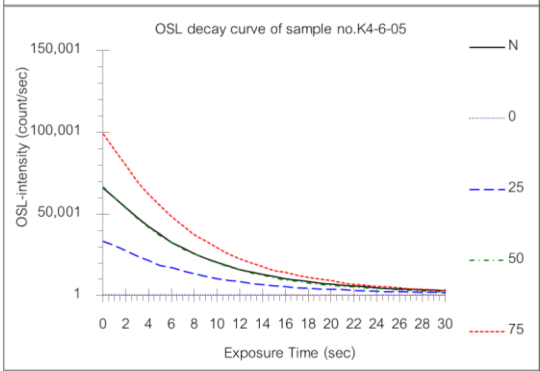
Table A.19 OSL dating results from beach ridge plain (Kui Buri, K4-6).

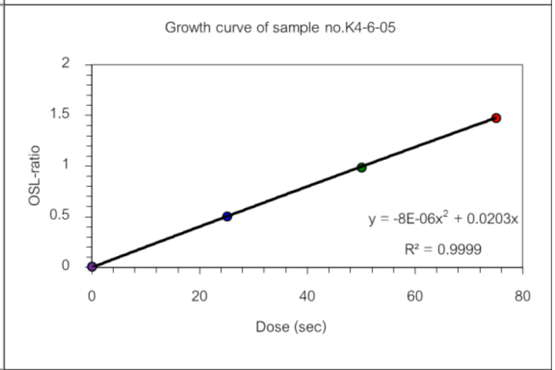
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K4-6-01	2,200	0.77±0.1	2.80±0.1	0.65±0.1	4.00	0.88±0.1	6.95±0.44	7,870±1,020
K4-6-02	2,200	0.77±0.1	2.80±0.1	0.65±0.1	4.00	0.88±0.1	7.79±0.27	8,830±1,040
K4-6-03	2,200	0.77±0.1	2.80±0.1	0.65±0.1	4.00	0.88±0.1	6.84±0.25	7,760±920
K4-6-04	2,200	0.77±0.1	2.80±0.1	0.65±0.1	4.00	0.88±0.1	6.41±0.31	7,270±890
K4-6-05	2,200	0.77±0.1	2.80±0.1	0.65±0.1	4.00	0.88±0.1	6.70±0.49	7,590±1,020
K4-6-06	2,200	0.77±0.1	2.80±0.1	0.65±0.1	4.00	0.88±0.1	7.56±0.35	8,570±1,040

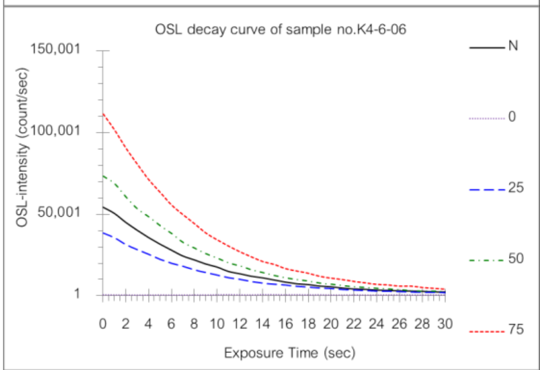



OSL decay curve of sample no.K4-6-04
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75


Growth curve of sample no.K4-6-04
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -2E-06x^2 + 0.0225x
R² = 0.9998


OSL decay curve of sample no.K4-6-05
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75


Growth curve of sample no.K4-6-05
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -8E-06x^2 + 0.0203x
R² = 0.9999


OSL decay curve of sample no.K4-6-06
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75

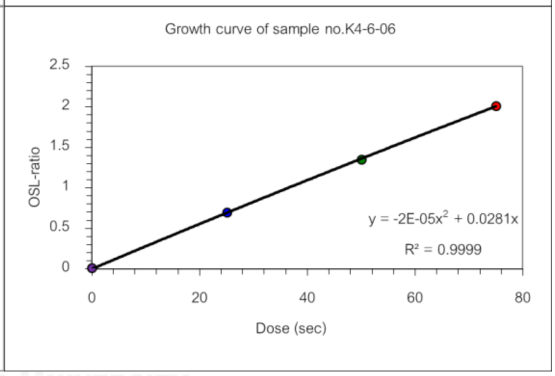
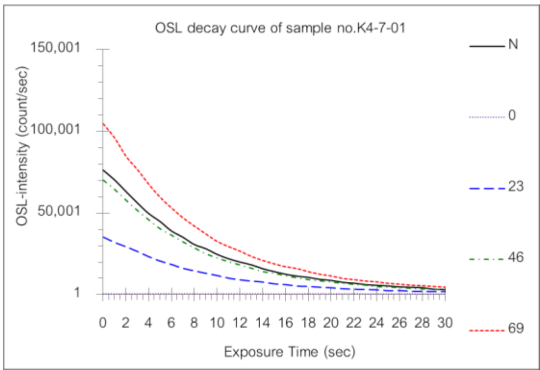
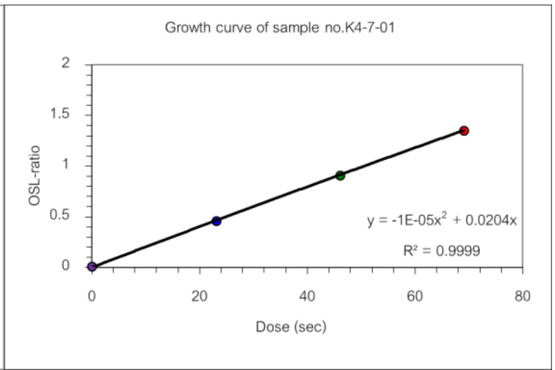
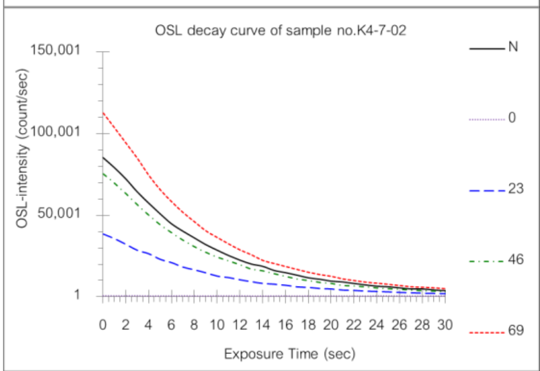

Growth curve of sample no.K4-6-06
OSL-ratio
2.5
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -2E-05x^2 + 0.0281x
R² = 0.9999

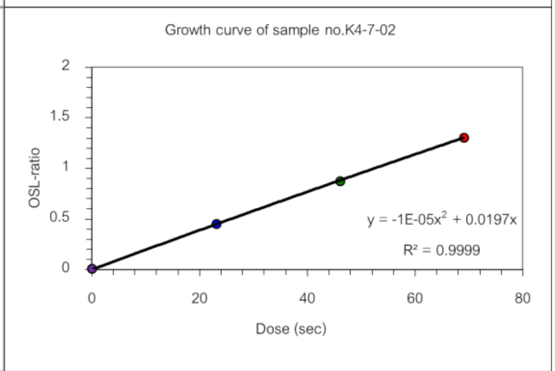
Table A.20 OSL dating results from beach ridge plain (Kui Buri, K4-7).

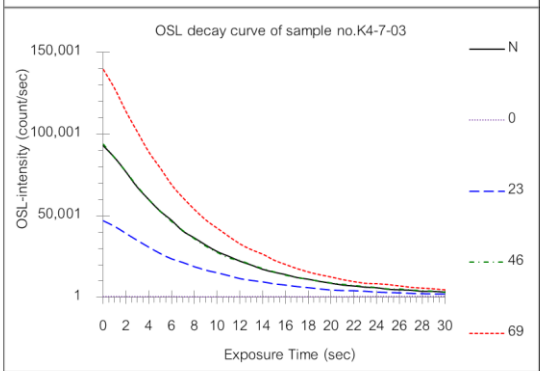
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K4-7-01	2,480	0.81±0.1	2.70±0.1	0.72±0.1	1.69	0.96±0.1	6.85±0.41	7,110±850
K4-7-02	2,480	0.81±0.1	2.70±0.1	0.72±0.1	1.69	0.96±0.1	5.75±0.19	5,960±650
K4-7-03	2,480	0.81±0.1	2.70±0.1	0.72±0.1	1.69	0.96±0.1	6.81±0.32	7,060±800
K4-7-04	2,480	0.81±0.1	2.70±0.1	0.72±0.1	1.69	0.96±0.1	7.21±0.36	7,480±850
K4-7-05	2,480	0.81±0.1	2.70±0.1	0.72±0.1	1.69	0.96±0.1	6.40±0.21	6,640±720
K4-7-06	2,480	0.81±0.1	2.70±0.1	0.72±0.1	1.69	0.96±0.1	6.16±0.19	6,390±690

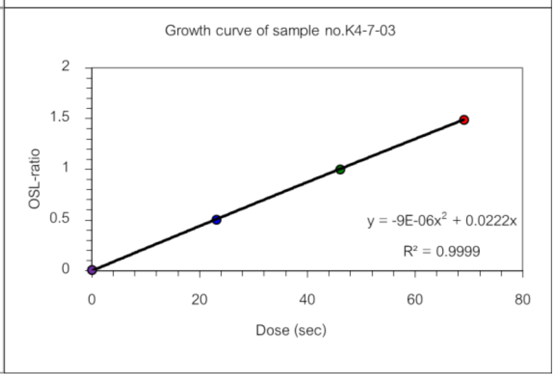


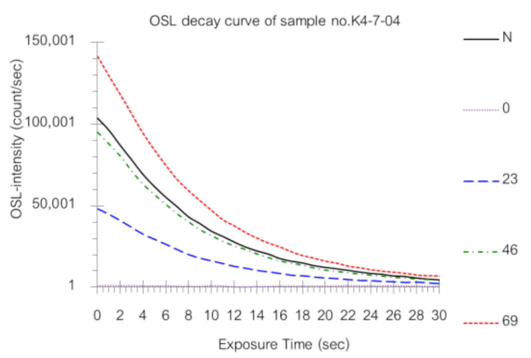


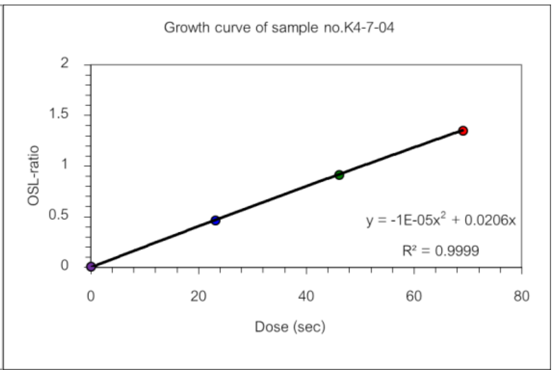


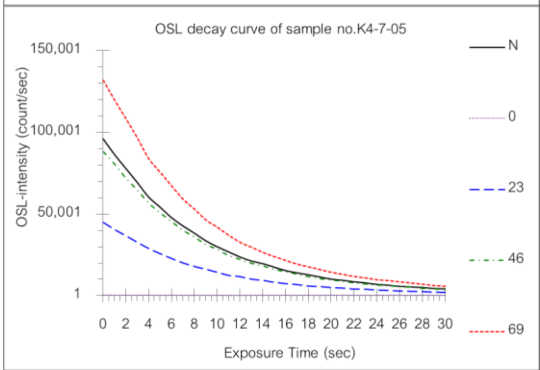


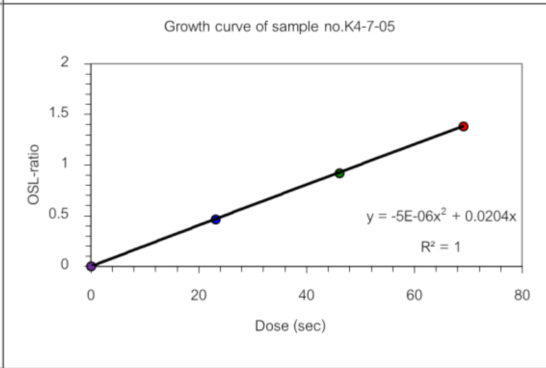


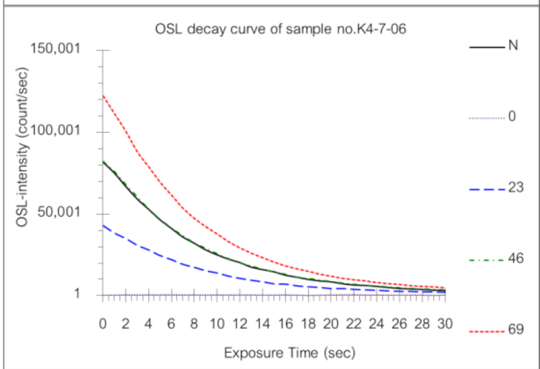



OSL decay curve of sample no.K4-7-04
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
23
46
69


Growth curve of sample no.K4-7-04
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -1E-05x^2 + 0.0206x
R² = 0.9999


OSL decay curve of sample no.K4-7-05
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
23
46
69


Growth curve of sample no.K4-7-05
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -5E-06x^2 + 0.0204x
R² = 1


OSL decay curve of sample no.K4-7-06
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
23
46
69

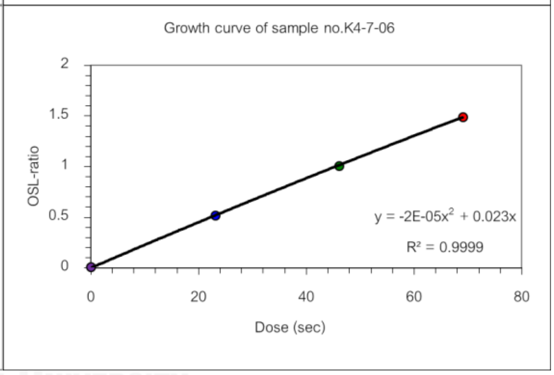
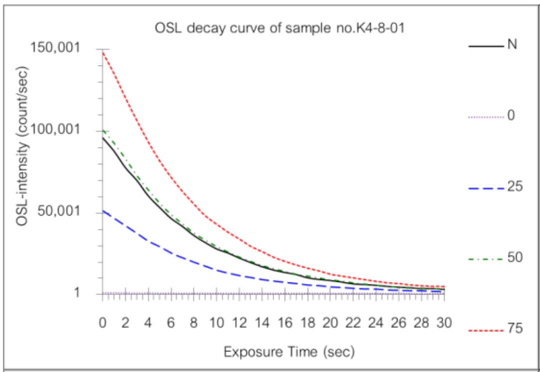
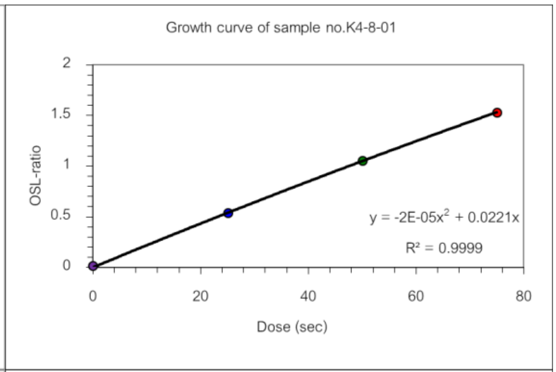
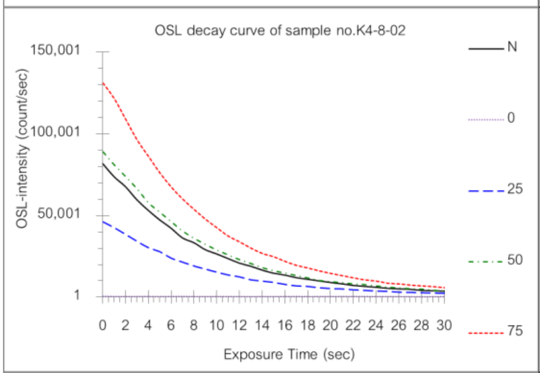

Growth curve of sample no.K4-7-06
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -2E-05x^2 + 0.023x
R² = 0.9999

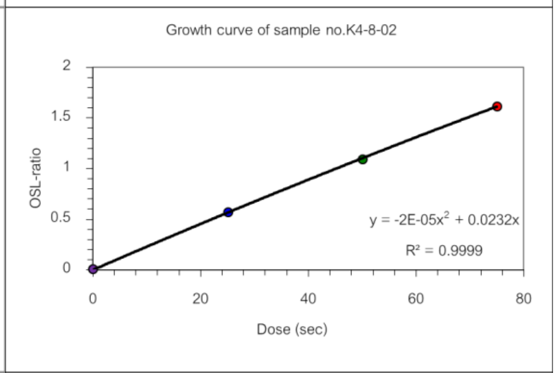
Table A.21 OSL dating results from beach ridge plain (Kui Buri, K4-8).

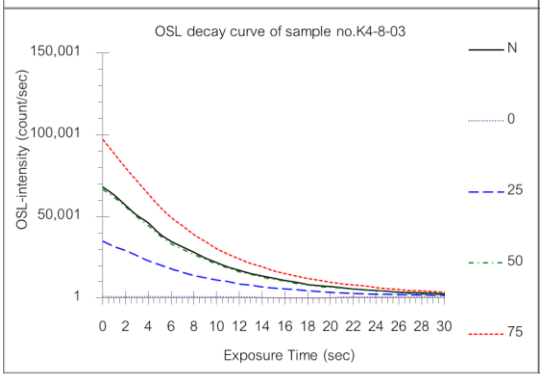
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K4-8-01	3,100	0.96±0.1	4.05±0.1	0.73±0.1	1.98	1.10±0.1	8.44±0.40	7,650±780
K4-8-02	3,100	0.96±0.1	4.05±0.1	0.73±0.1	1.98	1.10±0.1	5.84±0.22	5,280±510
K4-8-03	3,100	0.96±0.1	4.05±0.1	0.73±0.1	1.98	1.10±0.1	8.53±0.35	7,720±760
K4-8-04	3,100	0.96±0.1	4.05±0.1	0.73±0.1	1.98	1.10±0.1	5.99±0.34	5,430±570
K4-8-05	3,100	0.96±0.1	4.05±0.1	0.73±0.1	1.98	1.10±0.1	5.71±0.33	5,160±550
K4-8-06	3,100	0.96±0.1	4.05±0.1	0.73±0.1	1.98	1.10±0.1	5.95±0.30	5,380±550

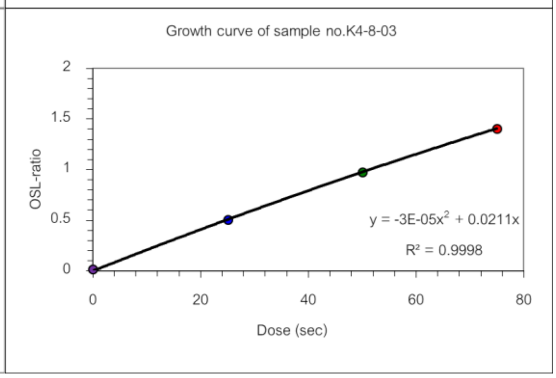












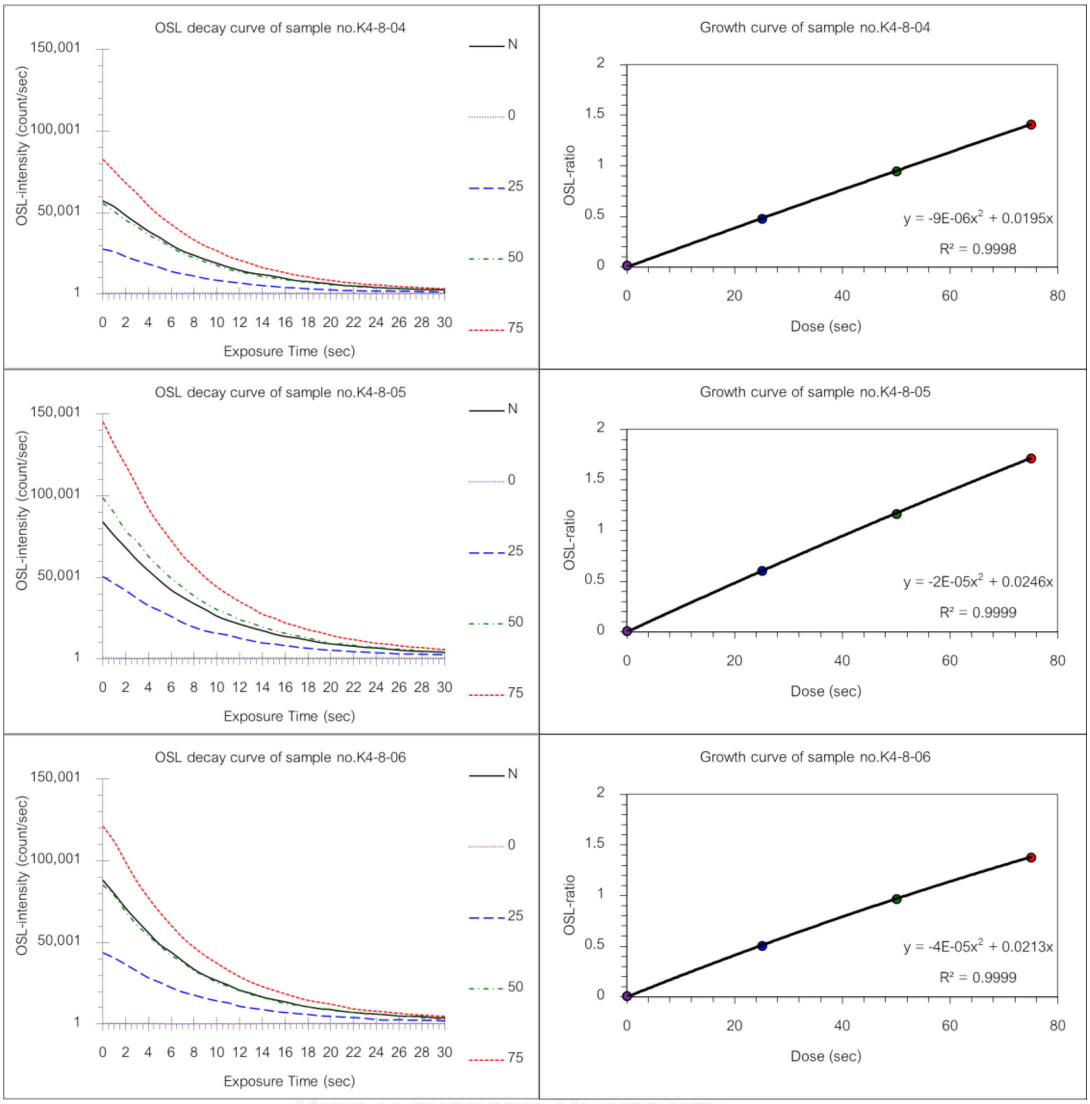
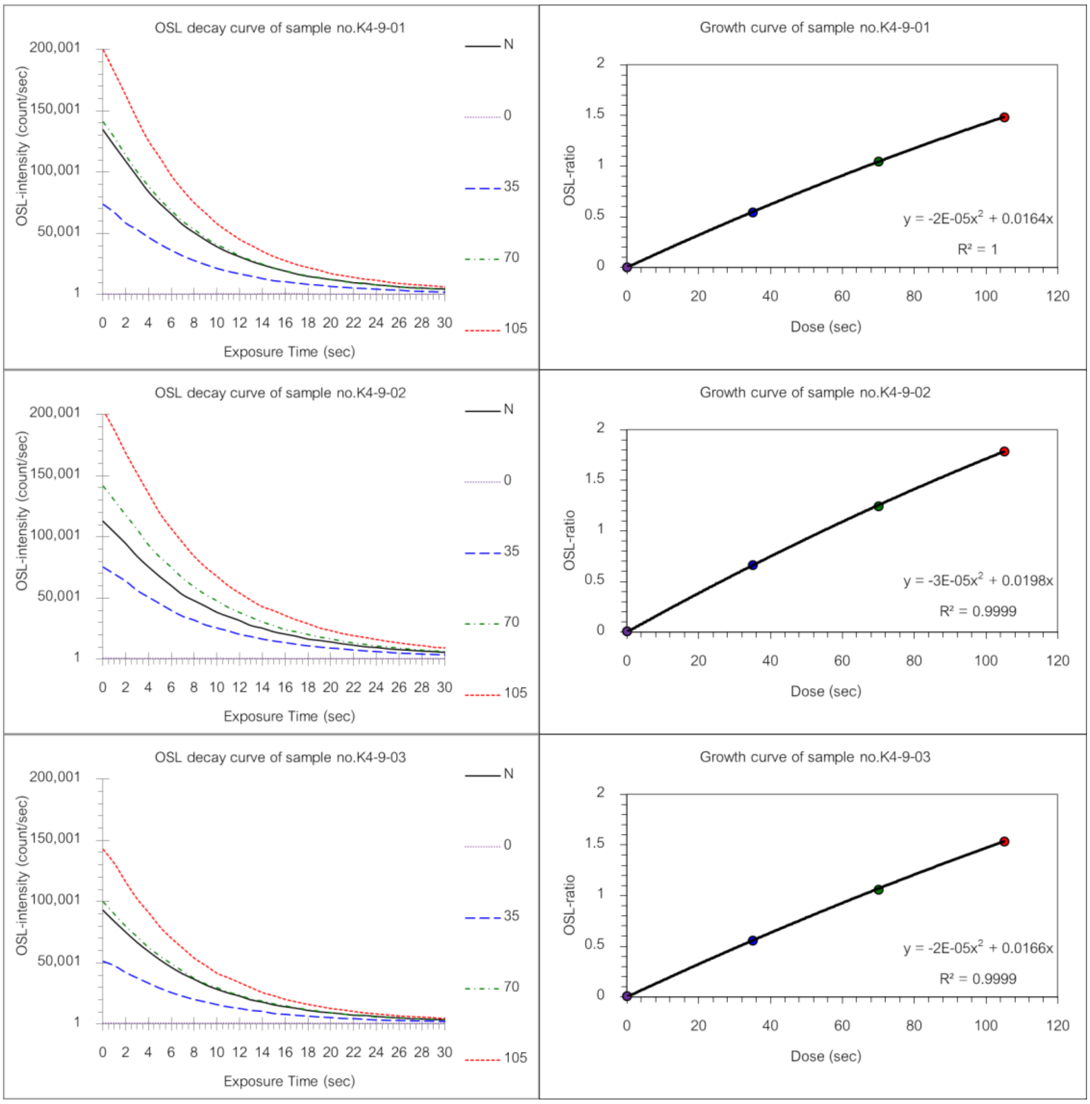
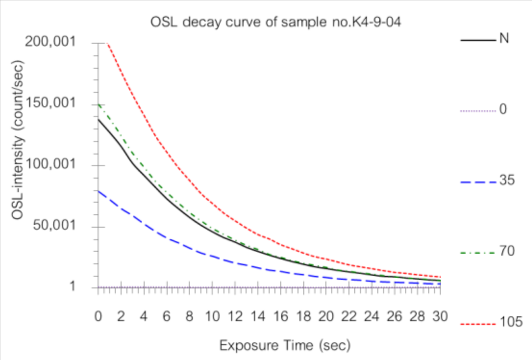
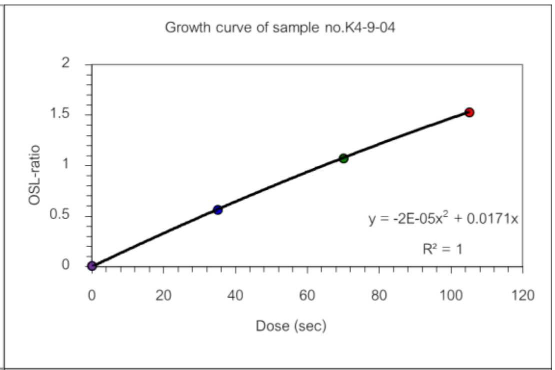

OSL decay curve of sample no.K4-8-04
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75
Growth curve of sample no.K4-8-04
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -9E-06x2 + 0.0195x
R² = 0.9998
OSL decay curve of sample no.K4-8-05
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75
Growth curve of sample no.K4-8-05
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -2E-05x2 + 0.0246x
R² = 0.9999
OSL decay curve of sample no.K4-8-06
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75
Growth curve of sample no.K4-8-06
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -4E-05x2 + 0.0213x
R² = 0.9999

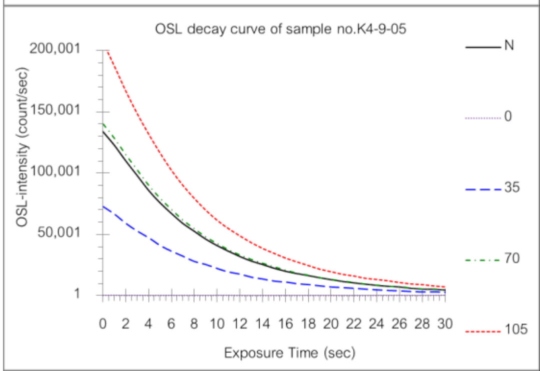
Table A.22 OSL dating results from beach ridge plain (Kui Buri, K4-9).

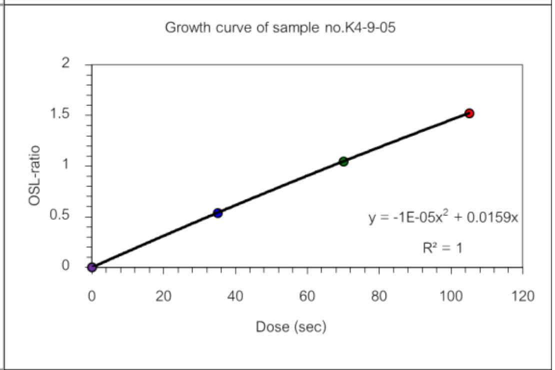
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K4-9-01	3,500	1.25±0.1	5.13±0.1	0.85±0.1	1.77	1.34±0.1	11.36±0.54	8,460±740
K4-9-02	3,500	1.25±0.1	5.13±0.1	0.85±0.1	1.77	1.34±0.1	10.60±0.55	7,890±710
K4-9-03	3,500	1.25±0.1	5.13±0.1	0.85±0.1	1.77	1.34±0.1	8.71±0.39	6,480±560
K4-9-04	3,500	1.25±0.1	5.13±0.1	0.85±0.1	1.77	1.34±0.1	10.98±0.38	8,170±670
K4-9-05	3,500	1.25±0.1	5.13±0.1	0.85±0.1	1.77	1.34±0.1	10.25±0.42	7,630±650
K4-9-06	3,500	1.25±0.1	5.13±0.1	0.85±0.1	1.77	1.34±0.1	14.94±0.69	11,120±970

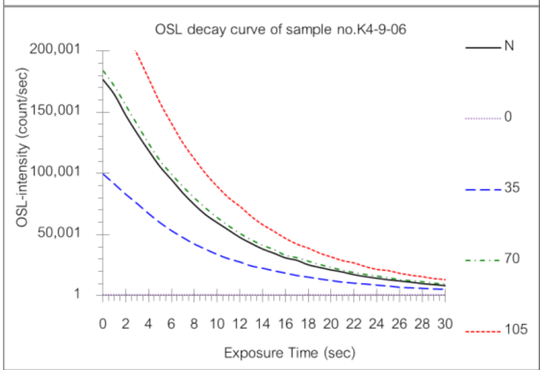



OSL decay curve of sample no.K4-9-04
OSL-intensity (count/sec)
200,001
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
35
70
105


Growth curve of sample no.K4-9-04
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80 100 120
Dose (sec)
y = -2E-05x2 + 0.0171x
R² = 1


OSL decay curve of sample no.K4-9-05
OSL-intensity (count/sec)
200,001
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
35
70
105


Growth curve of sample no.K4-9-05
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80 100 120
Dose (sec)
y = -1E-05x2 + 0.0159x
R² = 1


OSL decay curve of sample no.K4-9-06
OSL-intensity (count/sec)
200,001
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
35
70
105

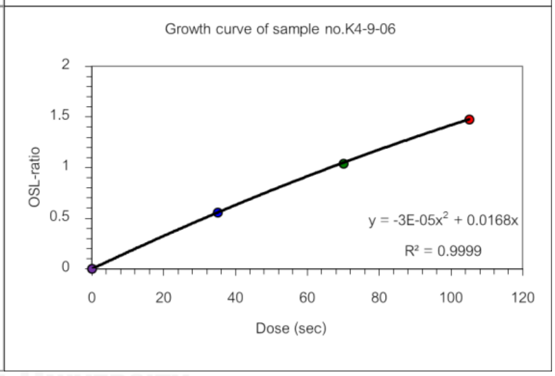
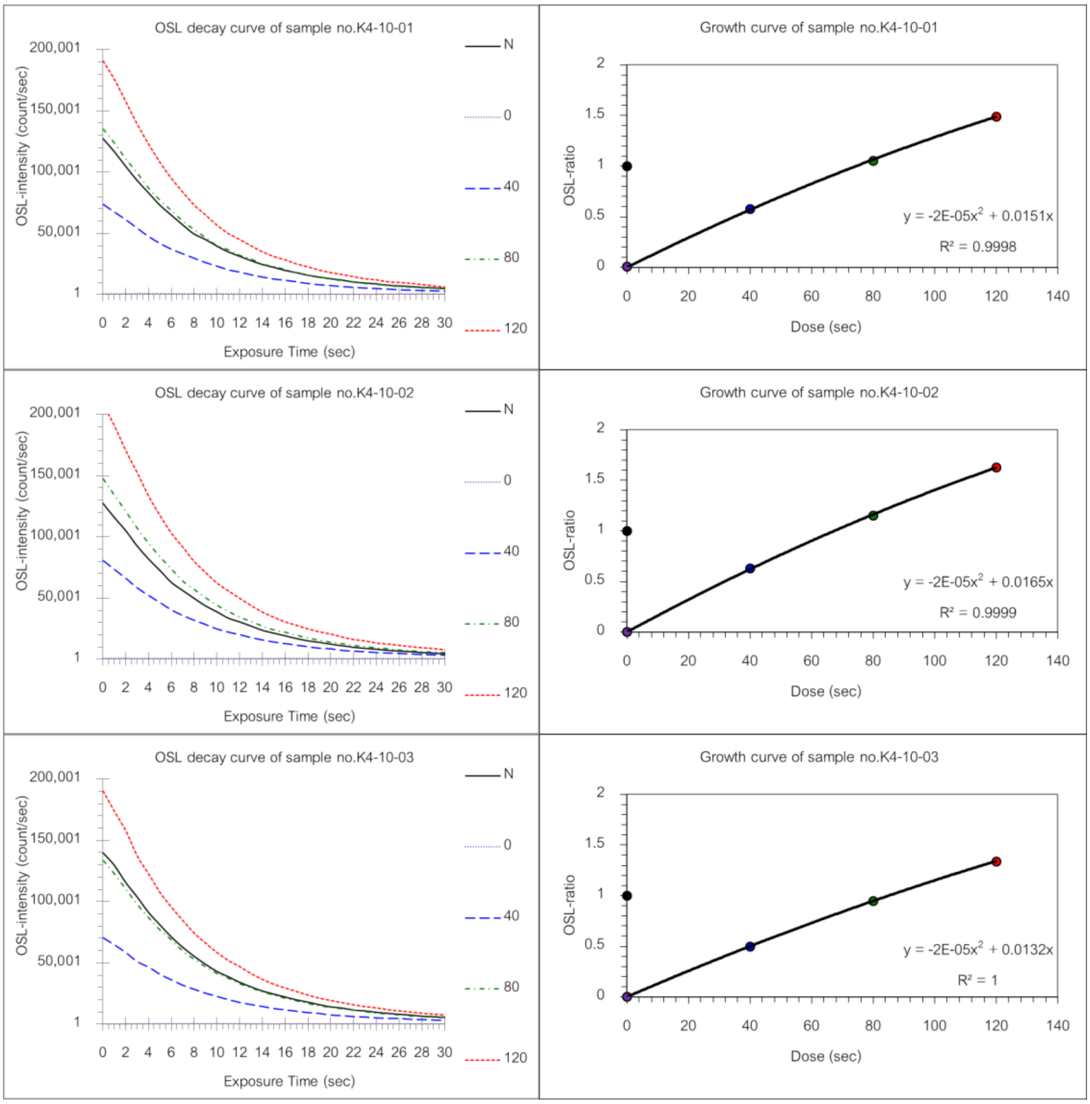

Growth curve of sample no.K4-9-06
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80 100 120
Dose (sec)
y = -3E-05x2 + 0.0168x
R² = 0.9999

Table A.23 OSL dating results from beach ridge plain (Kui Buri, K4-10).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
K4-10-01	3,800	1.09±0.1	4.72±0.1	1.01±0.1	2.02	1.41±0.1	9.90±0.46	7,030±590
K4-10-02	3,800	1.09±0.1	4.72±0.1	1.01±0.1	2.02	1.41±0.1	11.20±0.84	7,950±820
K4-10-03	3,800	1.09±0.1	4.72±0.1	1.01±0.1	2.02	1.41±0.1	12.06±0.44	8,560±680
K4-10-04	3,800	1.09±0.1	4.72±0.1	1.01±0.1	2.02	1.41±0.1	11.19±0.53	7,940±670
K4-10-05	3,800	1.09±0.1	4.72±0.1	1.01±0.1	2.02	1.41±0.1	9.72±0.99	6,900±850



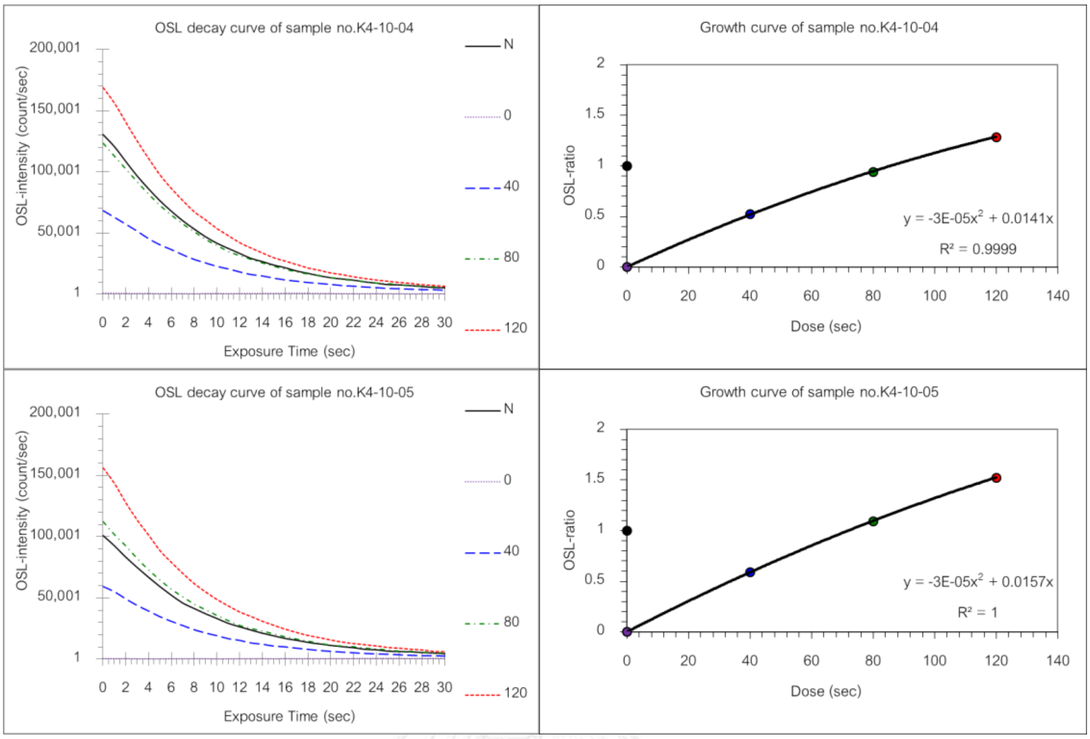
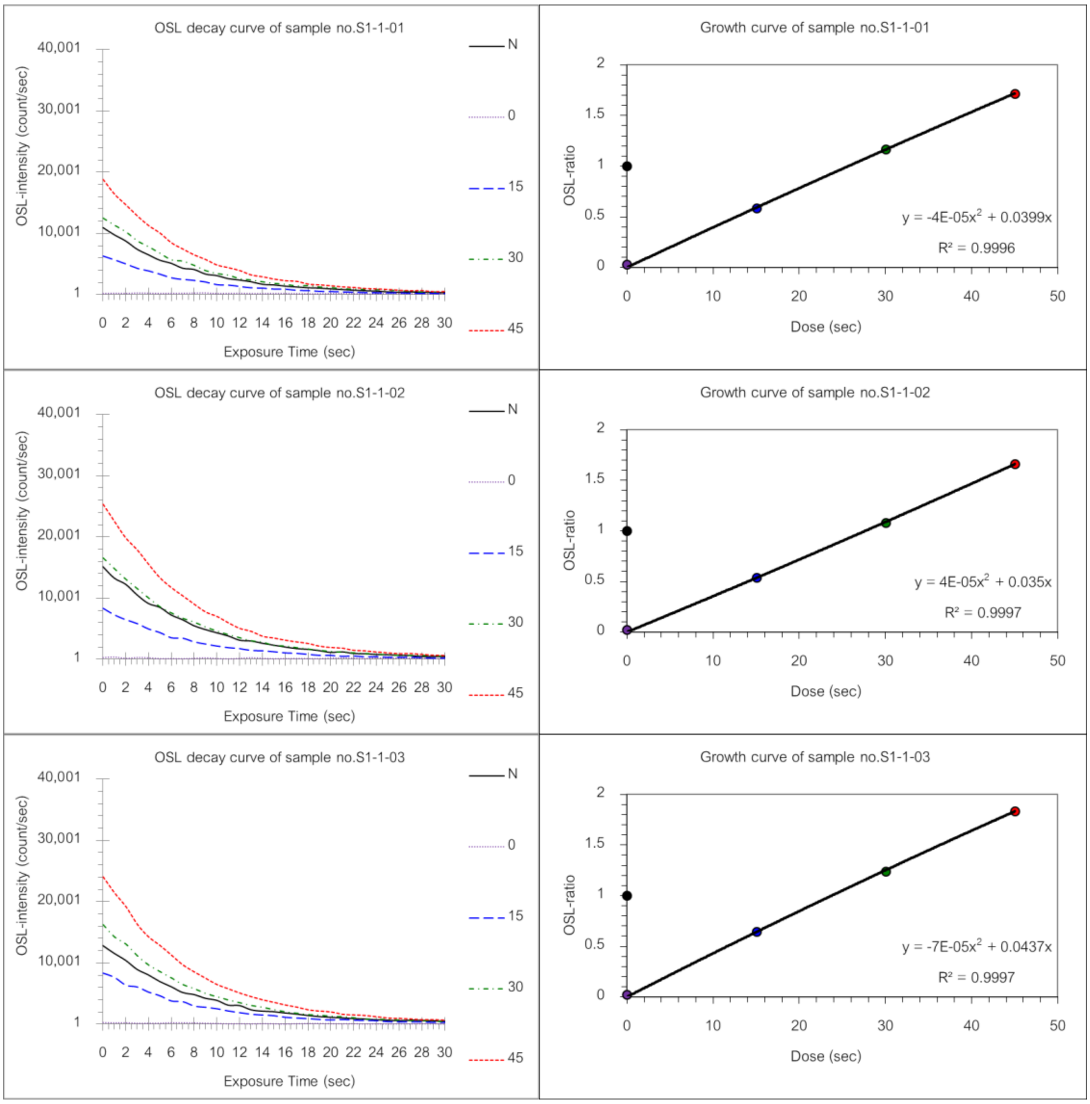

OSL decay curve of sample no.K4-10-04
OSL-intensity (count/sec)
200,001
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
40
80
120
Growth curve of sample no.K4-10-04
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80 100 120 140
Dose (sec)
y = -3E-05x2 + 0.0141x
R² = 0.9999
OSL decay curve of sample no.K4-10-05
OSL-intensity (count/sec)
200,001
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
40
80
120
Growth curve of sample no.K4-10-05
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80 100 120 140
Dose (sec)
y = -3E-05x2 + 0.0157x
R² = 1

Table A.24 OSL dating results from beach ridge plain (Sam Roi Yot, S1-1).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S1-1-01	290	1.03±0.1	3.31±0.1	0.62±0.1	0.51	0.99±0.1	2.86±0.18	2,880±340
S1-1-02	290	1.03±0.1	3.31±0.1	0.62±0.1	0.51	0.99±0.1	3.18±0.18	3,210±370
S1-1-03	290	1.03±0.1	3.31±0.1	0.62±0.1	0.51	0.99±0.1	3.56±0.30	3,590±470
S1-1-04	290	1.03±0.1	3.31±0.1	0.62±0.1	0.51	0.99±0.1	3.57±0.16	3,600±390
S1-1-05	290	1.03±0.1	3.31±0.1	0.62±0.1	0.51	0.99±0.1	5.56±0.65	5,610±860



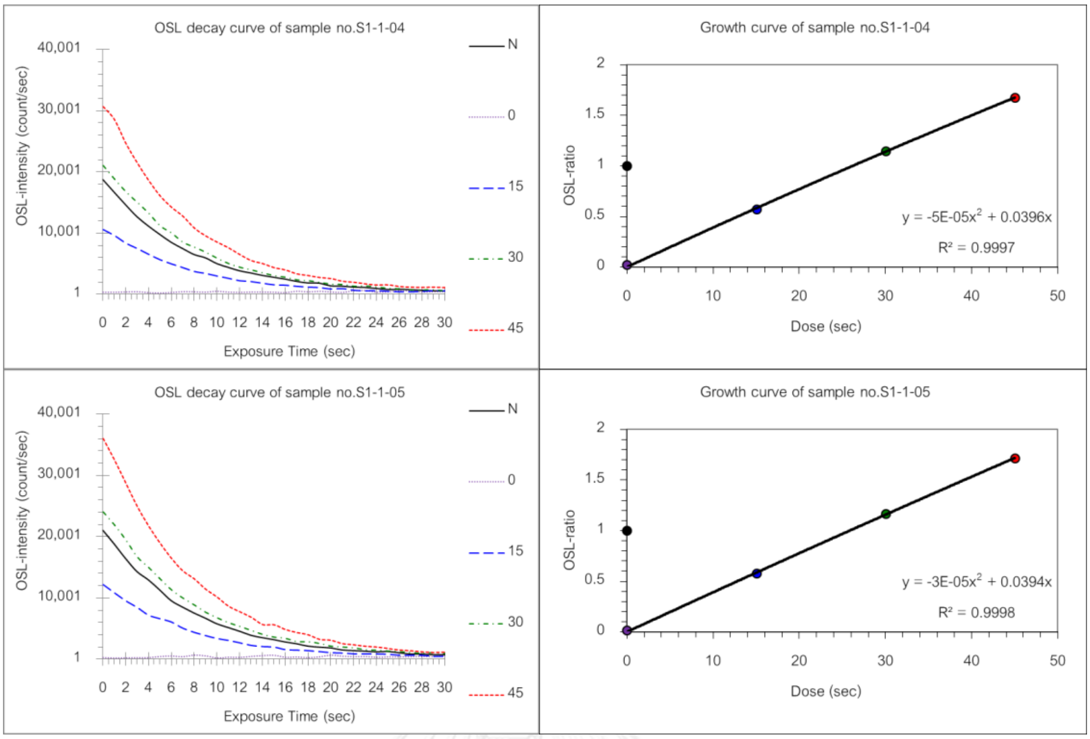
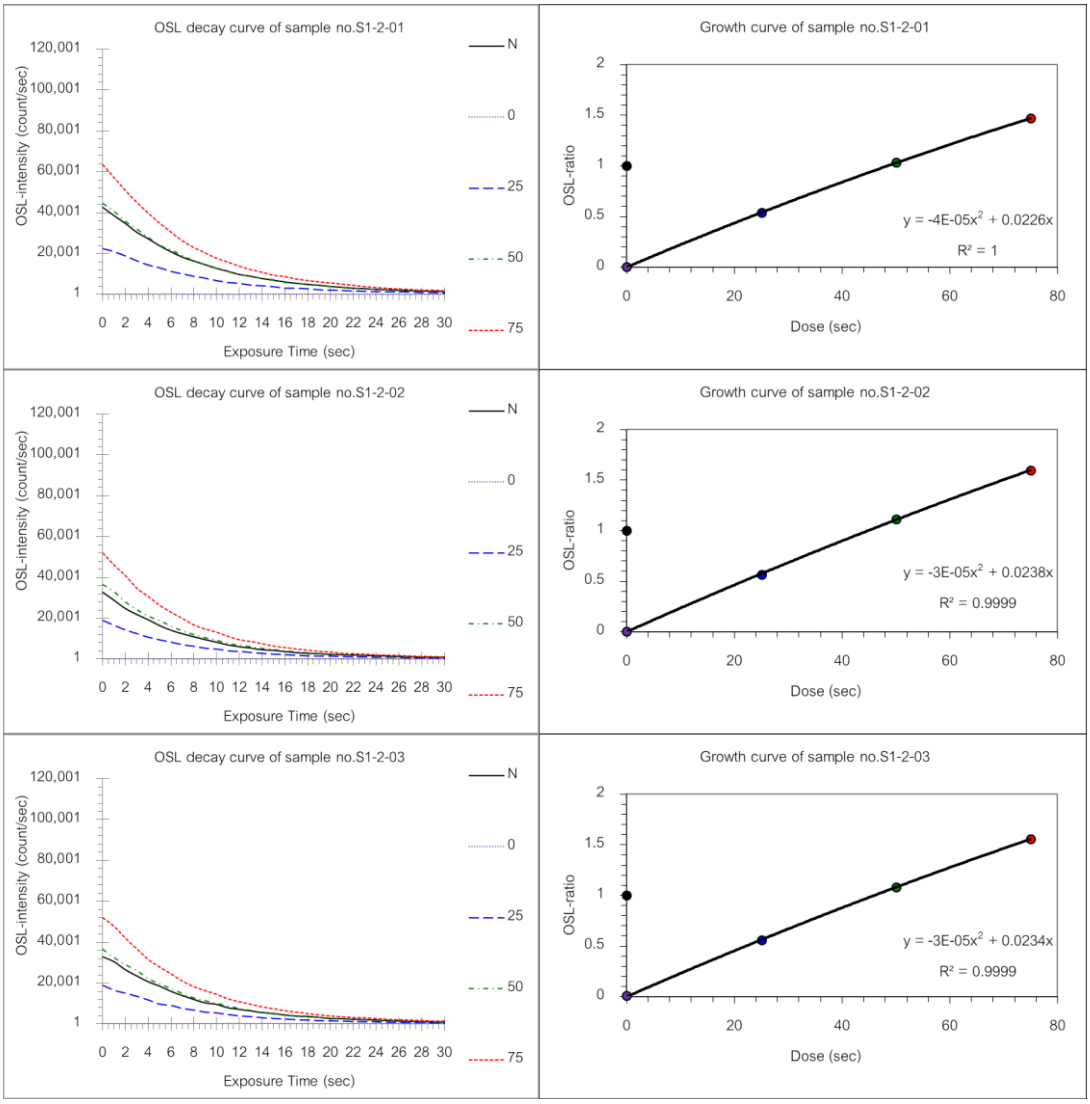
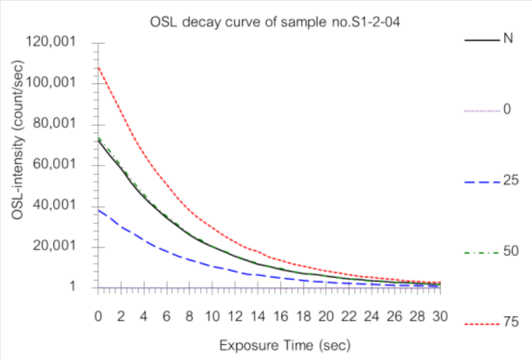
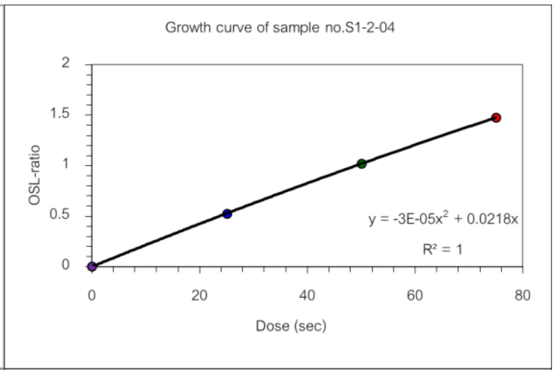

OSL decay curve of sample no.S1-1-04
OSL-intensity (count/sec)
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
15
30
45
Growth curve of sample no.S1-1-04
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50
Dose (sec)
y = -5E-05x2 + 0.0396x
R² = 0.9997
OSL decay curve of sample no.S1-1-05
OSL-intensity (count/sec)
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
15
30
45
Growth curve of sample no.S1-1-05
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50
Dose (sec)
y = -3E-05x2 + 0.0394x
R² = 0.9998

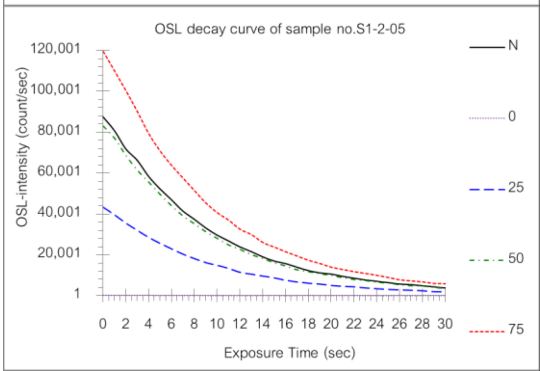
Table A.25 OSL dating results from beach ridge plain (Sam Roi Yot, S1-2).

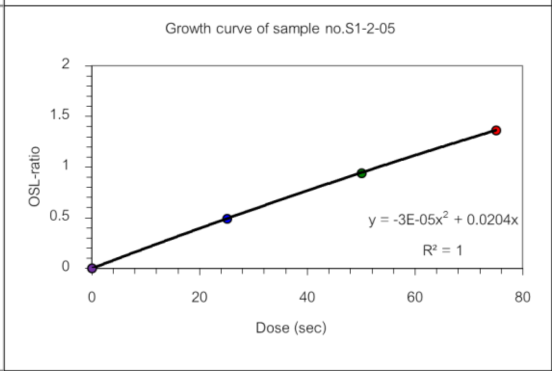
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S1-2-01	730	0.98±0.1	3.53±0.1	0.80±0.1	0.90	1.14±0.1	7.07±0.29	6,200±600
S1-2-02	730	0.98±0.1	3.53±0.1	0.80±0.1	0.90	1.14±0.1	6.95±0.41	6,100±640
S1-2-03	730	0.98±0.1	3.53±0.1	0.80±0.1	0.90	1.14±0.1	6.50±0.34	5,710±580
S1-2-04	730	0.98±0.1	3.53±0.1	0.80±0.1	0.90	1.14±0.1	6.31±0.24	5,540±520
S1-2-05	730	0.98±0.1	3.53±0.1	0.80±0.1	0.90	1.14±0.1	7.77±0.26	6,820±640
S1-2-06	730	0.98±0.1	3.53±0.1	0.80±0.1	0.90	1.14±0.1	6.21±0.22	5,450±510
S1-2-07	730	0.98±0.1	3.53±0.1	0.80±0.1	0.90	1.14±0.1	6.60±0.27	5,800±560
S1-2-08	730	0.98±0.1	3.53±0.1	0.80±0.1	0.90	1.14±0.1	6.70±0.22	5,880±550
S1-2-09	730	0.98±0.1	3.53±0.1	0.80±0.1	0.90	1.14±0.1	6.02±0.27	5,290±520

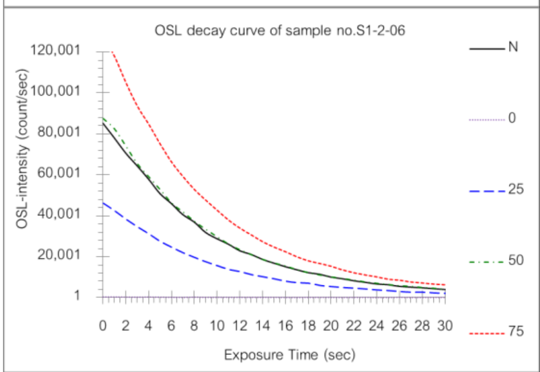


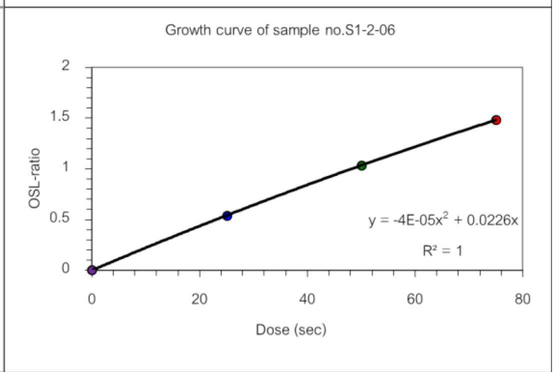

OSL decay curve of sample no.S1-2-04
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75

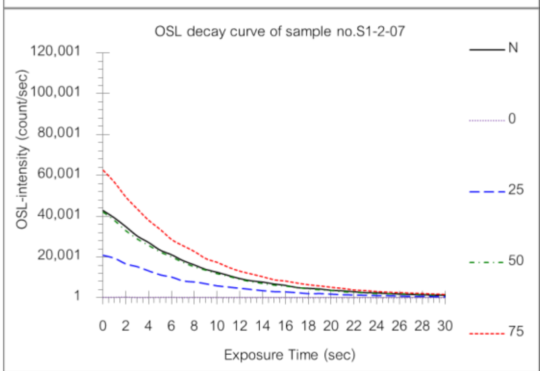

Growth curve of sample no.S1-2-04
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -3E-05x2 + 0.0218x
R² = 1

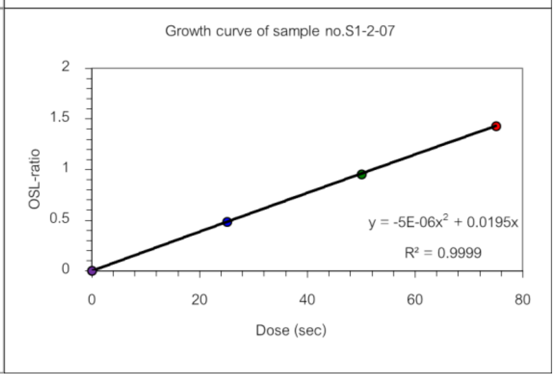

OSL decay curve of sample no.S1-2-05
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75

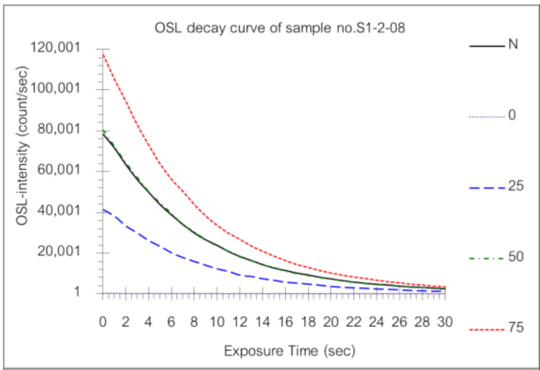

Growth curve of sample no.S1-2-05
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -3E-05x2 + 0.0204x
R² = 1

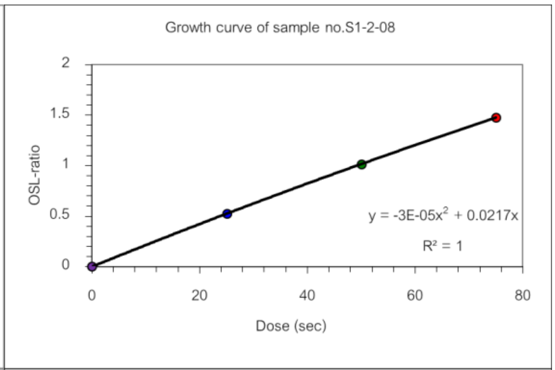

OSL decay curve of sample no.S1-2-06
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75

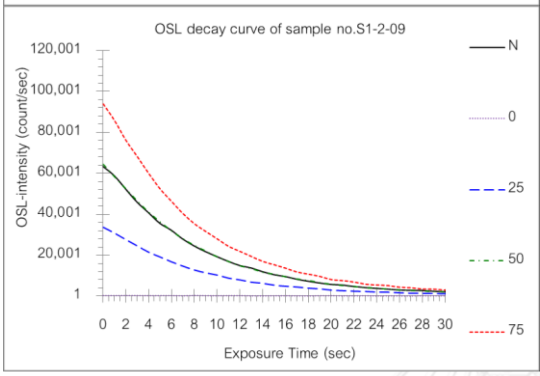

Growth curve of sample no.S1-2-06
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -4E-05x2 + 0.0226x
R² = 1


OSL decay curve of sample no.S1-2-07
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75


Growth curve of sample no.S1-2-07
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -5E-06x2 + 0.0195x
R² = 0.9999


OSL decay curve of sample no.S1-2-08
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75


Growth curve of sample no.S1-2-08
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -3E-05x^2 + 0.0217x
R² = 1


OSL decay curve of sample no.S1-2-09
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75

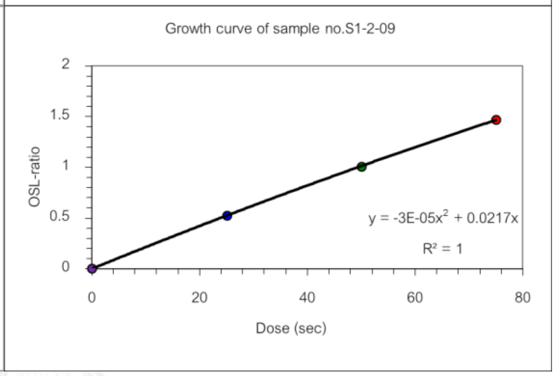
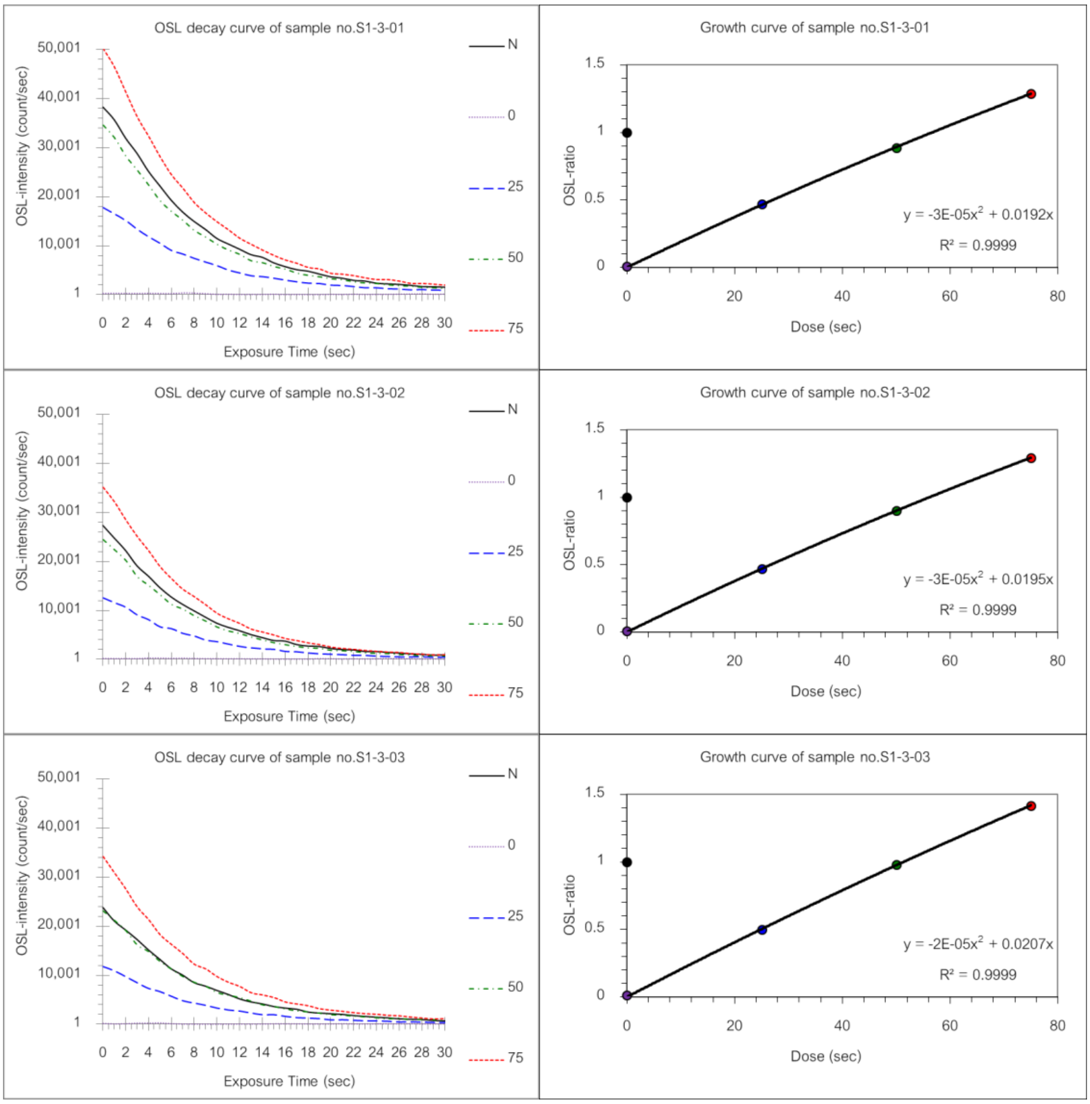
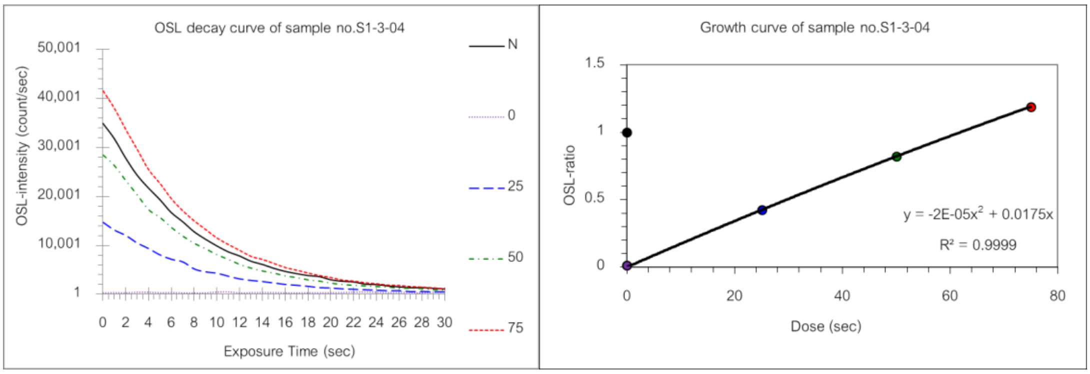

Growth curve of sample no.S1-2-09
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -3E-05x^2 + 0.0217x
R² = 1

Table A.26 OSL dating results from beach ridge plain (Sam Roi Yot, S1-3).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S1-3-01	1,030	0.91±0.1	3.79±0.1	1.03±0.1	0.90	1.13±0.1	8.52±0.47	6,410±590
S1-3-02	1,030	0.91±0.1	3.79±0.1	1.03±0.1	0.90	1.13±0.1	7.82±0.59	5,890±620
S1-3-03	1,030	0.91±0.1	3.79±0.1	1.03±0.1	0.90	1.13±0.1	8.84±0.59	6,660±660
S1-3-04	1,030	0.91±0.1	3.79±0.1	1.03±0.1	0.90	1.13±0.1	7.24±0.41	5,450±510

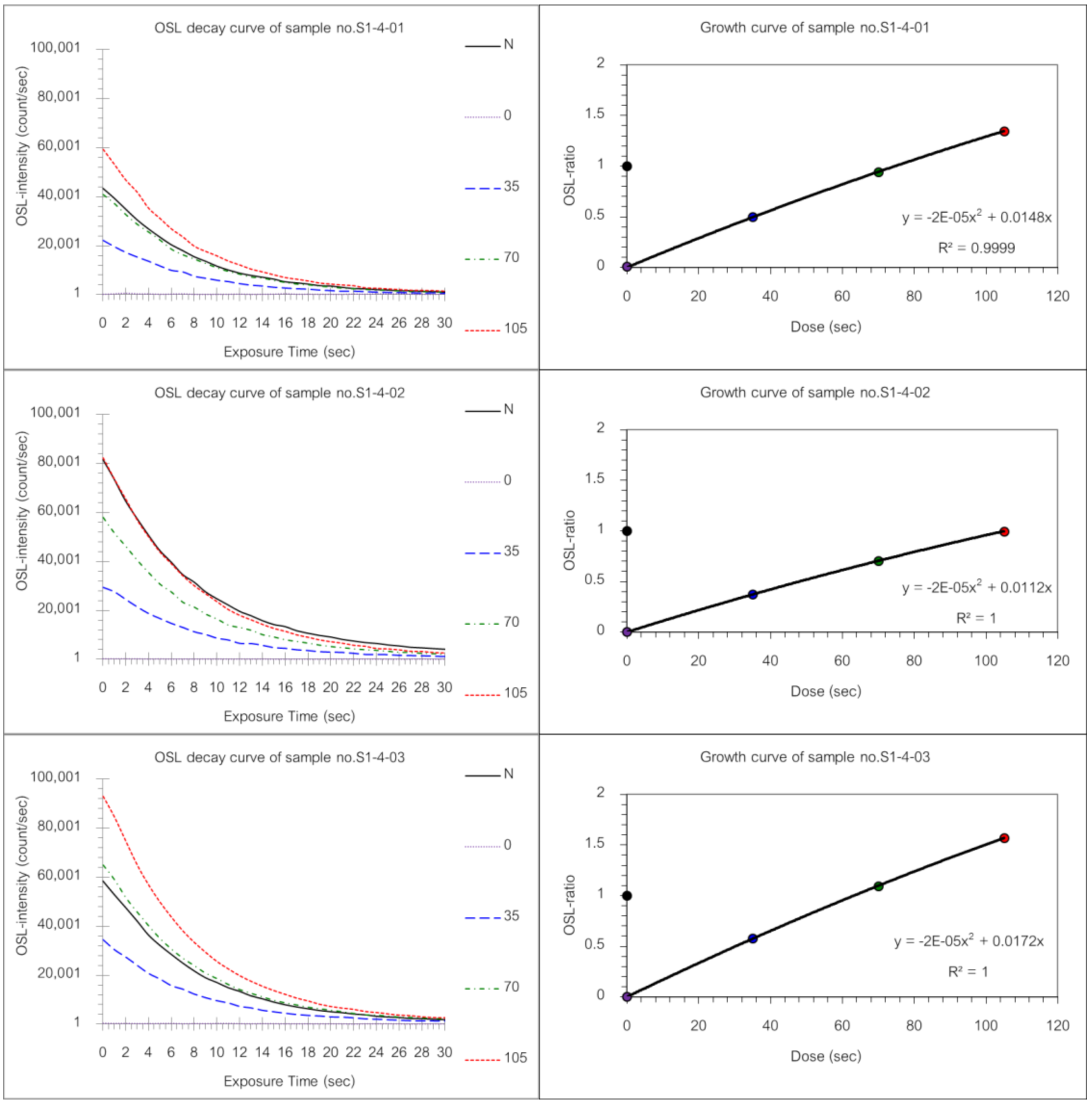


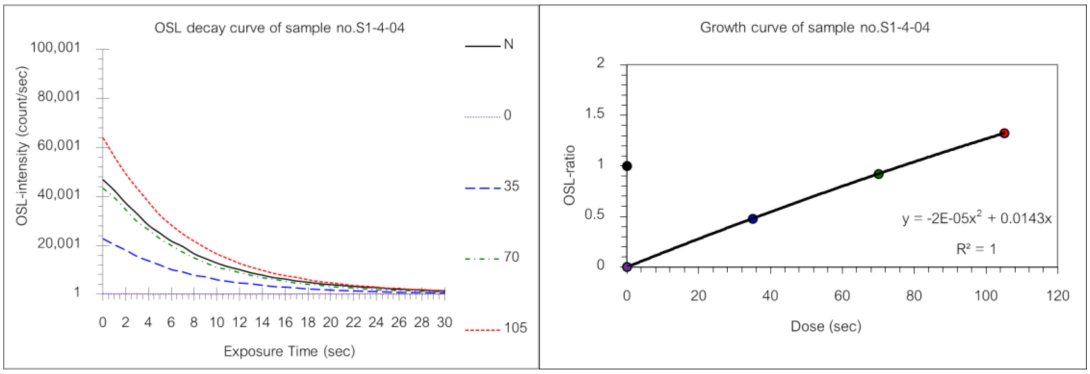


OSL decay curve of sample no.S1-3-04
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75
Growth curve of sample no.S1-3-04
OSL-ratio
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -2E-05x^2 + 0.0175x
R^2 = 0.9999

Table A.27 OSL dating results from beach ridge plain (Sam Roi Yot, S1-4).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S1-4-01	1,450	0.99±0.1	4.10±0.1	1.06±0.1	0.87	1.40±0.1	10.15±0.58	7,250±660
S1-4-02	1,450	0.99±0.1	4.10±0.1	1.06±0.1	0.87	1.40±0.1	13.65±0.72	9,760±860
S1-4-03	1,450	0.99±0.1	4.10±0.1	1.06±0.1	0.87	1.40±0.1	8.75±0.46	6,260±550
S1-4-04	1,450	0.99±0.1	4.10±0.1	1.06±0.1	0.87	1.40±0.1	9.45±0.58	6,760±630

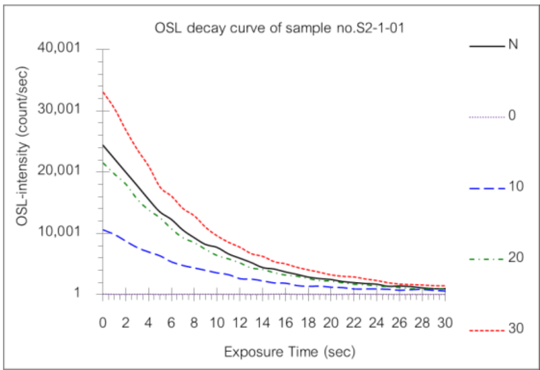


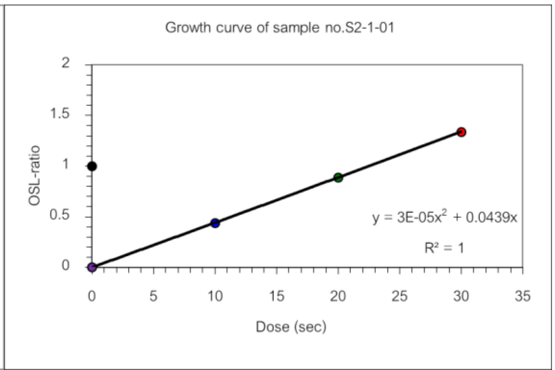


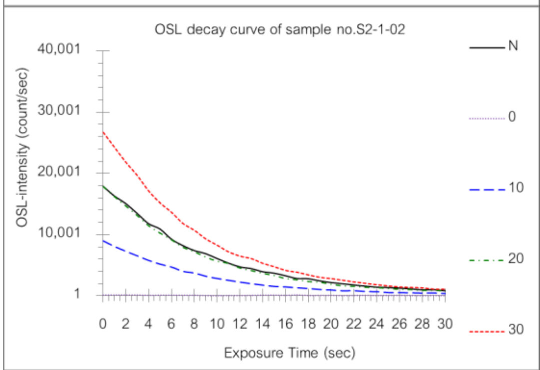
OSL decay curve of sample no.S1-4-04
OSL-intensity (count/sec)
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
35
70
105
Growth curve of sample no.S1-4-04
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80 100 120
Dose (sec)
y = -2E-05x2 + 0.0143x
R² = 1

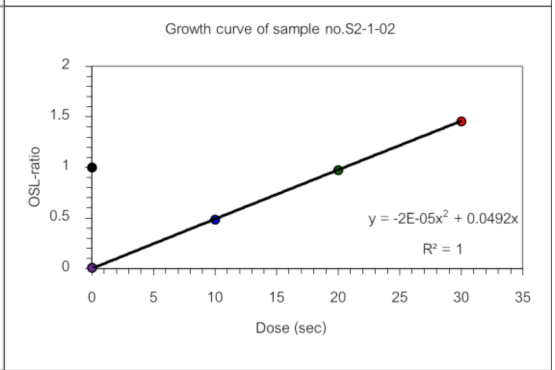
Table A.28 OSL dating results from beach ridge plain (Sam Roi Yot, S2-1).

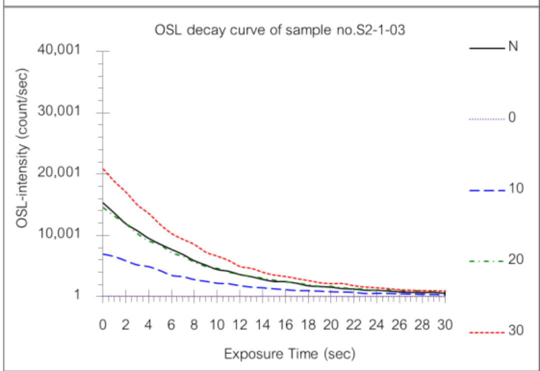
Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S2-1-01	570	1.14±0.1	4.86±0.1	0.89±0.1	0.36	1.35±0.1	3.58±0.16	2,640±220
S2-1-02	570	1.14±0.1	4.86±0.1	0.89±0.1	0.36	1.35±0.1	2.63±0.11	1,940±160
S2-1-03	570	1.14±0.1	4.86±0.1	0.89±0.1	0.36	1.35±0.1	2.99±0.16	2,200±200
S2-1-04	570	1.14±0.1	4.86±0.1	0.89±0.1	0.36	1.35±0.1	2.83±0.13	2,090±180
S2-1-05	570	1.14±0.1	4.86±0.1	0.89±0.1	0.36	1.35±0.1	3.37±0.18	2,480±220
S2-1-06	570	1.14±0.1	4.86±0.1	0.89±0.1	0.36	1.35±0.1	3.79±0.16	2,800±240

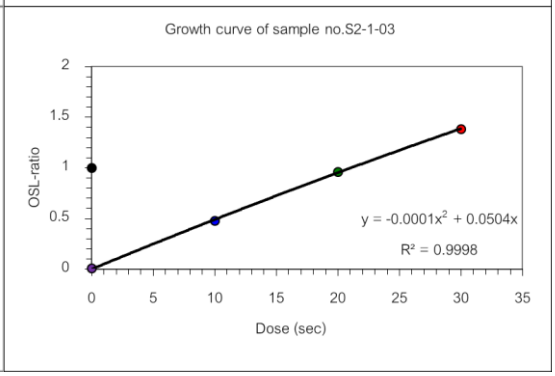


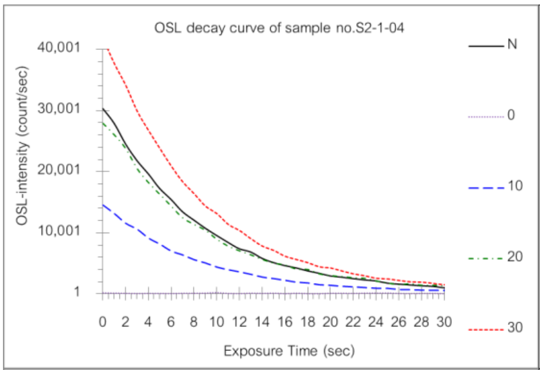


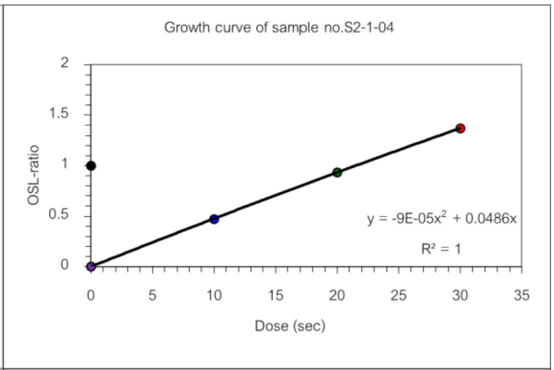


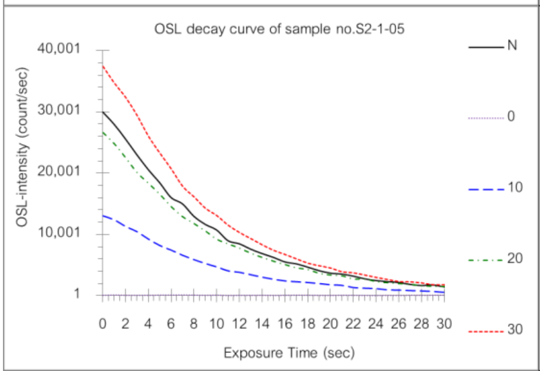


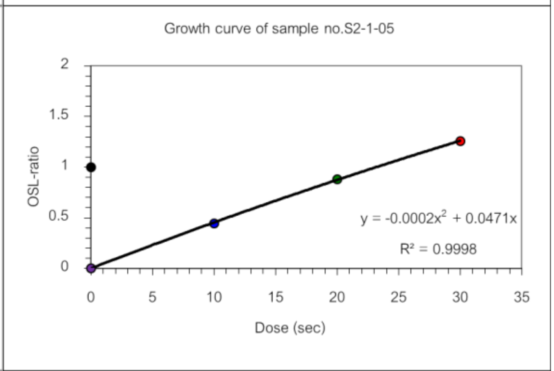


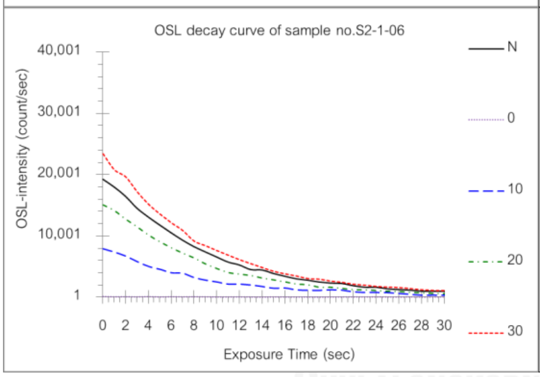



OSL decay curve of sample no.S2-1-04
OSL-intensity (count/sec)
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30


Growth curve of sample no.S2-1-04
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = -9E-05x^2 + 0.0486x
R² = 1


OSL decay curve of sample no.S2-1-05
OSL-intensity (count/sec)
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30


Growth curve of sample no.S2-1-05
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = -0.0002x^2 + 0.0471x
R² = 0.9998


OSL decay curve of sample no.S2-1-06
OSL-intensity (count/sec)
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30

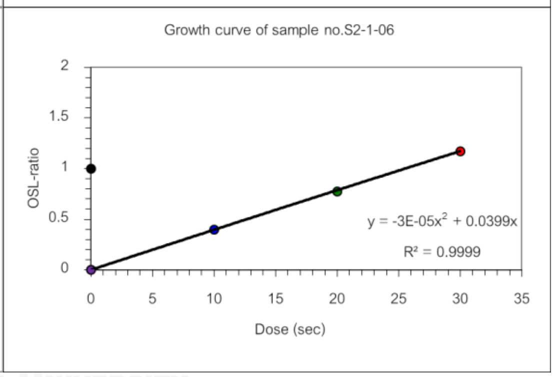

Growth curve of sample no.S2-1-06
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35
Dose (sec)
y = -3E-05x^2 + 0.0399x
R² = 0.9999

Table A.29 OSL dating results from beach ridge plain (Sam Roi Yot, S2-2).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S2-2-01	1,450	1.00±0.1	3.86±0.1	0.98±0.1	0.53	1.32±0.1	5.91±0.30	4,470±400
S2-2-02	1,450	1.00±0.1	3.86±0.1	0.98±0.1	0.53	1.32±0.1	7.74±0.47	5,860±560
S2-2-03	1,450	1.00±0.1	3.86±0.1	0.98±0.1	0.53	1.32±0.1	7.14±0.40	5,400±500

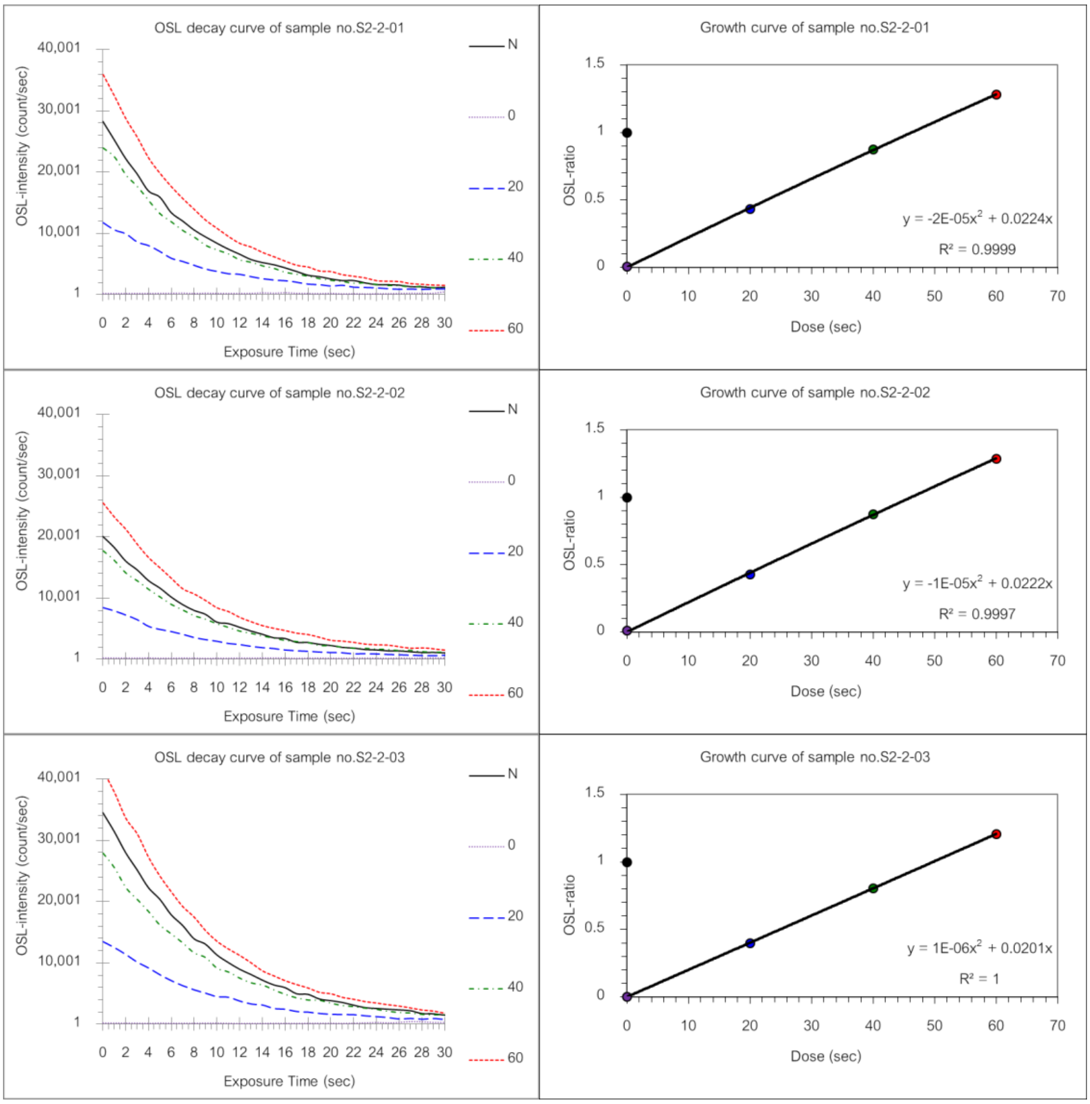
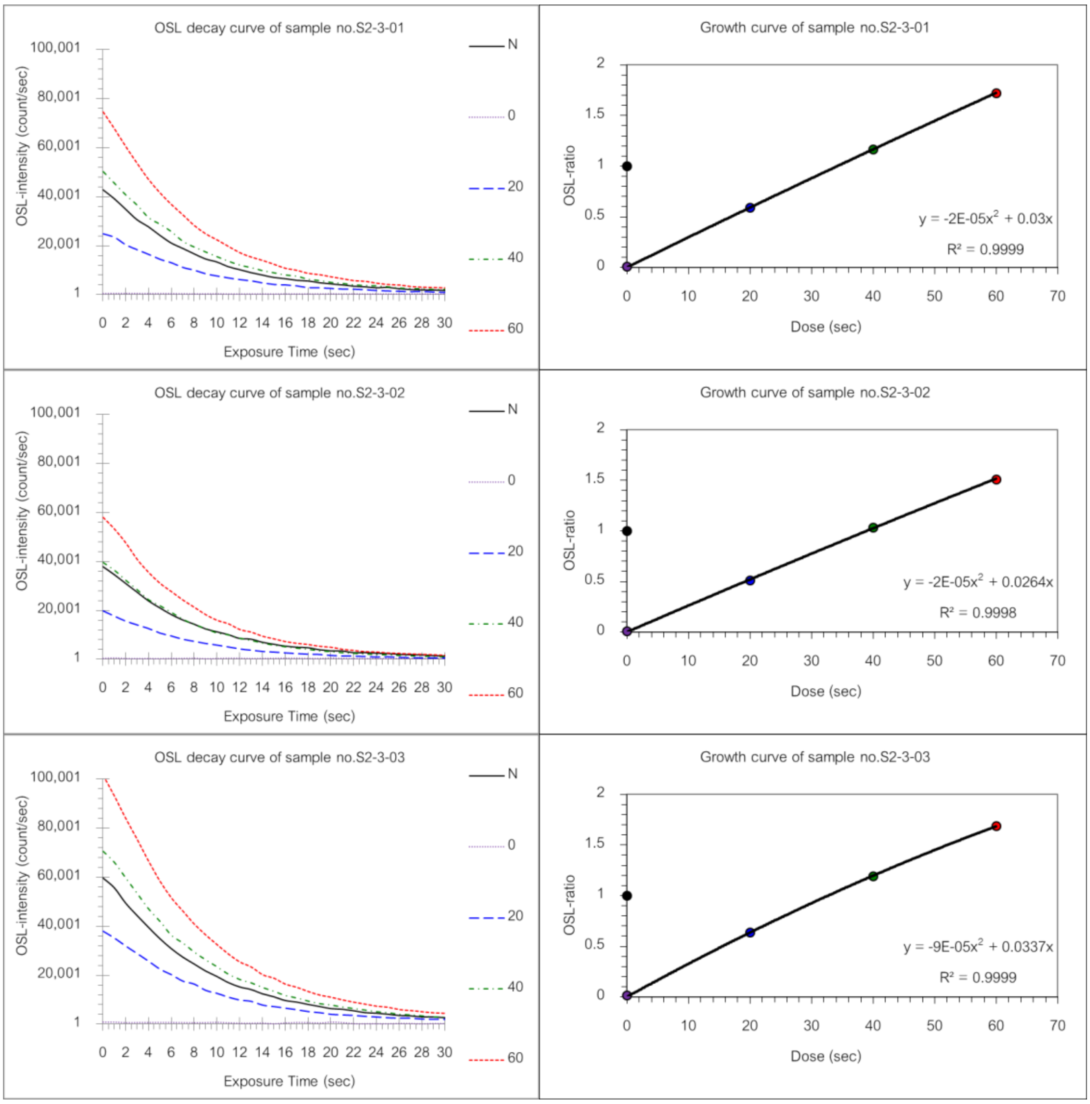
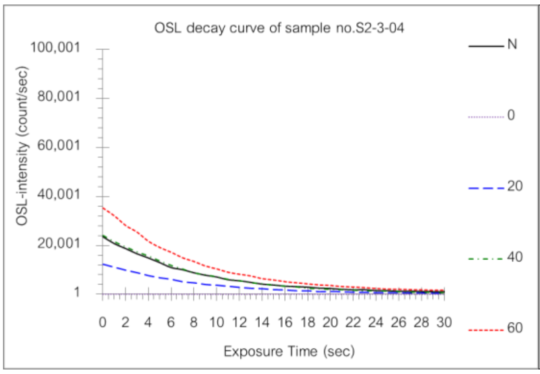


Table A.30 OSL dating results from beach ridge plain (Sam Roi Yot, S2-3).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S2-3-01	1,900	0.77±0.1	3.51±0.1	1.01±0.1	0.73	1.27±0.1	5.89±0.33	4,650±440
S2-3-02	1,900	0.77±0.1	3.51±0.1	1.01±0.1	0.73	1.27±0.1	7.43±1.51	5,860±1,270
S2-3-03	1,900	0.77±0.1	3.51±0.1	1.01±0.1	0.73	1.27±0.1	5.38±1.39	4,250±1,140
S2-3-04	1,900	0.77±0.1	3.51±0.1	1.01±0.1	0.73	1.27±0.1	6.26±0.36	4,940±480




OSL decay curve of sample no.S2-3-04
OSL-intensity (count/sec)
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
20
40
60

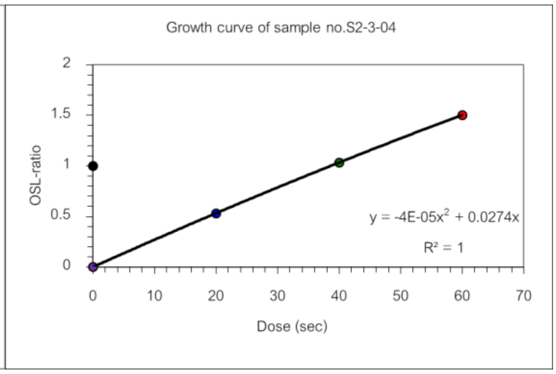
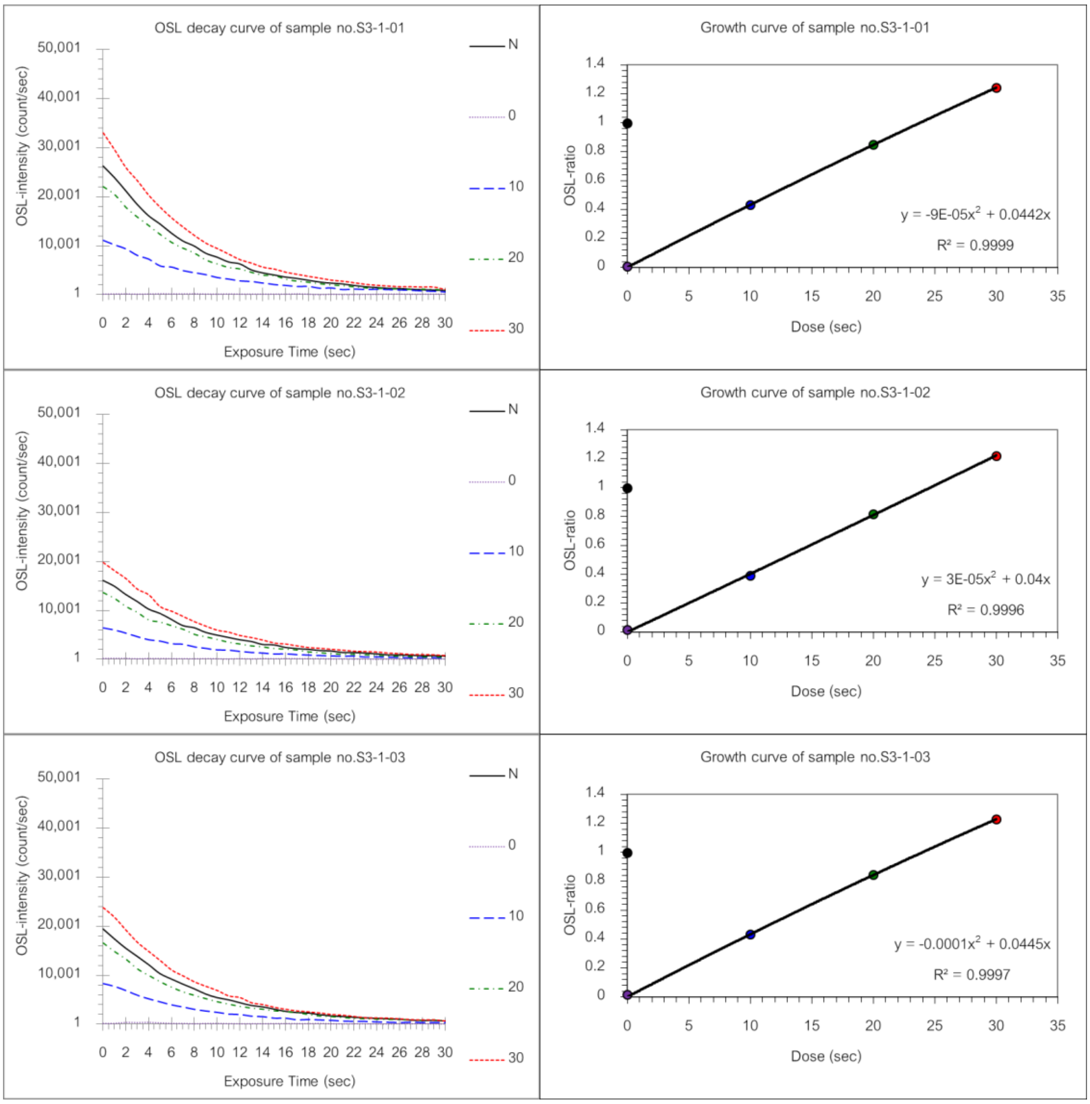
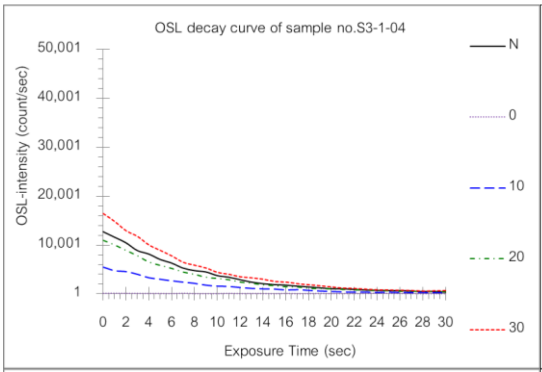
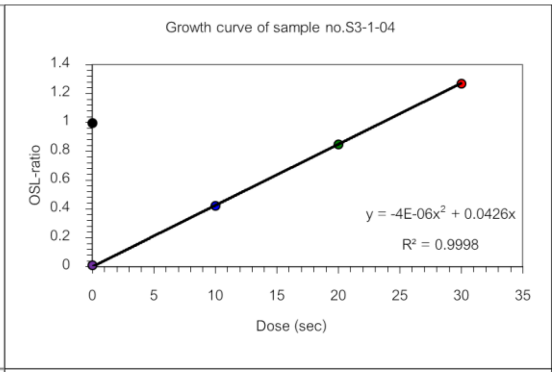

Growth curve of sample no.S2-3-04
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60 70
Dose (sec)
y = -4E-05x2 + 0.0274x
R² = 1

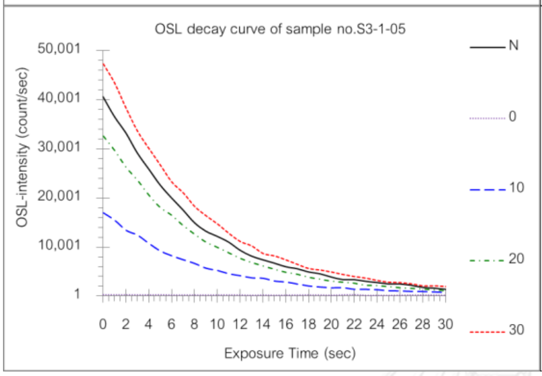
Table A.31 OSL dating results from beach ridge plain (Sam Roi Yot, S3-1).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S3-1-01	700	0.81±0.1	2.98±0.1	0.67±0.1	1.83	0.94±0.1	3.09±0.19	3,280±400
S3-1-02	700	0.81±0.1	2.98±0.1	0.67±0.1	1.83	0.94±0.1	4.54±0.30	4,810±600
S3-1-03	700	0.81±0.1	2.98±0.1	0.67±0.1	1.83	0.94±0.1	3.99±0.21	4,230±490
S3-1-04	700	0.81±0.1	2.98±0.1	0.67±0.1	1.83	0.94±0.1	3.85±0.75	4,080±900
S3-1-05	700	0.81±0.1	2.98±0.1	0.67±0.1	1.83	0.94±0.1	4.28±0.20	4,540±520




OSL decay curve of sample no.S3-1-04
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30


Growth curve of sample no.S3-1-04
OSL-ratio
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0 5 10 15 20 25 30 35
Dose (sec)
y = -4E-06x2 + 0.0426x
R² = 0.9998


OSL decay curve of sample no.S3-1-05
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30

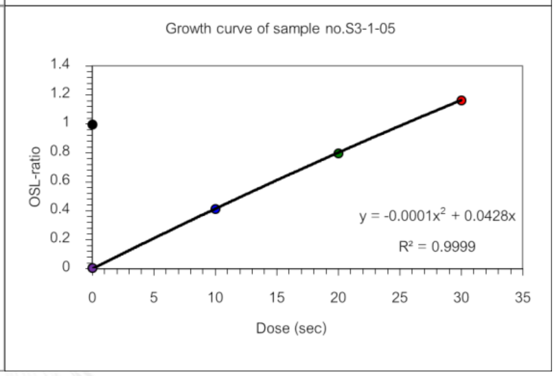
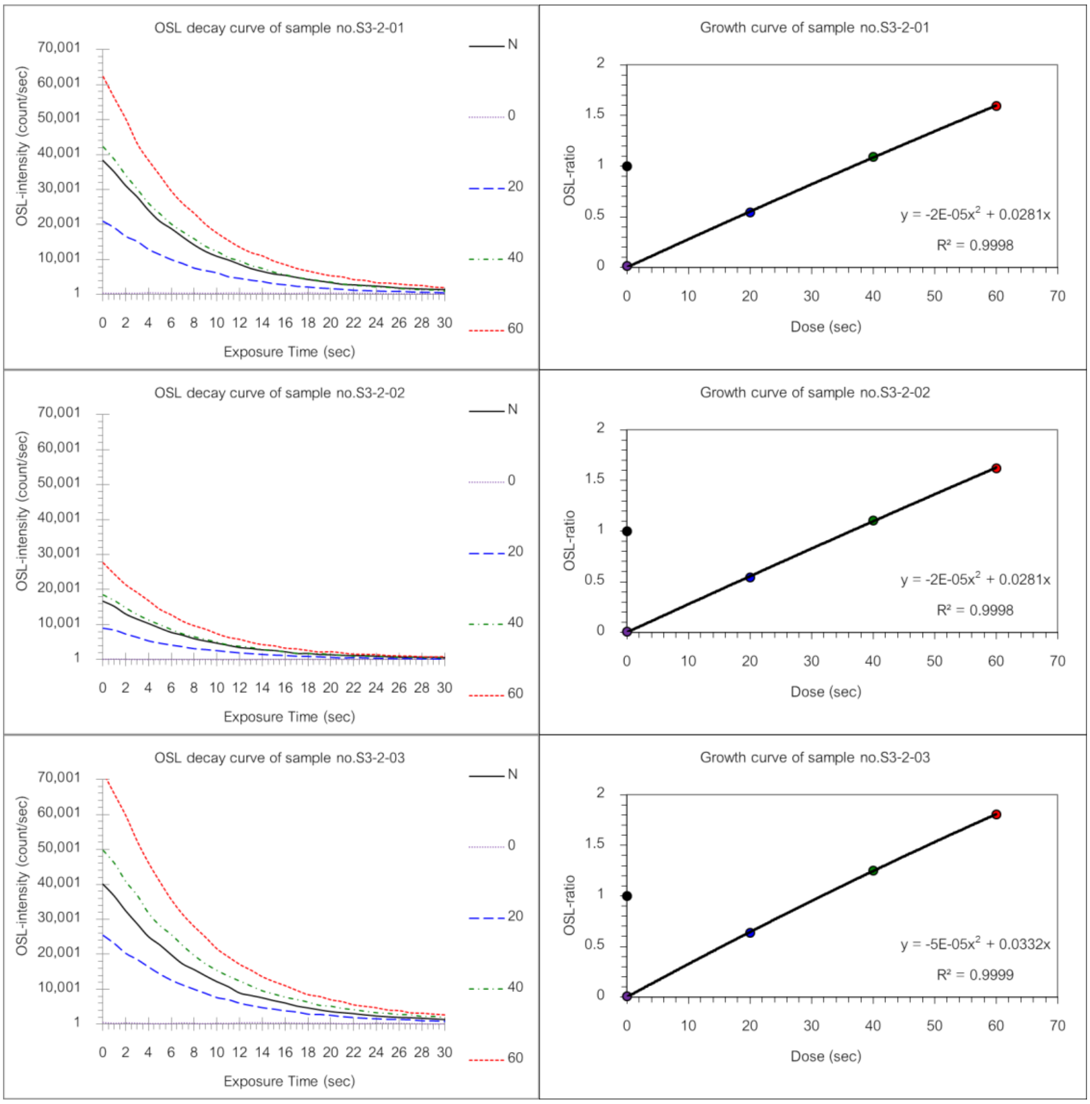

Growth curve of sample no.S3-1-05
OSL-ratio
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0 5 10 15 20 25 30 35
Dose (sec)
y = -0.0001x2 + 0.0428x
R² = 0.9999

Table A.32 OSL dating results from beach ridge plain (Sam Roi Yot, S3-2).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S3-2-01	1,300	1.03±0.1	4.47±0.1	0.95±0.1	4.18	1.29±0.1	5.92±0.33	4,590±430
S3-2-02	1,300	1.03±0.1	4.47±0.1	0.95±0.1	4.18	1.29±0.1	4.75±0.39	3,680±410
S3-2-03	1,300	1.03±0.1	4.47±0.1	0.95±0.1	4.18	1.29±0.1	4.54±0.20	3,520±310
S3-2-04	1,300	1.03±0.1	4.47±0.1	0.95±0.1	4.18	1.29±0.1	4.85±0.61	3,760±550
S3-2-05	1,300	1.03±0.1	4.47±0.1	0.95±0.1	4.18	1.29±0.1	7.34±0.49	5,690±570



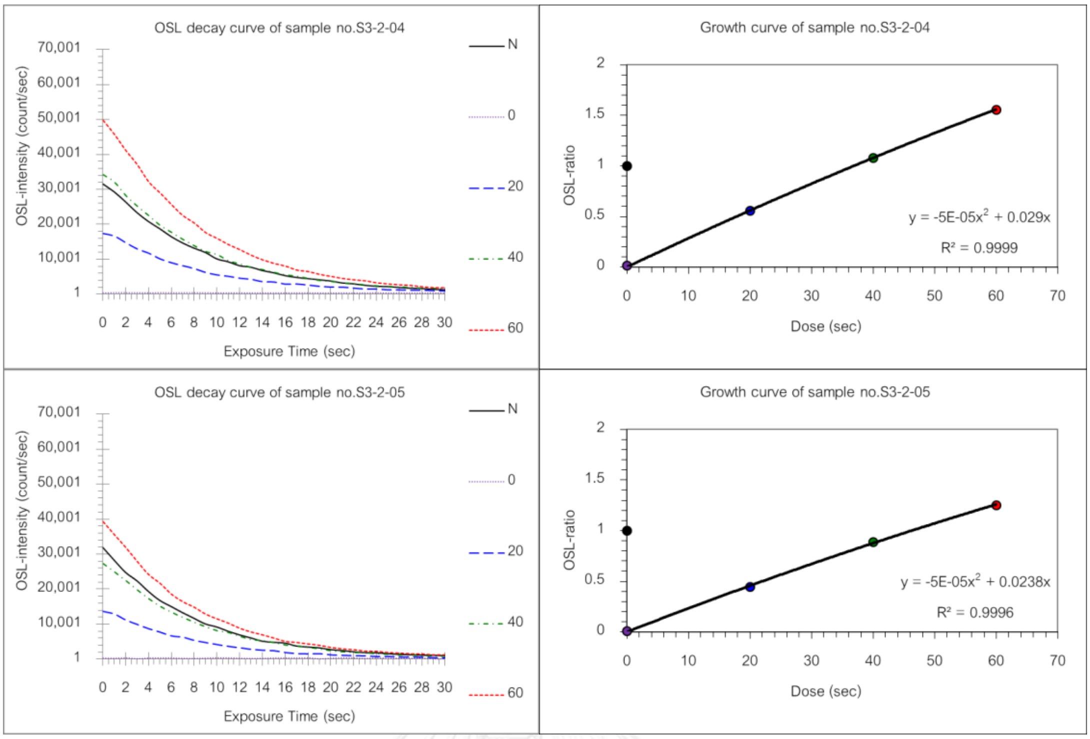
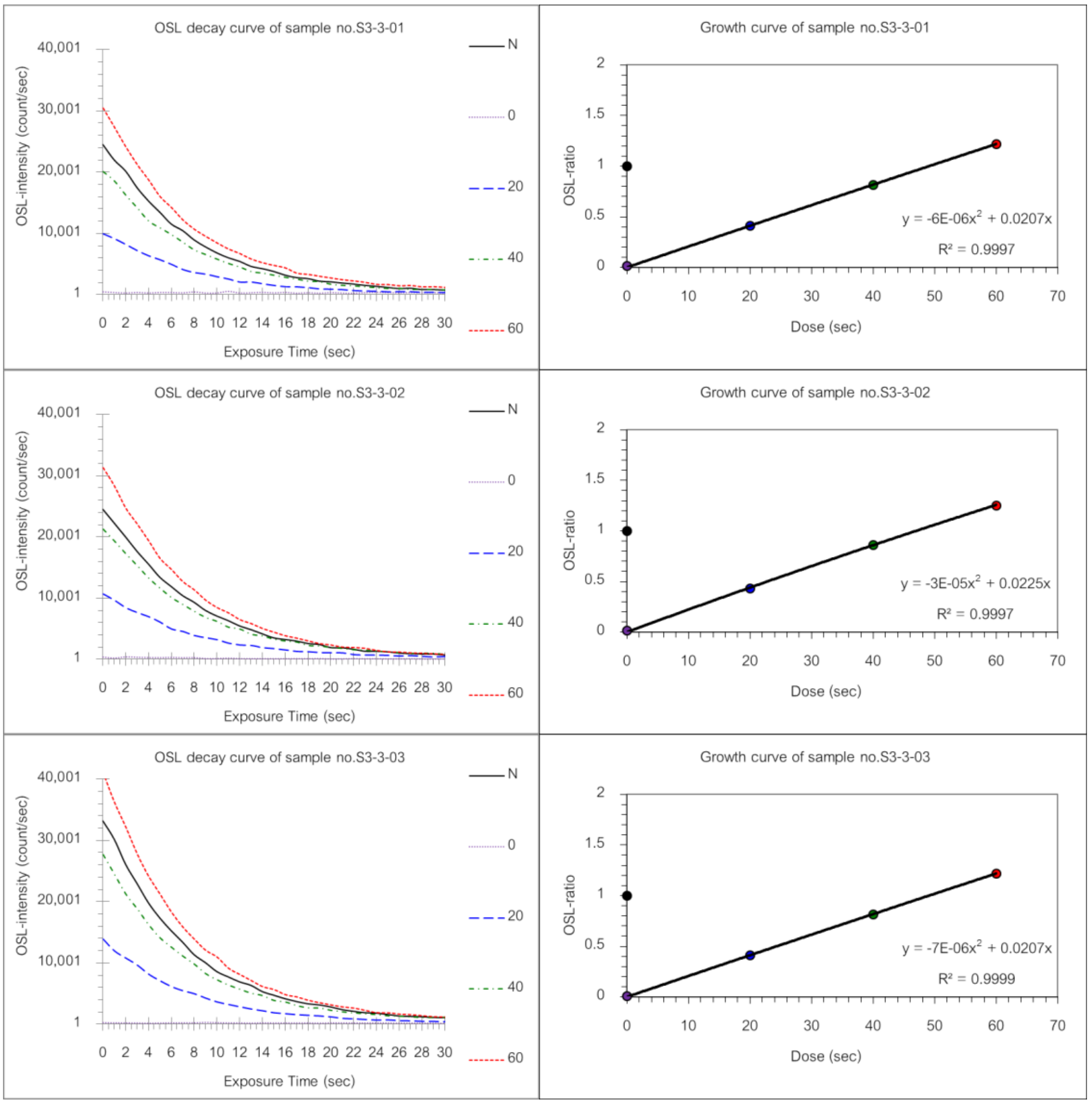
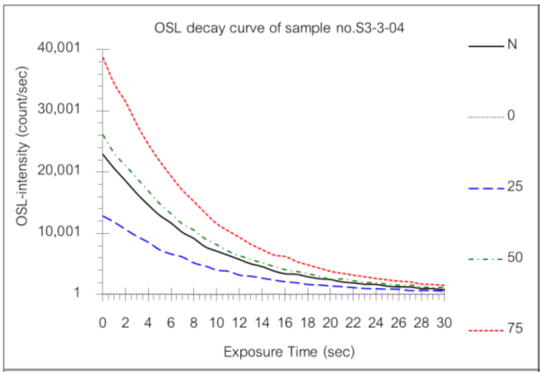
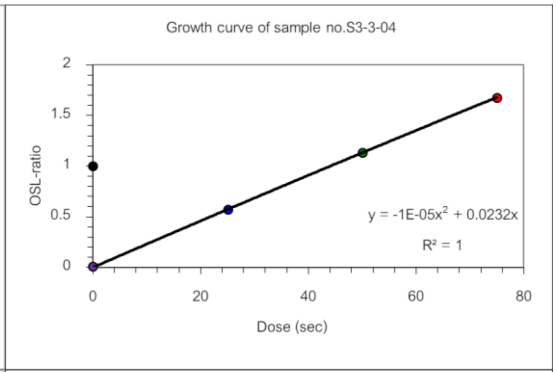

OSL decay curve of sample no.S3-2-04
OSL-intensity (count/sec)
70,001
60,001
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
20
40
60
Growth curve of sample no.S3-2-04
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60 70
Dose (sec)
y = -5E-05x2 + 0.029x
R² = 0.9999
OSL decay curve of sample no.S3-2-05
OSL-intensity (count/sec)
70,001
60,001
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
20
40
60
Growth curve of sample no.S3-2-05
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60 70
Dose (sec)
y = -5E-05x2 + 0.0238x
R² = 0.9996

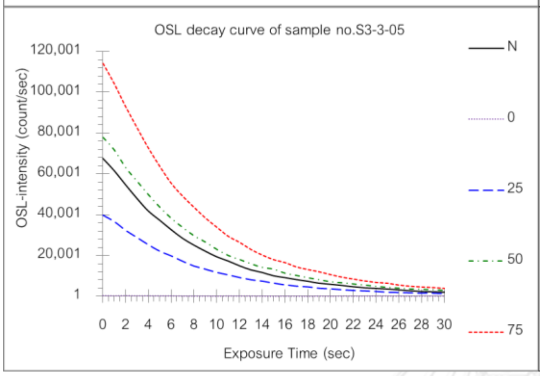
Table A.33 OSL dating results from beach ridge plain (Sam Roi Yot, S3-3).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S3-3-01	1,800	0.89±0.1	2.91±0.1	0.84±0.1	1.06	1.11±0.1	8.85±0.62	8,000±910
S3-3-02	1,800	0.89±0.1	2.91±0.1	0.84±0.1	1.06	1.11±0.1	6.56±0.34	5,930±610
S3-3-03	1,800	0.89±0.1	2.91±0.1	0.84±0.1	1.06	1.11±0.1	8.15±0.52	7,370±810
S3-3-04	1,800	0.89±0.1	2.91±0.1	0.84±0.1	1.06	1.11±0.1	9.10±0.71	8,220±970
S3-3-05	1,800	0.89±0.1	2.91±0.1	0.84±0.1	1.06	1.11±0.1	5.85±0.24	5,290±520




OSL decay curve of sample no.S3-3-04
OSL-intensity (count/sec)
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75


Growth curve of sample no.S3-3-04
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -1E-05x2 + 0.0232x
R² = 1


OSL decay curve of sample no.S3-3-05
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
25
50
75

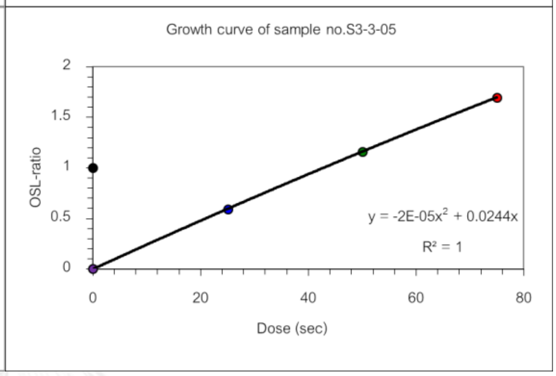
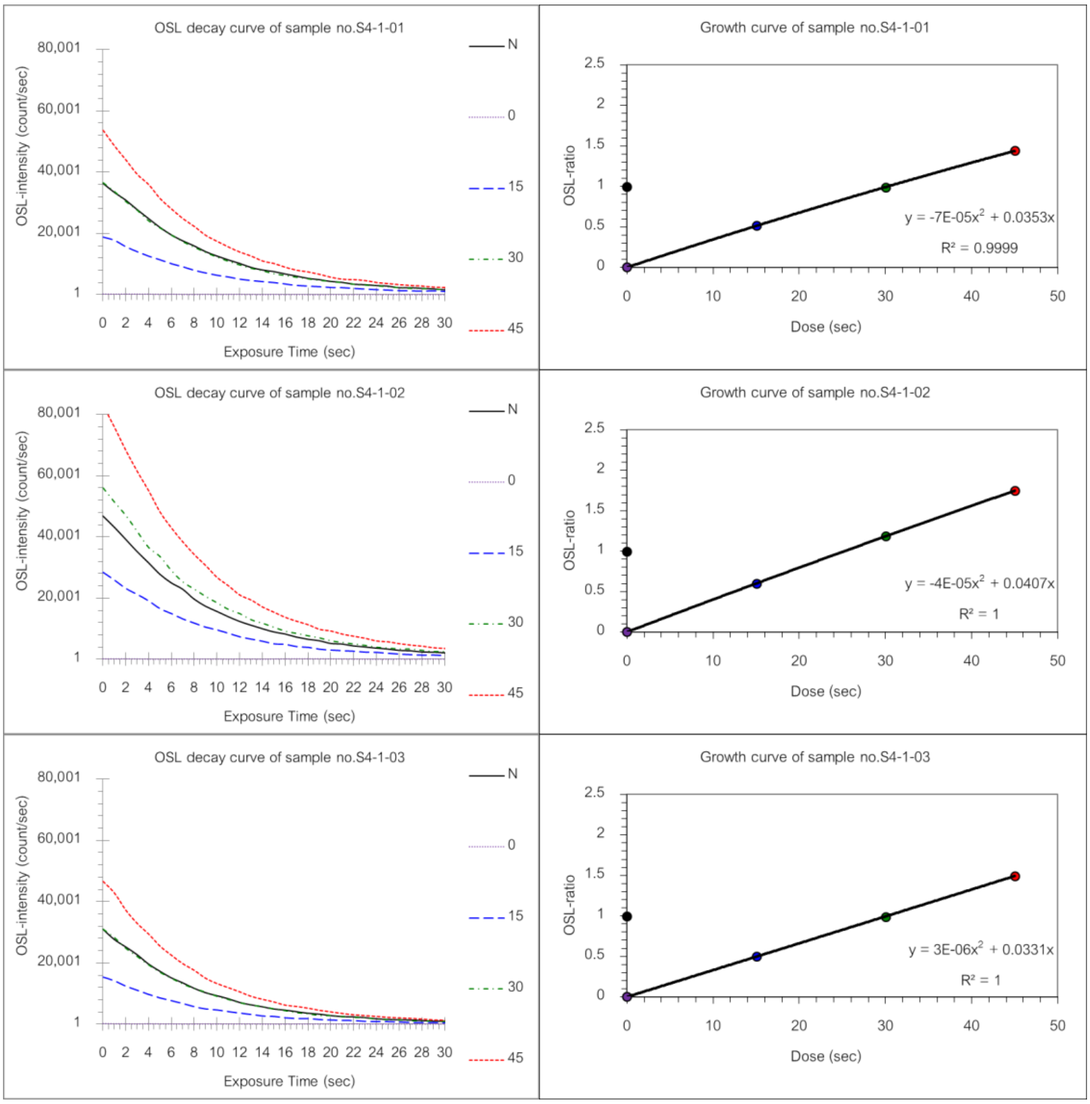

Growth curve of sample no.S3-3-05
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80
Dose (sec)
y = -2E-05x2 + 0.0244x
R² = 1

Table A.34 OSL dating results from beach ridge plain (Sam Roi Yot, S4-1).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S4-1-01	490	1.15±0.1	4.83±0.1	0.70±0.1	0.58	1.20±0.1	3.56±0.12	2,970±260
S4-1-02	490	1.15±0.1	4.83±0.1	0.70±0.1	0.58	1.20±0.1	3.37±0.11	2,810±250
S4-1-03	490	1.15±0.1	4.83±0.1	0.70±0.1	0.58	1.20±0.1	4.75±0.23	3,970±380
S4-1-04	490	1.15±0.1	4.83±0.1	0.70±0.1	0.58	1.20±0.1	4.33±0.21	3,610±340
S4-1-05	490	1.15±0.1	4.83±0.1	0.70±0.1	0.58	1.20±0.1	3.34±0.26	2,790±310



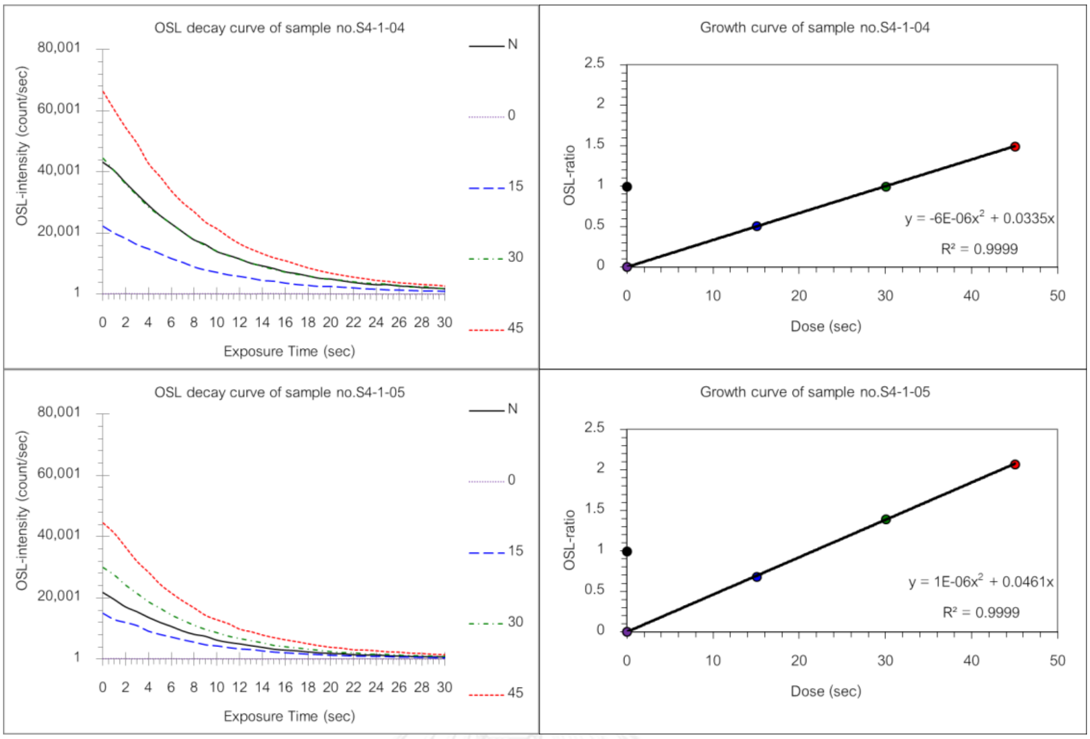
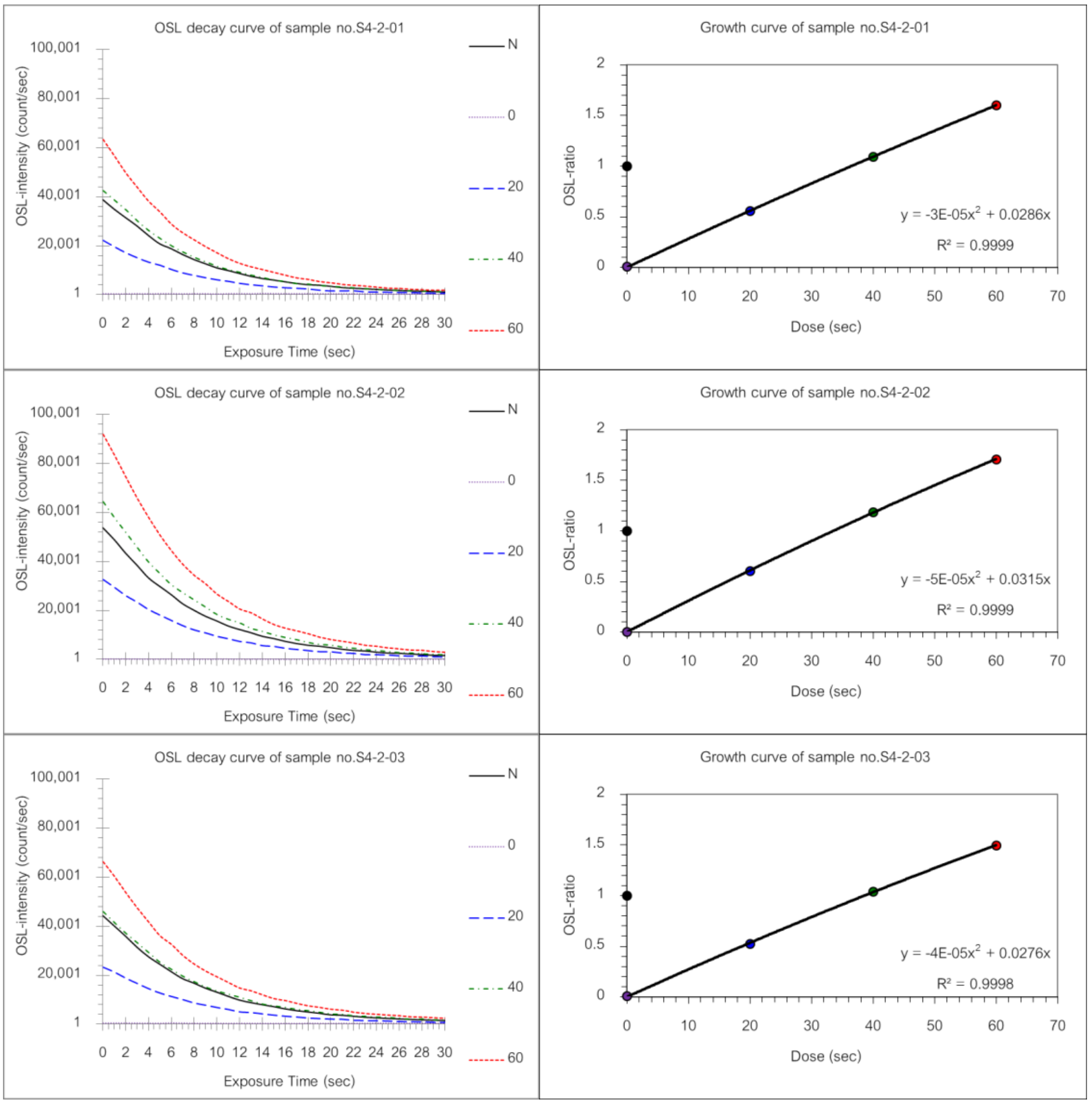
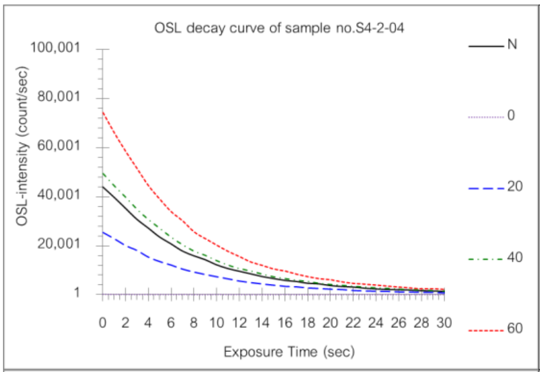
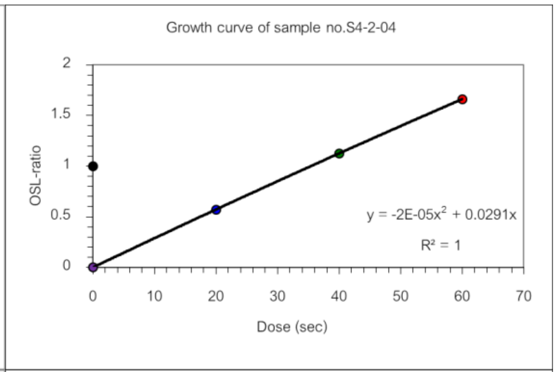

OSL decay curve of sample no.S4-1-04
OSL-intensity (count/sec)
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
15
30
45
Growth curve of sample no.S4-1-04
OSL-ratio
2.5
2
1.5
1
0.5
0
0 10 20 30 40 50
Dose (sec)
y = -6E-06x2 + 0.0335x
R² = 0.9999
OSL decay curve of sample no.S4-1-05
OSL-intensity (count/sec)
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
15
30
45
Growth curve of sample no.S4-1-05
OSL-ratio
2.5
2
1.5
1
0.5
0
0 10 20 30 40 50
Dose (sec)
y = 1E-06x2 + 0.0461x
R² = 0.9999

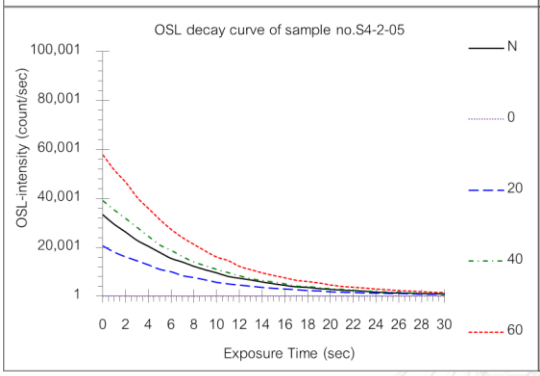
Table A.35 OSL dating results from beach ridge plain (Sam Roi Yot, S4-2).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S4-2-01	1,260	0.80±0.1	3.15±0.1	0.80±0.1	1.22	1.06±0.1	5.08±0.21	4,780±490
S4-2-02	1,260	0.80±0.1	3.15±0.1	0.80±0.1	1.22	1.06±0.1	4.75±0.25	4,460±480
S4-2-03	1,260	0.80±0.1	3.15±0.1	0.80±0.1	1.22	1.06±0.1	6.02±0.32	5,660±610
S4-2-04	1,260	0.80±0.1	3.15±0.1	0.80±0.1	1.22	1.06±0.1	5.44±0.23	5,110±520
S4-2-05	1,260	0.80±0.1	3.15±0.1	0.80±0.1	1.22	1.06±0.1	4.48±0.16	4,210±420




OSL decay curve of sample no.S4-2-04
100,001
80,001
60,001
40,001
20,001
1
OSL-intensity (count/sec)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
20
40
60


Growth curve of sample no.S4-2-04
2
1.5
1
0.5
0
OSL-ratio
y = -2E-05x^2 + 0.0291x
R² = 1
0 10 20 30 40 50 60 70
Dose (sec)


OSL decay curve of sample no.S4-2-05
100,001
80,001
60,001
40,001
20,001
1
OSL-intensity (count/sec)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
20
40
60

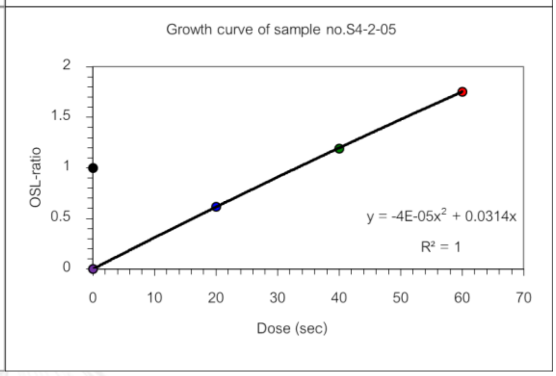
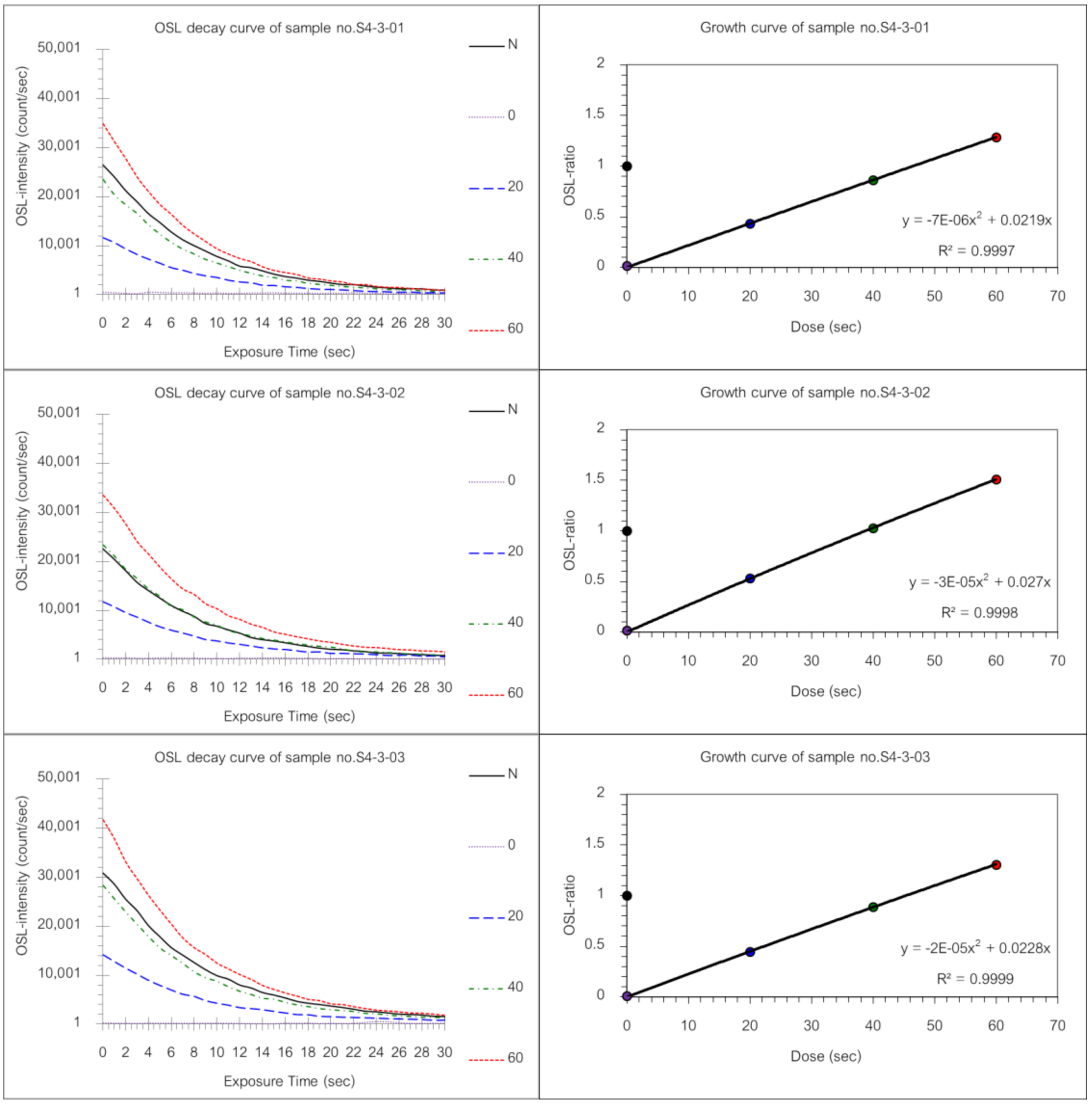
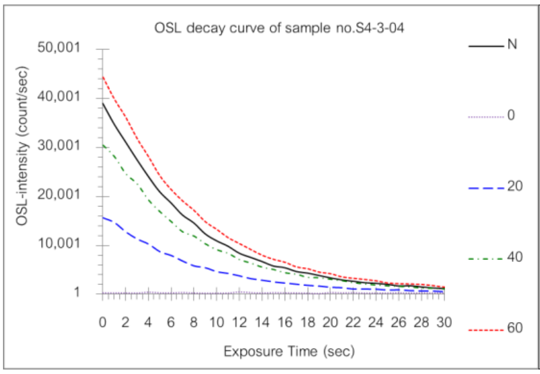

Growth curve of sample no.S4-2-05
2
1.5
1
0.5
0
OSL-ratio
y = -4E-05x^2 + 0.0314x
R² = 1
0 10 20 30 40 50 60 70
Dose (sec)

Table A.36 OSL dating results from beach ridge plain (Sam Roi Yot, S4-3).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
S4-3-01	1,670	0.86±0.1	3.48±0.1	0.85±0.1	0.68	1.16±0.1	6.14±0.30	5,300±520
S4-3-02	1,670	0.86±0.1	3.48±0.1	0.85±0.1	0.68	1.16±0.1	5.95±0.41	5,140±560
S4-3-03	1,670	0.86±0.1	3.48±0.1	0.85±0.1	0.68	1.16±0.1	5.58±1.14	4,820±1,070
S4-3-04	1,670	0.86±0.1	3.48±0.1	0.85±0.1	0.68	1.16±0.1	8.00±0.41	6,910±690




OSL decay curve of sample no.S4-3-04
OSL-intensity (count/sec)
50,001
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
20
40
60

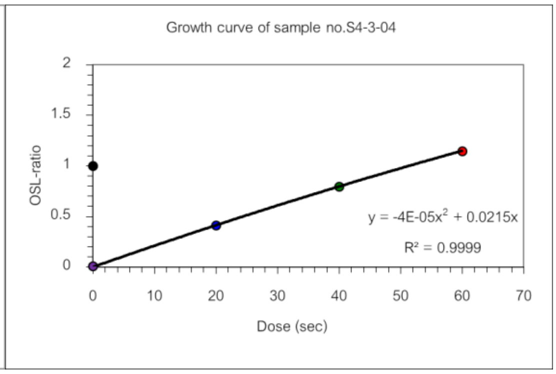
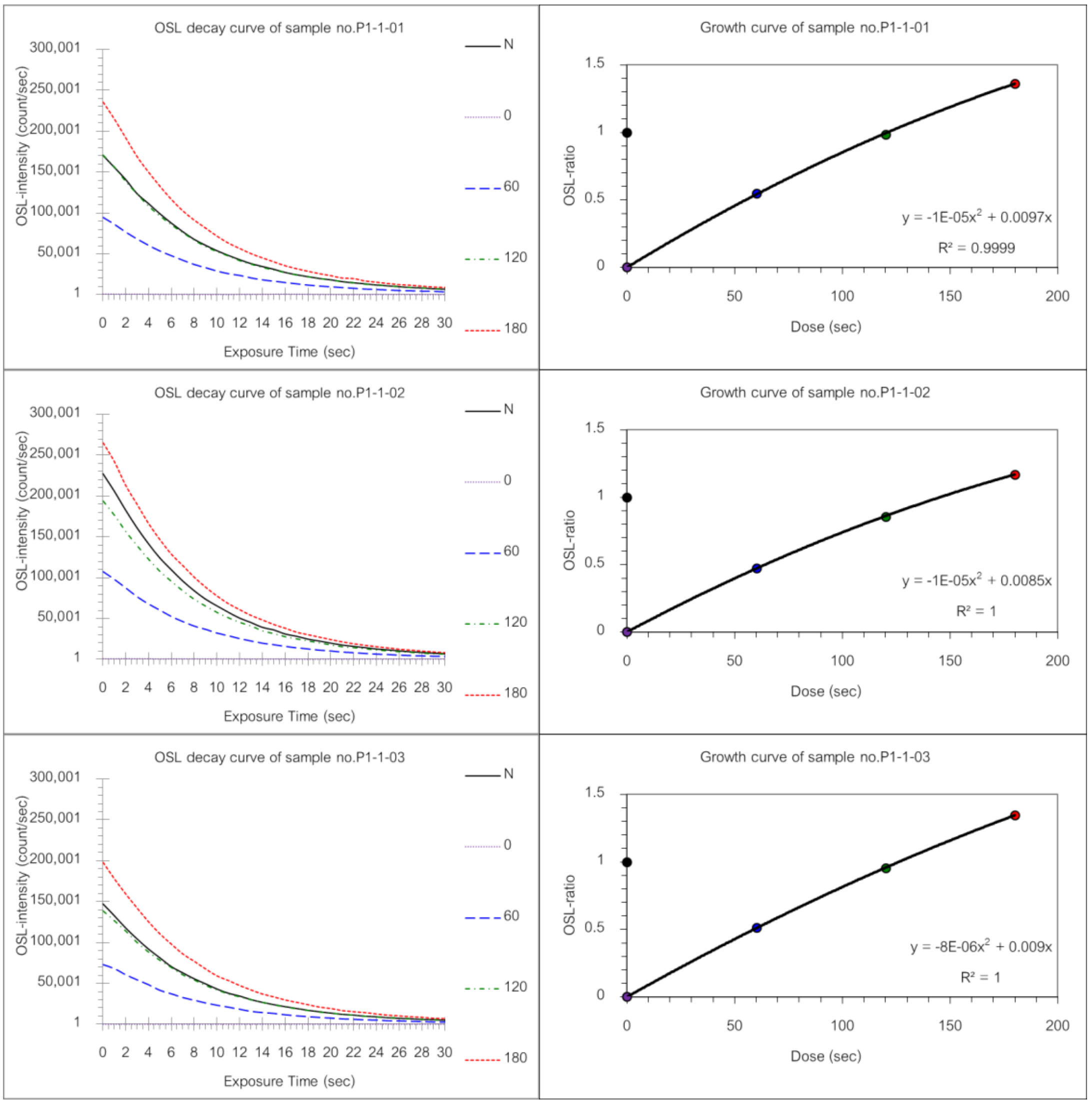

Growth curve of sample no.S4-3-04
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60 70
Dose (sec)
y = -4E-05x^2 + 0.0215x
R² = 0.9999

Table A.37 OSL dating results from beach ridge plain (Pran Buri, P1-1).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
P1-1-01	160	1.32±0.1	9.34±0.1	1.06±0.1	0.85	1.86±0.1	15.35±0.61	8,250±550
P1-1-02	160	1.32±0.1	9.34±0.1	1.06±0.1	0.85	1.86±0.1	17.76±0.82	9,550±670
P1-1-03	160	1.32±0.1	9.34±0.1	1.06±0.1	0.85	1.86±0.1	17.03±0.63	9,160±590
P1-1-04	160	1.32±0.1	9.34±0.1	1.06±0.1	0.85	1.86±0.1	16.57±0.63	8,910±580



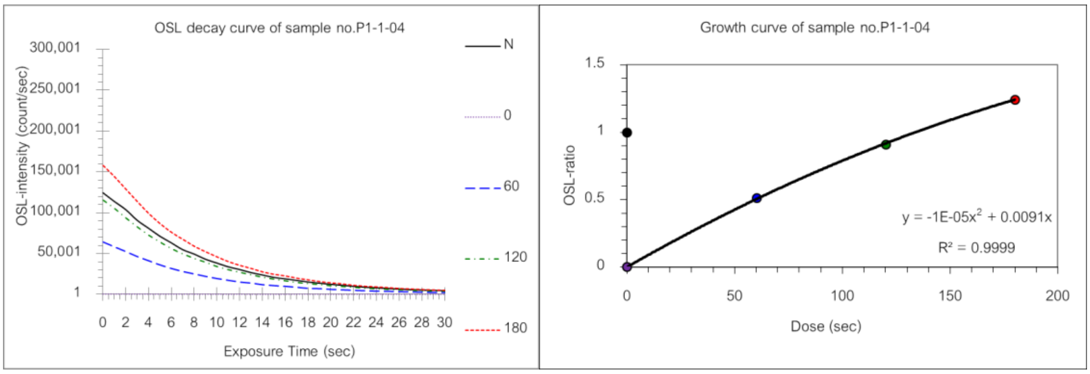
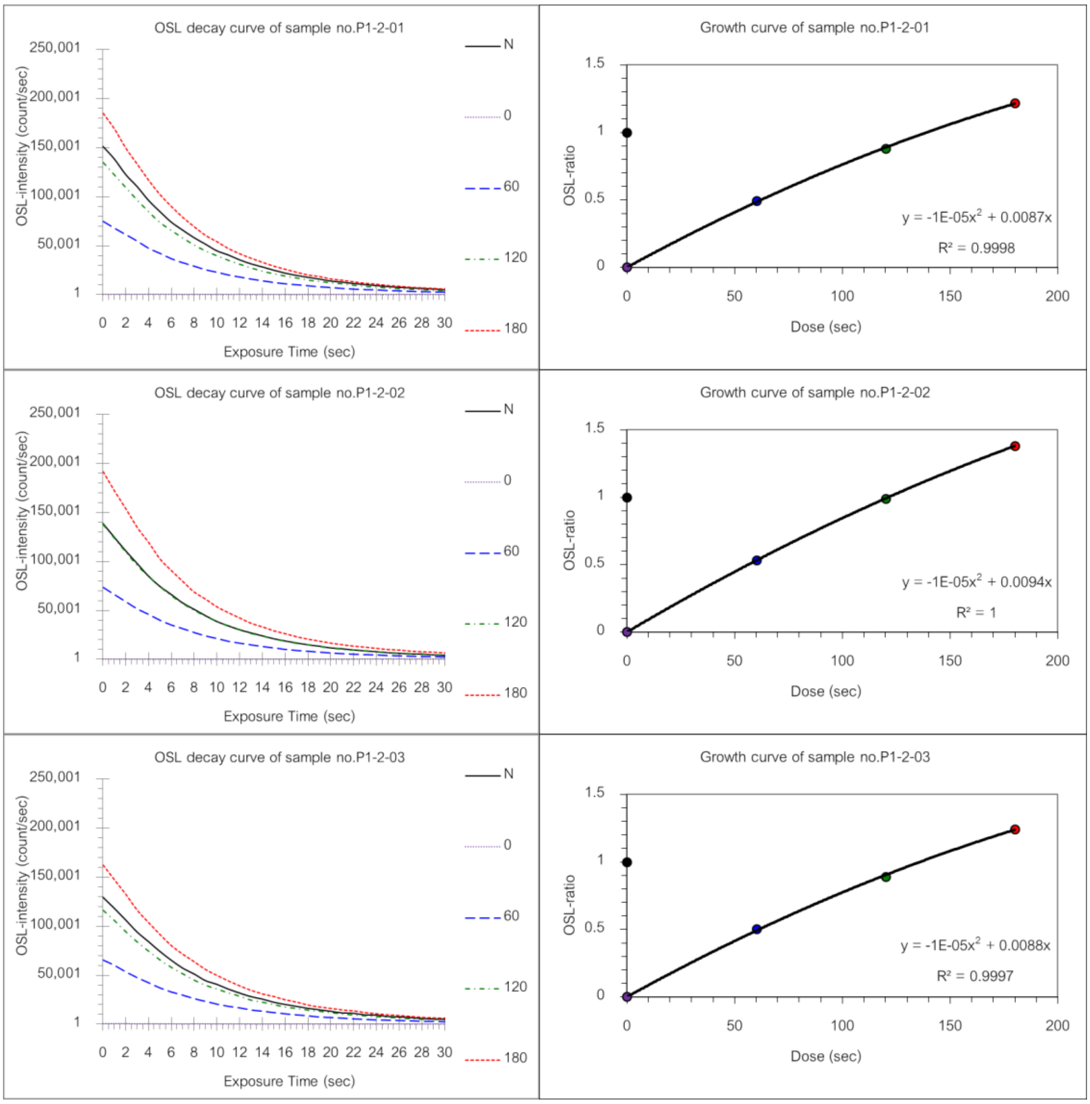
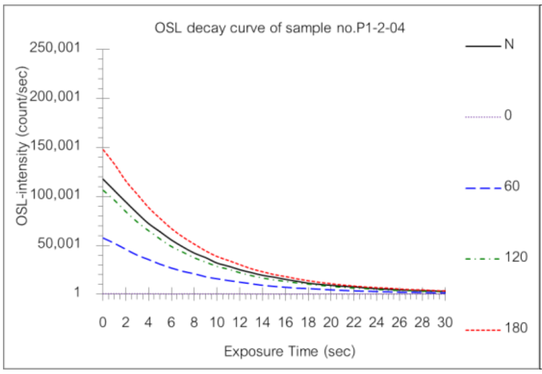

OSL decay curve of sample no.P1-1-04
OSL-intensity (count/sec)
300,001
250,001
200,001
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
60
120
180
Growth curve of sample no.P1-1-04
OSL-ratio
1.5
1
0.5
0
0 50 100 150 200
Dose (sec)
y = -1E-05x2 + 0.0091x
R² = 0.9999

Table A.38 OSL dating results from beach ridge plain (Pran Buri, P1-2).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
P1-2-01	300	1.05±0.1	4.06±0.1	1.33±0.1	1.07	1.63±0.1	17.52±0.83	10,760±830
P1-2-02	300	1.05±0.1	4.06±0.1	1.33±0.1	1.07	1.63±0.1	17.25±0.87	10,600±840
P1-2-03	300	1.05±0.1	4.06±0.1	1.33±0.1	1.07	1.63±0.1	16.60±0.77	10,200±780
P1-2-04	300	1.05±0.1	4.06±0.1	1.33±0.1	1.07	1.63±0.1	20.39±0.84	12,520±920




OSL decay curve of sample no.P1-2-04
250,001
200,001
150,001
100,001
50,001
1
OSL-intensity (count/sec)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
60
120
180

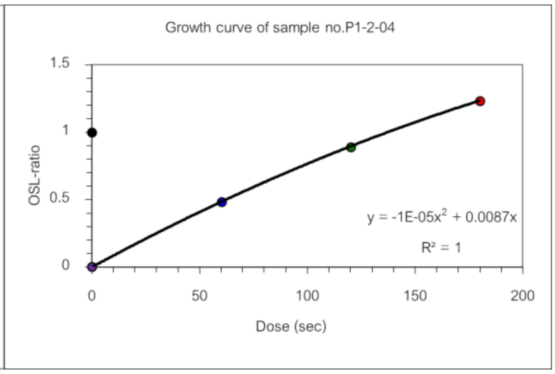
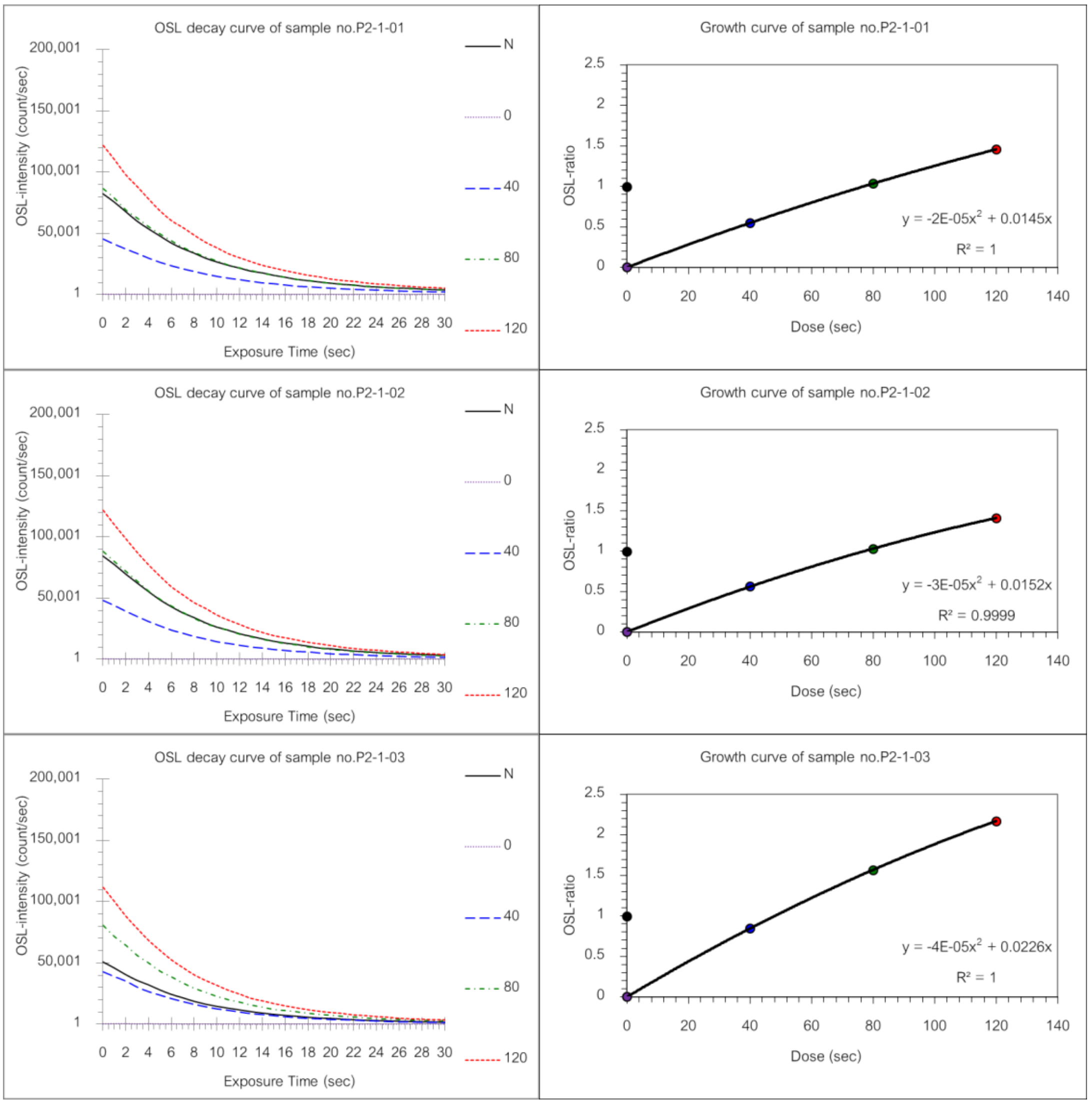
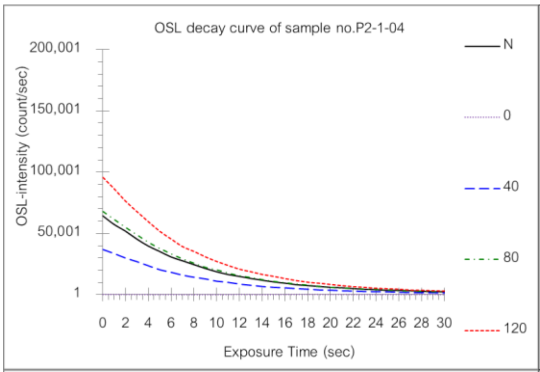
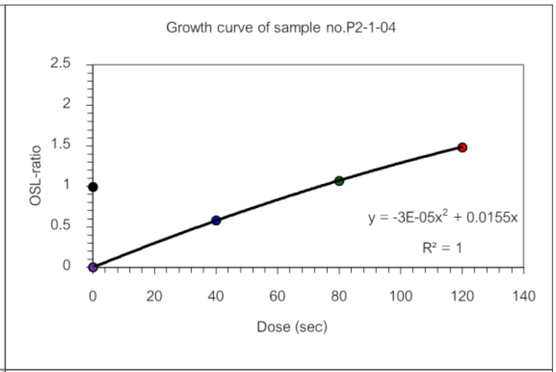

Growth curve of sample no.P1-2-04
1.5
1
0.5
0
OSL-ratio
0 50 100 150 200
Dose (sec)
y = -1E-05x2 + 0.0087x
R² = 1

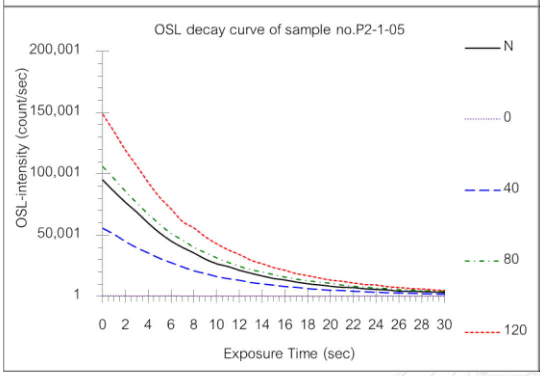
Table A.39 OSL dating results from beach ridge plain (Pran Buri, P2-1).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
P2-1-01	160	1.05±0.1	4.50±0.1	1.14±0.1	0.85	1.51±0.1	10.33±0.49	6,850±550
P2-1-02	160	1.05±0.1	4.50±0.1	1.14±0.1	0.85	1.51±0.1	8.30±0.32	5,500±420
P2-1-03	160	1.05±0.1	4.50±0.1	1.14±0.1	0.85	1.51±0.1	6.45±0.23	4,270±320
P2-1-04	160	1.05±0.1	4.50±0.1	1.14±0.1	0.85	1.51±0.1	8.78±1.37	5,820±980
P2-1-05	160	1.05±0.1	4.50±0.1	1.14±0.1	0.85	1.51±0.1	10.74±0.68	7,120±650




OSL decay curve of sample no.P2-1-04
OSL-intensity (count/sec)
200,001
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
40
80
120


Growth curve of sample no.P2-1-04
OSL-ratio
2.5
2
1.5
1
0.5
0
0 20 40 60 80 100 120 140
Dose (sec)
y = -3E-05x2 + 0.0155x
R² = 1


OSL decay curve of sample no.P2-1-05
OSL-intensity (count/sec)
200,001
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
40
80
120

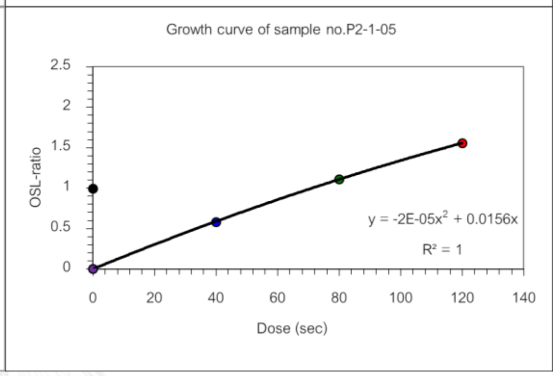
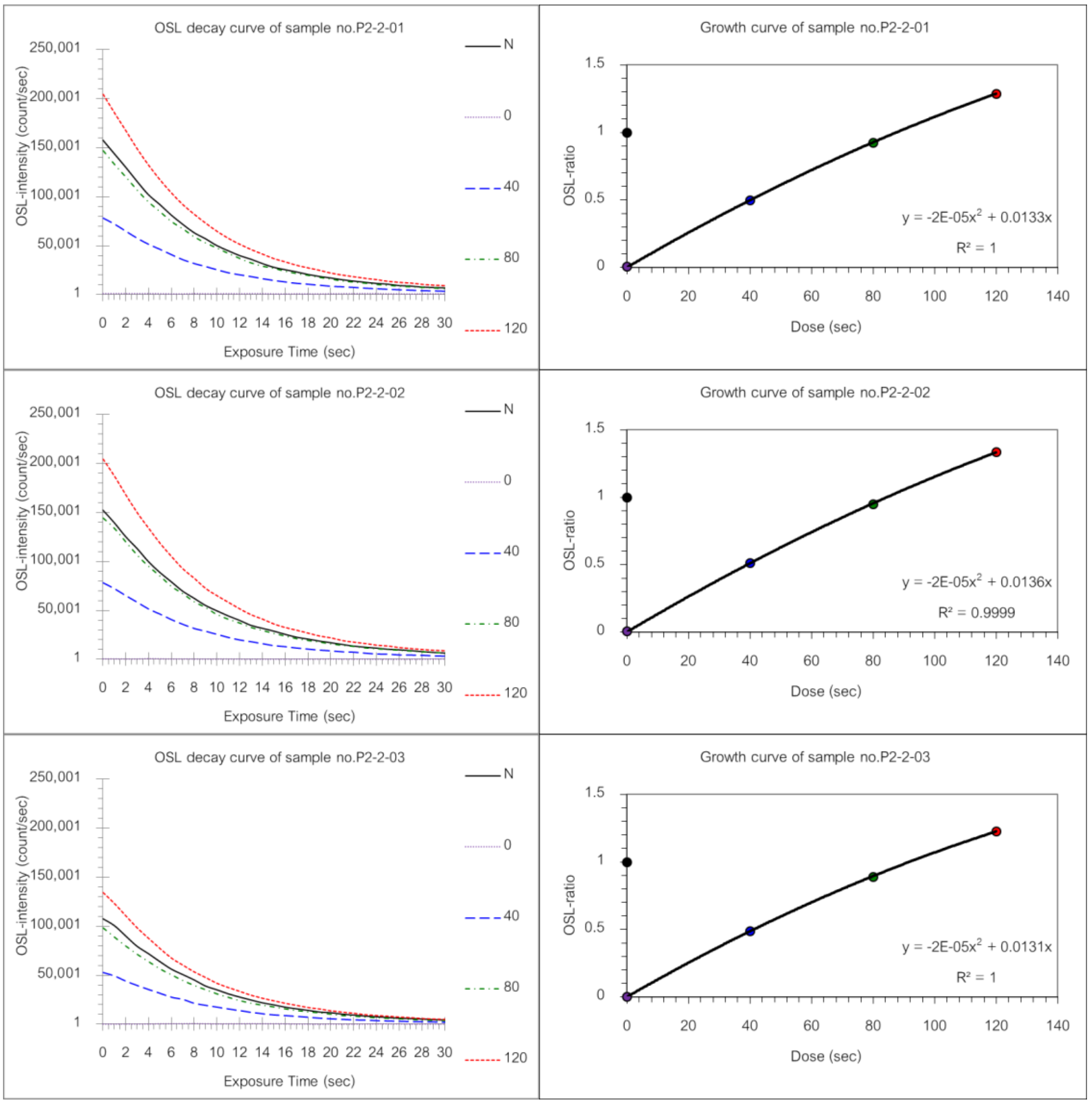
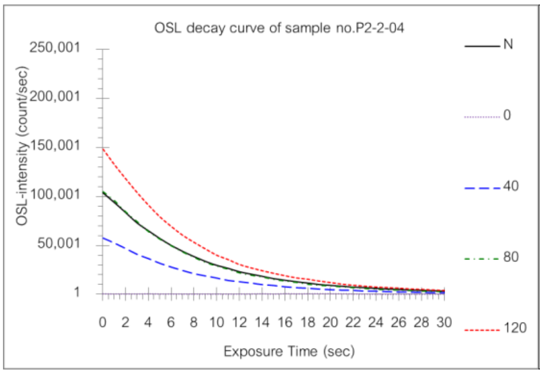

Growth curve of sample no.P2-1-05
OSL-ratio
2.5
2
1.5
1
0.5
0
0 20 40 60 80 100 120 140
Dose (sec)
y = -2E-05x2 + 0.0156x
R² = 1

Table A.40 OSL dating results from beach ridge plain (Pran Buri, P2-2).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
P2-2-01	340	1.11±0.1	4.62±0.1	1.03±0.1	2.15	1.42±0.1	12.00±0.59	8,470±730
P2-2-02	340	1.11±0.1	4.62±0.1	1.03±0.1	2.15	1.42±0.1	10.27±0.43	7,250±590
P2-2-03	340	1.11±0.1	4.62±0.1	1.03±0.1	2.15	1.42±0.1	10.51±0.59	7,410±660
P2-2-04	340	1.11±0.1	4.62±0.1	1.03±0.1	2.15	1.42±0.1	9.39±0.61	6,630±630




OSL decay curve of sample no.P2-2-04
OSL-intensity (count/sec)
250,001
200,001
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
40
80
120

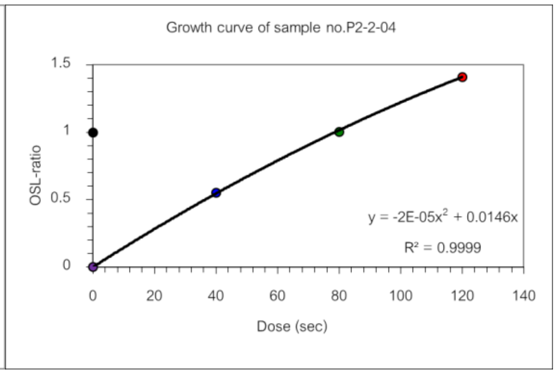
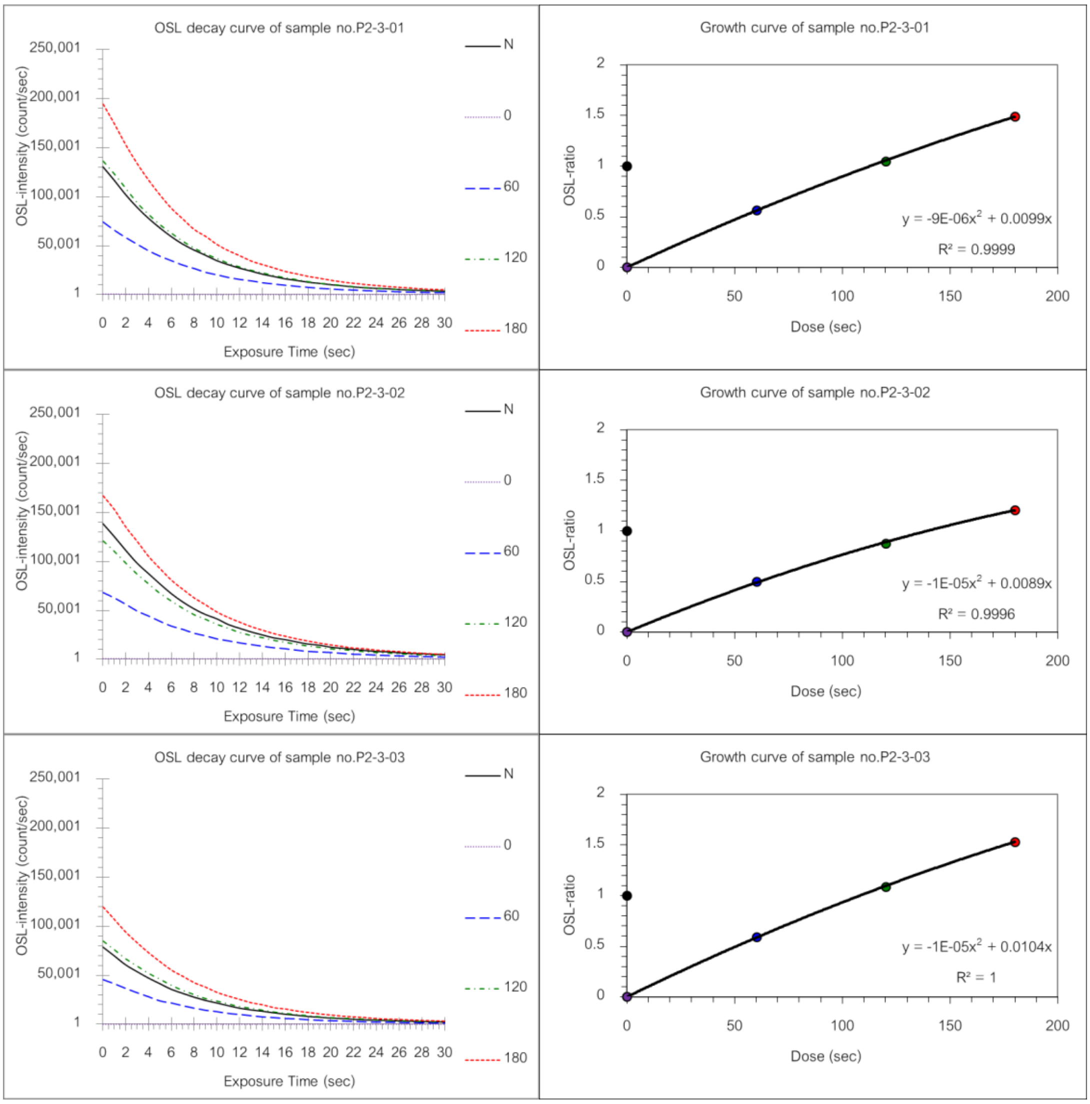
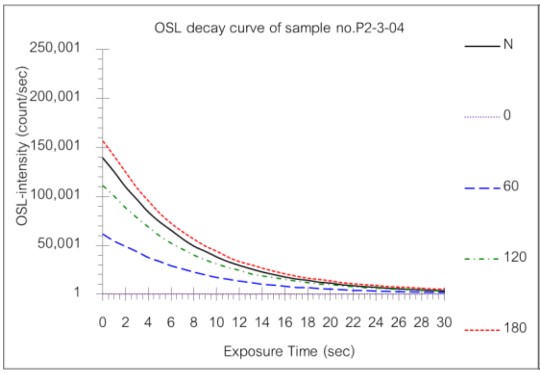

Growth curve of sample no.P2-2-04
OSL-ratio
1.5
1
0.5
0
0 20 40 60 80 100 120 140
Dose (sec)
y = -2E-05x^2 + 0.0146x
R² = 0.9999

Table A.41 OSL dating results from beach ridge plain (Pran Buri, P2-3).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
P2-3-01	470	1.66±0.1	6.52±0.1	0.76±0.1	1.34	1.48±0.1	14.20±0.62	9,610±770
P2-3-02	470	1.66±0.1	6.52±0.1	0.76±0.1	1.34	1.48±0.1	17.76±0.95	12,020±1,030
P2-3-03	470	1.66±0.1	6.52±0.1	0.76±0.1	1.34	1.48±0.1	14.45±0.84	9,780±870
P2-3-04	470	1.66±0.1	6.52±0.1	0.76±0.1	1.34	1.48±0.1	23.61±1.33	15,980±1,400




OSL decay curve of sample no.P2-3-04
OSL-intensity (count/sec)
250,001
200,001
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
60
120
180

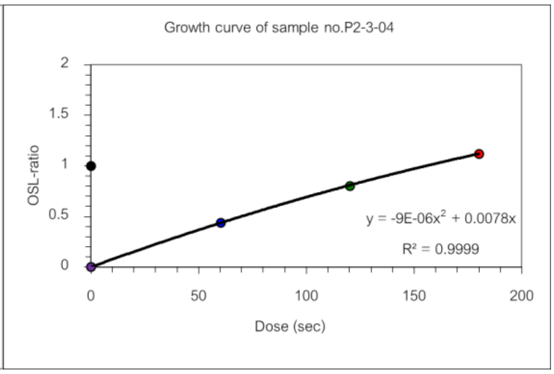
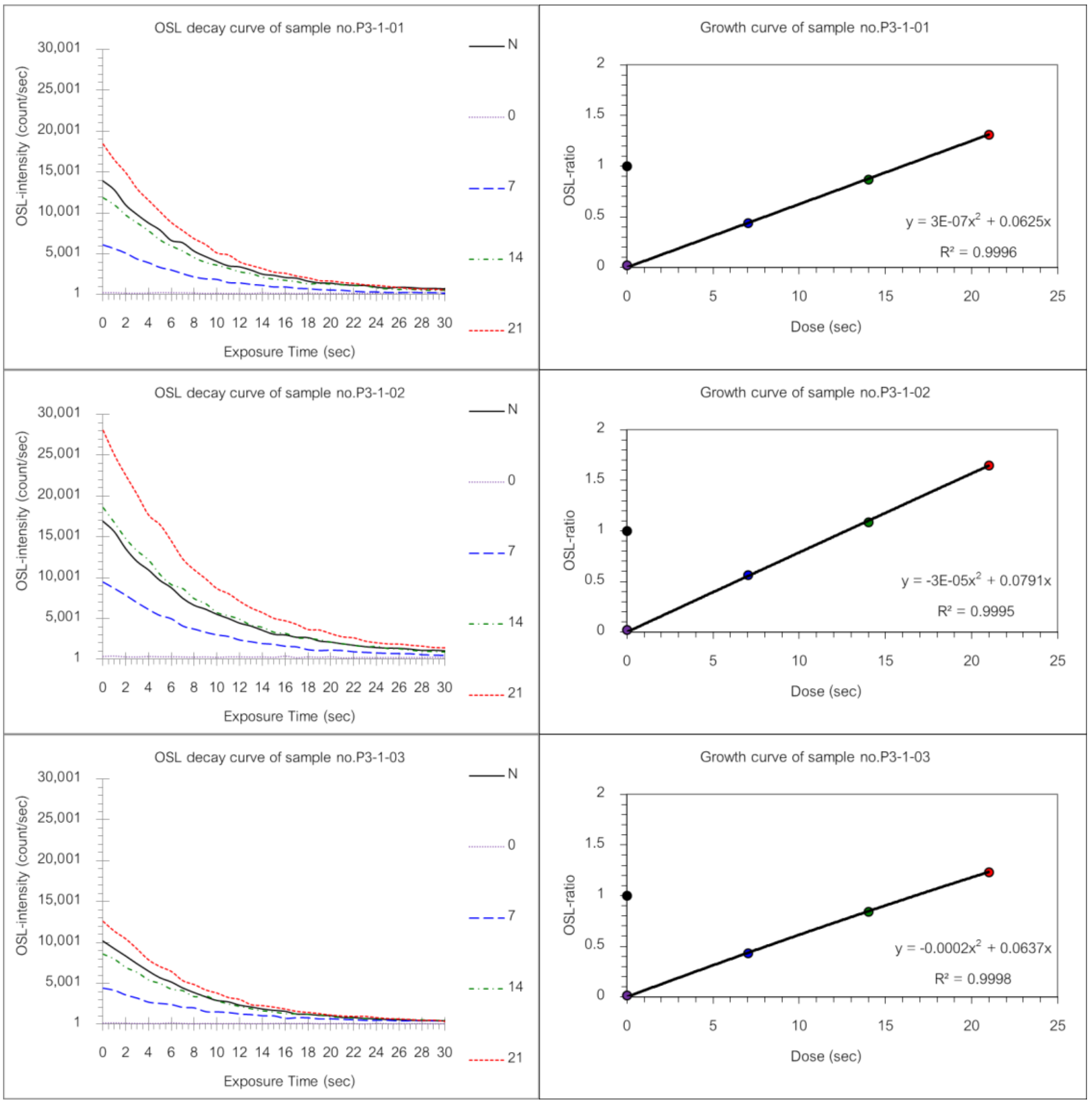
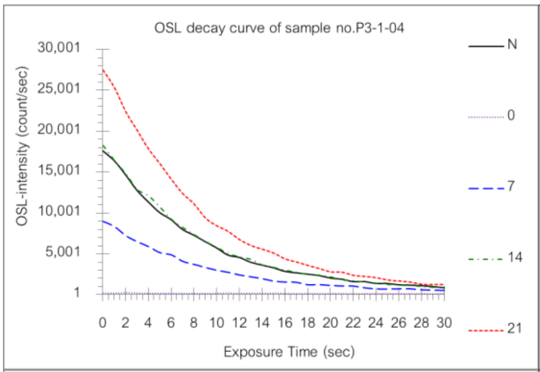
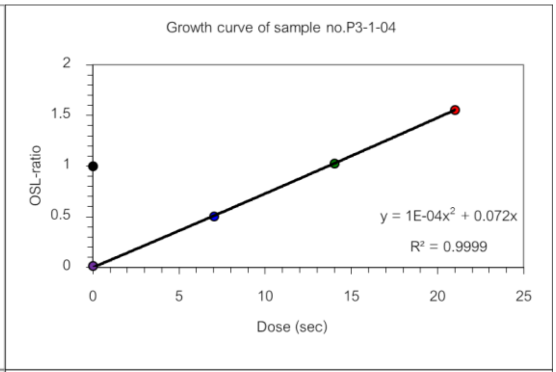

Growth curve of sample no.P2-3-04
OSL-ratio
2
1.5
1
0.5
0
0 50 100 150 200
Dose (sec)
y = -9E-06x^2 + 0.0078x
R² = 0.9999

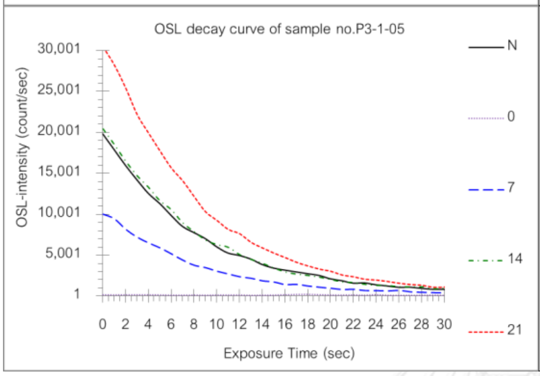
Table A.42 OSL dating results from beach ridge plain (Pran Buri, P3-1).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
P3-1-01	200	0.89±0.1	2.98±0.1	0.55±0.1	0.68	0.88±0.1	2.32±0.13	2,630±330
P3-1-02	200	0.89±0.1	2.98±0.1	0.55±0.1	0.68	0.88±0.1	1.86±0.07	2,110±250
P3-1-03	200	0.89±0.1	2.98±0.1	0.55±0.1	0.68	0.88±0.1	2.23±0.12	2,540±310
P3-1-04	200	0.89±0.1	2.98±0.1	0.55±0.1	0.68	0.88±0.1	1.99±0.09	2,260±270
P3-1-05	200	0.89±0.1	2.98±0.1	0.55±0.1	0.68	0.88±0.1	2.05±0.07	2,320±270




OSL decay curve of sample no.P3-1-04
OSL-intensity (count/sec)
30,001
25,001
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
7
14
21


Growth curve of sample no.P3-1-04
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25
Dose (sec)
y = 1E-04x^2 + 0.072x
R² = 0.9999


OSL decay curve of sample no.P3-1-05
OSL-intensity (count/sec)
30,001
25,001
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
7
14
21

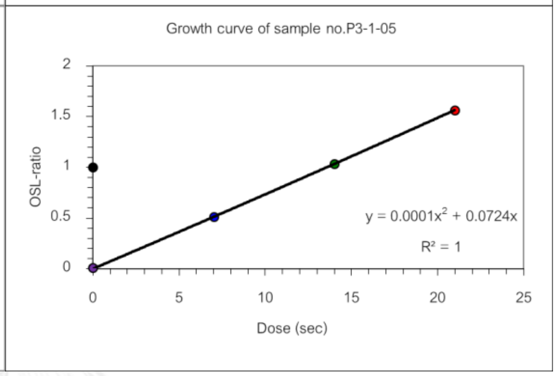
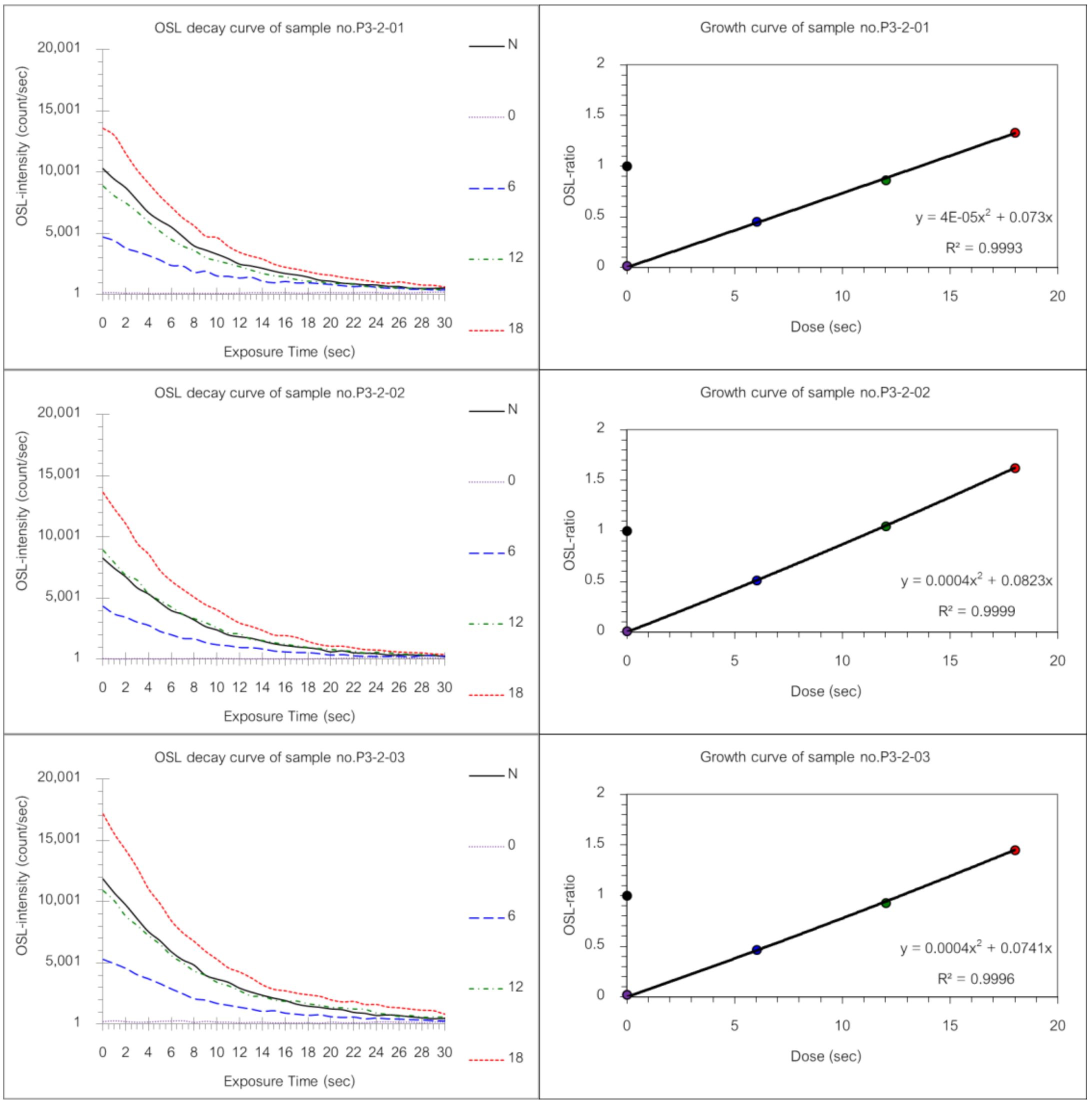

Growth curve of sample no.P3-1-05
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20 25
Dose (sec)
y = 0.0001x^2 + 0.0724x
R² = 1

Table A.43 OSL dating results from beach ridge plain (Pran Buri, P3-2).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
P3-2-01	415	0.64±0.1	2.12±0.1	0.60±0.1	0.29	0.80±0.1	2.06±0.19	2,580±400
P3-2-02	415	0.64±0.1	2.12±0.1	0.60±0.1	0.29	0.80±0.1	1.61±0.07	2,010±260
P3-2-03	415	0.64±0.1	2.12±0.1	0.60±0.1	0.29	0.80±0.1	2.05±0.09	2,560±340
P3-2-04	415	0.64±0.1	2.12±0.1	0.60±0.1	0.29	0.80±0.1	1.60±0.11	2,000±280
P3-2-05	415	0.64±0.1	2.12±0.1	0.60±0.1	0.29	0.80±0.1	1.91±0.12	2,390±330



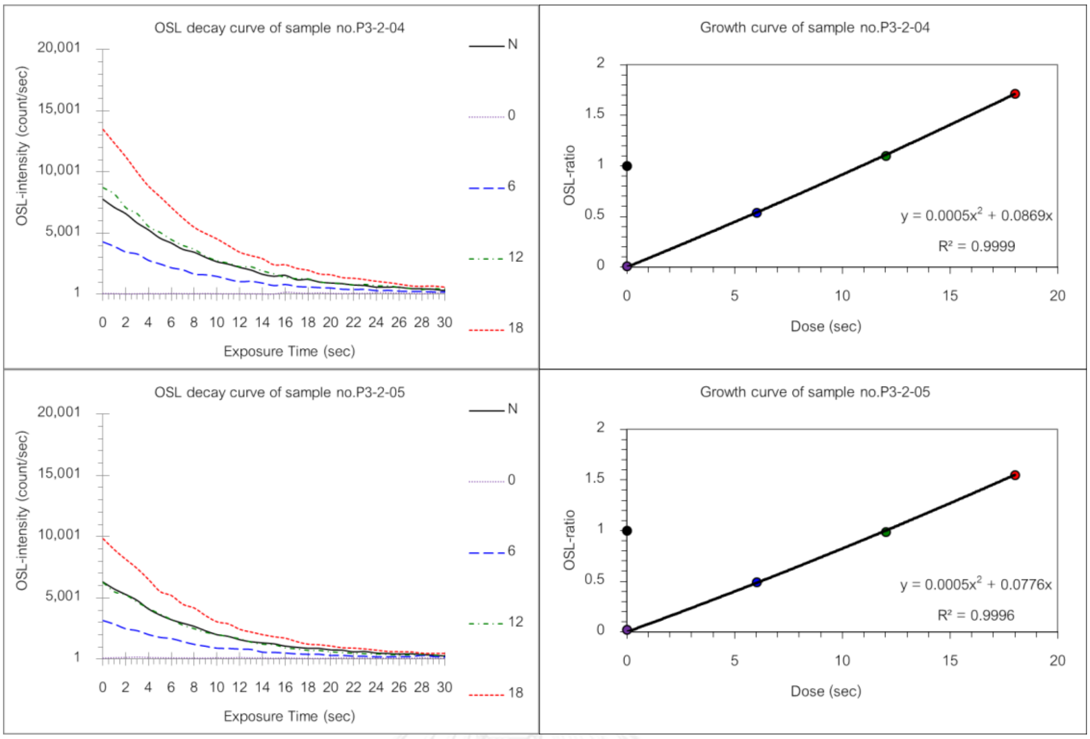
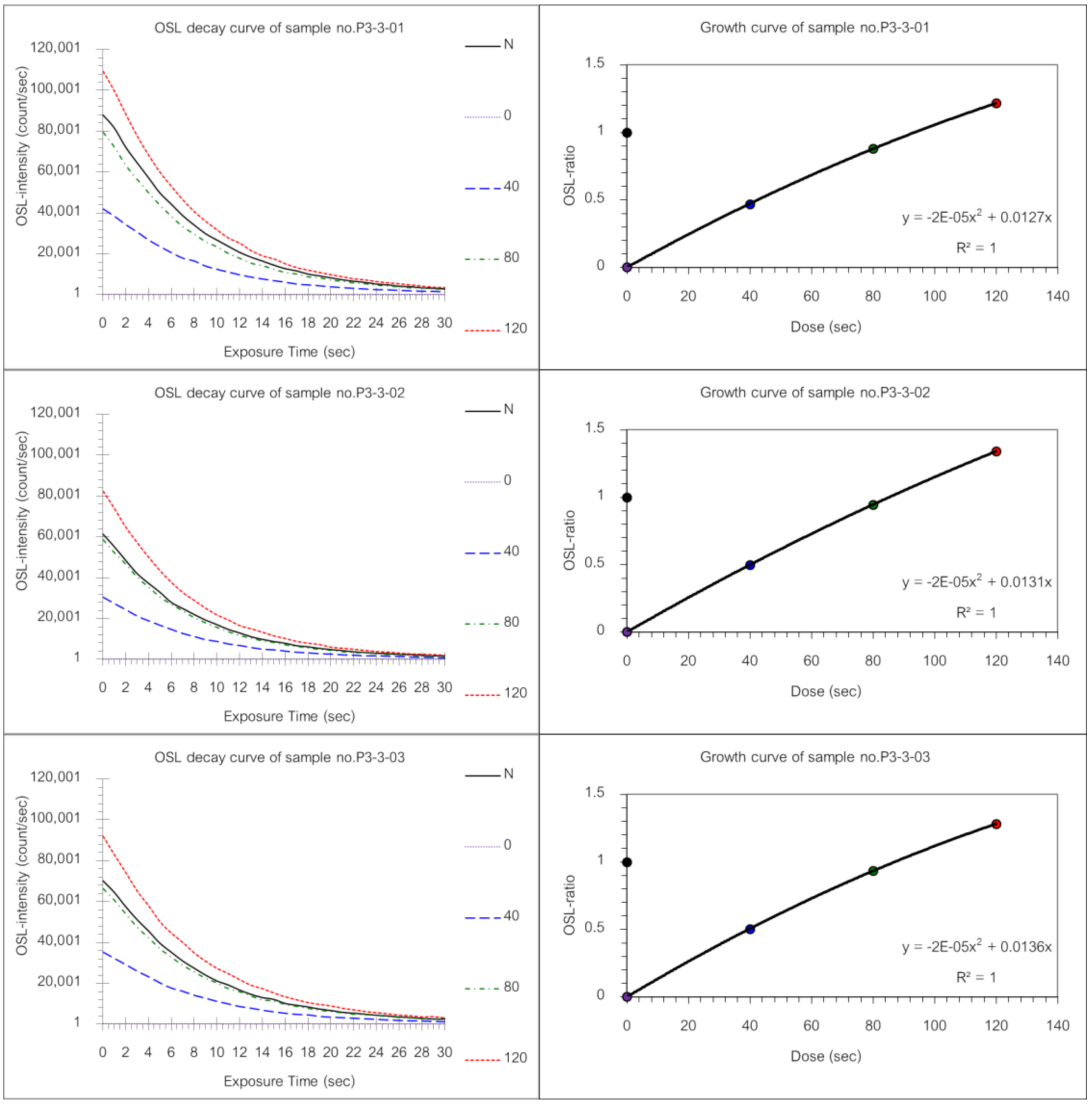

OSL decay curve of sample no.P3-2-04
OSL-intensity (count/sec)
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
6
12
18
Growth curve of sample no.P3-2-04
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20
Dose (sec)
y = 0.0005x2 + 0.0869x
R² = 0.9999
OSL decay curve of sample no.P3-2-05
OSL-intensity (count/sec)
20,001
15,001
10,001
5,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
6
12
18
Growth curve of sample no.P3-2-05
OSL-ratio
2
1.5
1
0.5
0
0 5 10 15 20
Dose (sec)
y = 0.0005x2 + 0.0776x
R² = 0.9996

Table A.44 OSL dating results from beach ridge plain (Pran Buri, P3-3).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
P3-3-01	750	1.24±0.1	4.21±0.1	0.82±0.1	0.56	1.27±0.1	10.82±0.79	8,510±910
P3-3-02	750	1.24±0.1	4.21±0.1	0.82±0.1	0.56	1.27±0.1	12.49±0.63	9,820±910
P3-3-03	750	1.24±0.1	4.21±0.1	0.82±0.1	0.56	1.27±0.1	10.15±0.60	7,980±780
P3-3-04	750	1.24±0.1	4.21±0.1	0.82±0.1	0.56	1.27±0.1	9.73±0.44	7,650±690



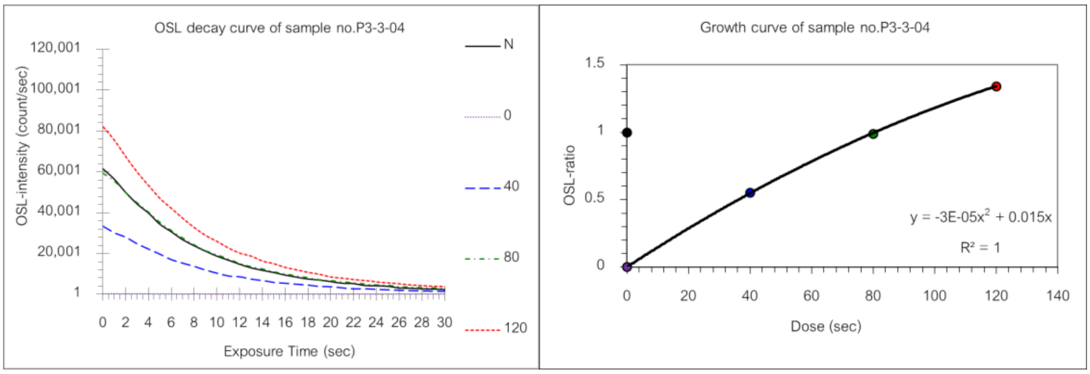
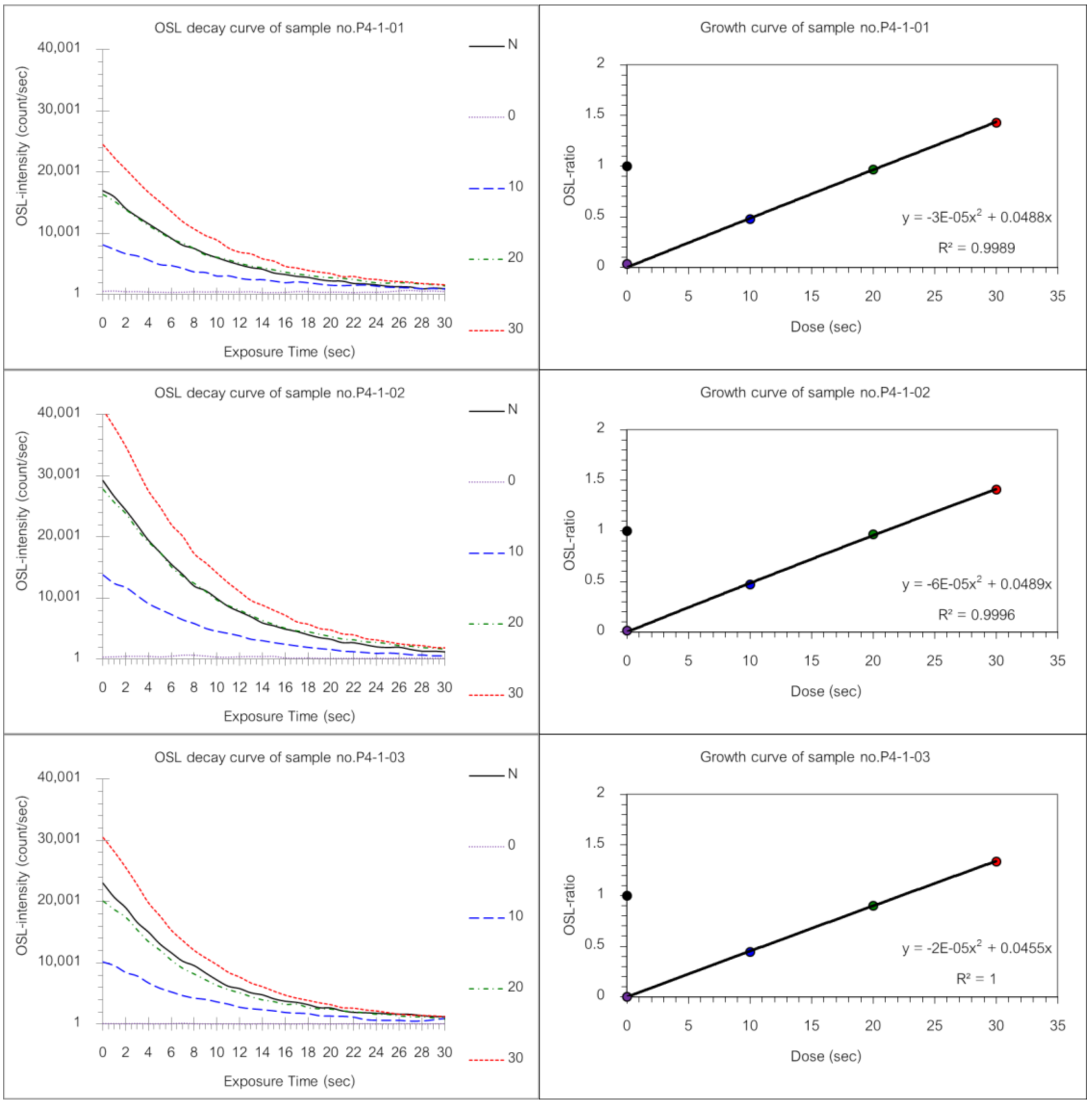

OSL decay curve of sample no.P3-3-04
OSL-intensity (count/sec)
120,001
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
40
80
120
Growth curve of sample no.P3-3-04
OSL-ratio
1.5
1
0.5
0
0 20 40 60 80 100 120 140
Dose (sec)
y = -3E-05x2 + 0.015x
R² = 1

Table A.45 OSL dating results from beach ridge plain (Pran Buri, P4-1).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
P4-1-01	265	0.71±0.1	2.75±0.1	0.79±0.1	0.79	1.02±0.1	1.88±0.16	1,850±230
P4-1-02	265	0.71±0.1	2.75±0.1	0.79±0.1	0.79	1.02±0.1	2.71±0.18	2,660±310
P4-1-03	265	0.71±0.1	2.75±0.1	0.79±0.1	0.79	1.02±0.1	5.34±0.35	5,250±620
P4-1-04	265	0.71±0.1	2.75±0.1	0.79±0.1	0.79	1.02±0.1	5.11±0.35	5,020±600
P4-1-05	265	0.71±0.1	2.75±0.1	0.79±0.1	0.79	1.02±0.1	3.29±0.21	3,220±370
P4-1-06	265	0.71±0.1	2.75±0.1	0.79±0.1	0.79	1.02±0.1	2.49±0.14	2,440±270



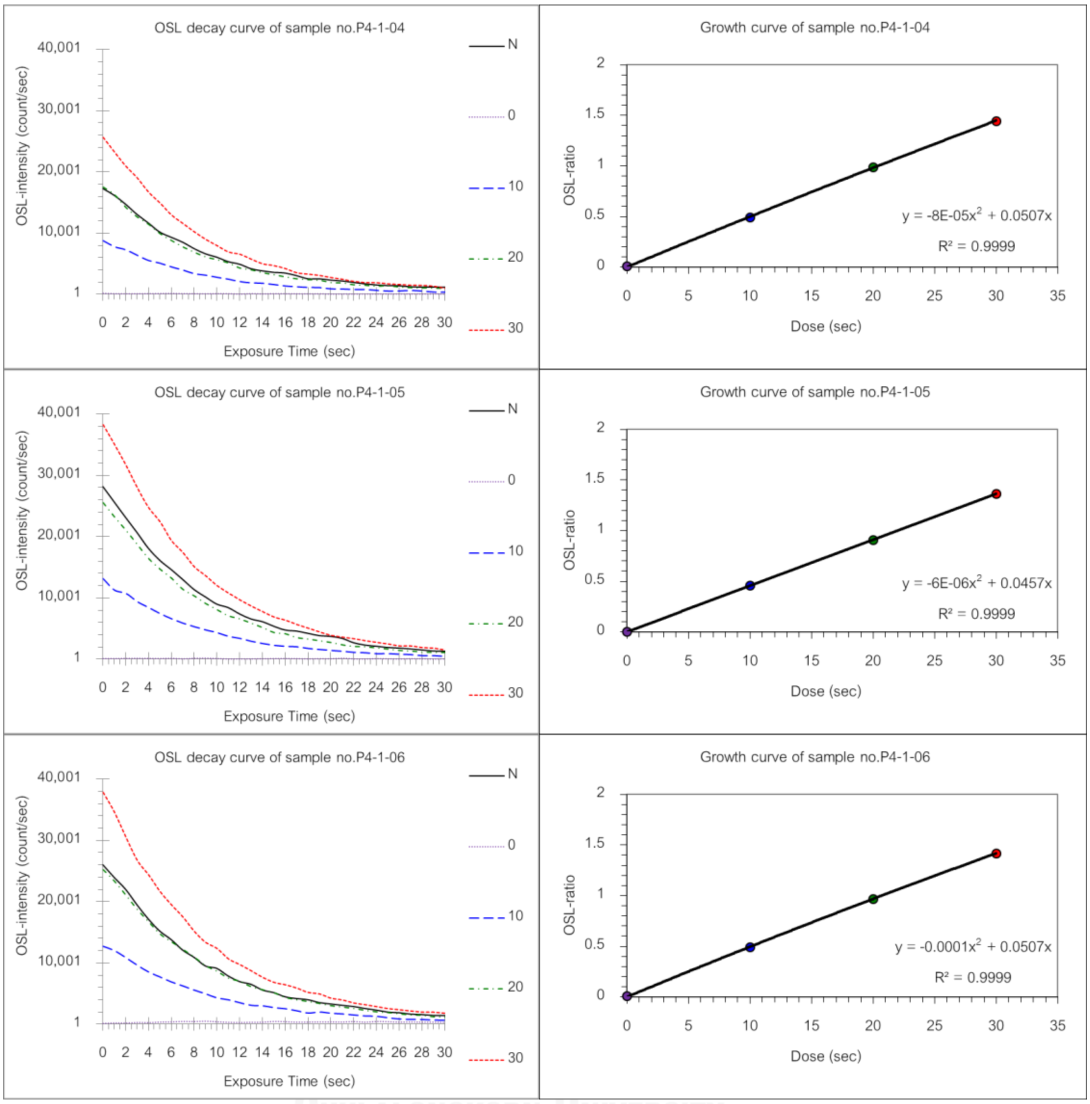
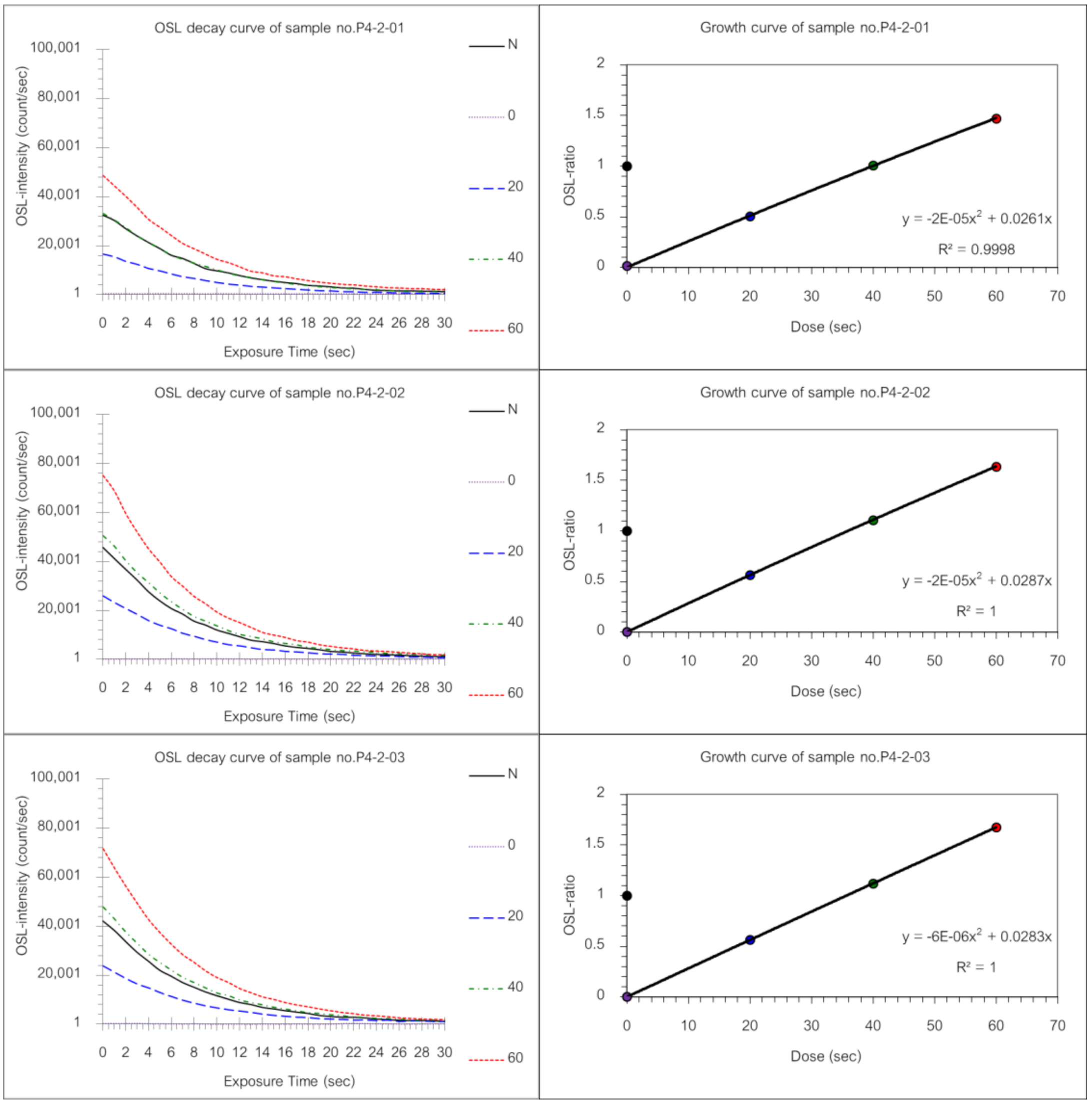
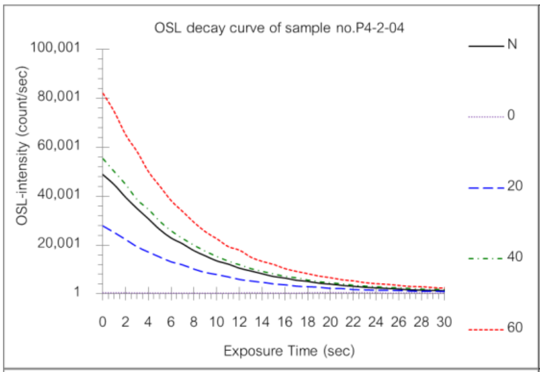
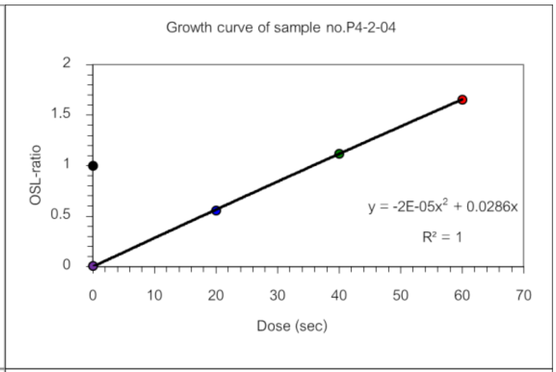

OSL decay curve of sample no.P4-1-04
OSL-intensity (count/sec)
40,001
30,001
20,001
10,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
10
20
30
Growth curve of sample no.P4-1-04
OSL-ratio
Dose (sec)
y = -8E-05x^2 + 0.0507x
R² = 0.9999
OSL decay curve of sample no.P4-1-05
Growth curve of sample no.P4-1-05
y = -6E-06x^2 + 0.0457x
R² = 0.9999
OSL decay curve of sample no.P4-1-06
Growth curve of sample no.P4-1-06
y = -0.0001x^2 + 0.0507x
R² = 0.9999

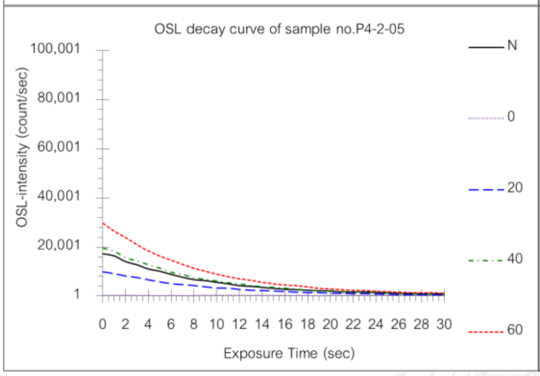
Table A.46 OSL dating results from beach ridge plain (Pran Buri, P4-2).

Sample no.	Distance from shoreline (m)	U (ppm)	Th (ppm)	K (%)	Water (%)	AD (Gy/ka)	ED (Gy)	Age (years)
P4-2-01	500	1.31±0.1	6.88±0.1	0.75±0.1	0.39	1.42±0.1	6.73±0.33	4,720±400
P4-2-02	500	1.31±0.1	6.88±0.1	0.75±0.1	0.39	1.42±0.1	5.04±0.39	3,530±370
P4-2-03	500	1.31±0.1	6.88±0.1	0.75±0.1	0.39	1.42±0.1	4.94±0.25	3,460±290
P4-2-04	500	1.31±0.1	6.88±0.1	0.75±0.1	0.39	1.42±0.1	5.56±0.22	3,900±310
P4-2-05	500	1.31±0.1	6.88±0.1	0.75±0.1	0.39	1.42±0.1	5.78±0.46	4,050±420




OSL decay curve of sample no.P4-2-04
OSL-intensity (count/sec)
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
20
40
60


Growth curve of sample no.P4-2-04
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60 70
Dose (sec)
y = -2E-05x2 + 0.0286x
R² = 1


OSL decay curve of sample no.P4-2-05
OSL-intensity (count/sec)
100,001
80,001
60,001
40,001
20,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
20
40
60

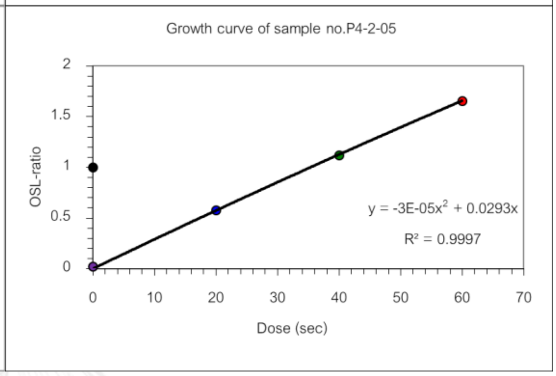
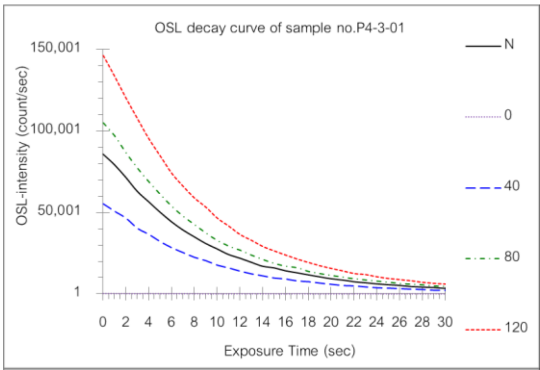
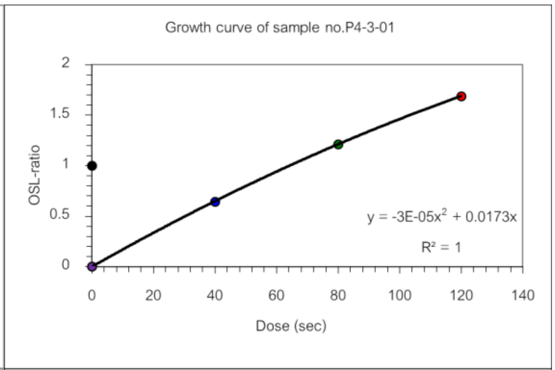
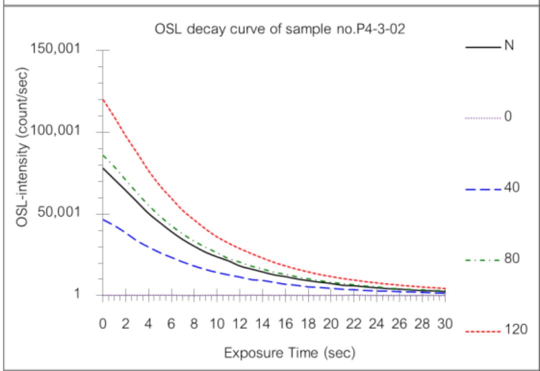

Growth curve of sample no.P4-2-05
OSL-ratio
2
1.5
1
0.5
0
0 10 20 30 40 50 60 70
Dose (sec)
y = -3E-05x2 + 0.0293x
R² = 0.9997

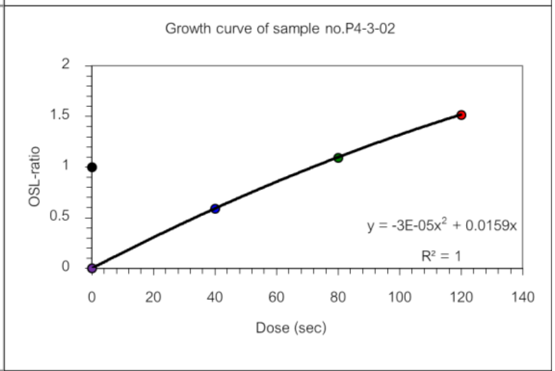
Table A.47 OSL dating results from beach ridge plain (Pran Buri, P4-3).

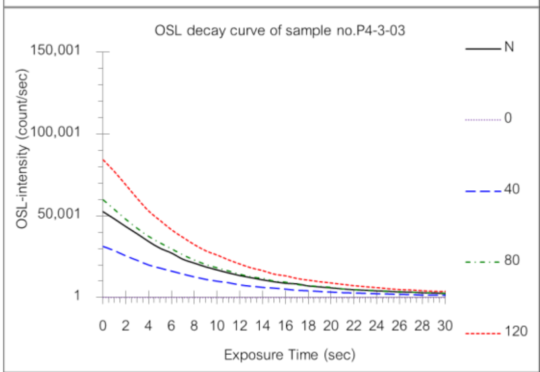
Sample no.	**Distance from shoreline (m)**	**U (ppm)**	**Th (ppm)**	**K (%)**	**Water (%)**	**AD (Gy/ka)**	**ED (Gy)**	**Age (years)**
P4-3-01	940	1.15±0.1	3.44±0.1	0.88±0.1	0.84	1.24±0.1	9.51±0.47	7,650±720
P4-3-02	940	1.15±0.1	3.44±0.1	0.88±0.1	0.84	1.24±0.1	8.10±0.65	6,510±730
P4-3-03	940	1.15±0.1	3.44±0.1	0.88±0.1	0.84	1.24±0.1	8.22±0.80	6,610±830
P4-3-04	940	1.15±0.1	3.44±0.1	0.88±0.1	0.84	1.24±0.1	11.12±0.47	8,950±810

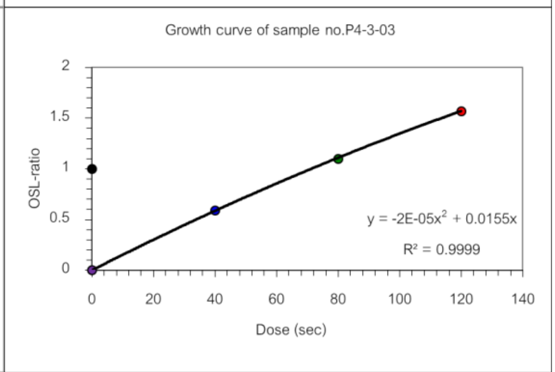

OSL decay curve of sample no.P4-3-01
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
40
80
120

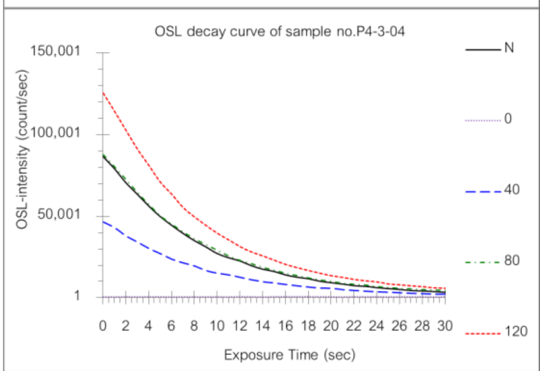

Growth curve of sample no.P4-3-01
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80 100 120 140
Dose (sec)
$y = -3E-05x^2 + 0.0173x$
$R^2 = 1$

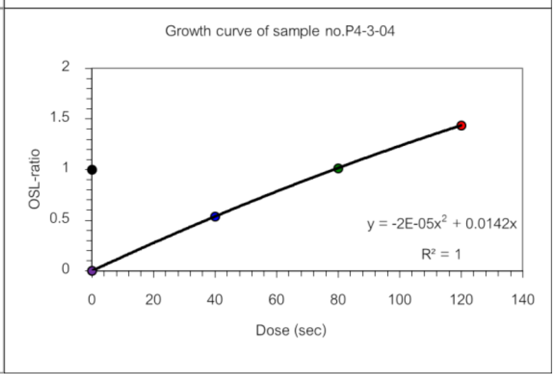

OSL decay curve of sample no.P4-3-02
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
40
80
120


Growth curve of sample no.P4-3-02
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80 100 120 140
Dose (sec)
$y = -3E-05x^2 + 0.0159x$
$R^2 = 1$


OSL decay curve of sample no.P4-3-03
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
40
80
120


Growth curve of sample no.P4-3-03
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80 100 120 140
Dose (sec)
$y = -2E-05x^2 + 0.0155x$
$R^2 = 0.9999$


OSL decay curve of sample no.P4-3-04
OSL-intensity (count/sec)
150,001
100,001
50,001
1
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Exposure Time (sec)
N
0
40
80
120


Growth curve of sample no.P4-3-04
OSL-ratio
2
1.5
1
0.5
0
0 20 40 60 80 100 120 140
Dose (sec)
$y = -2E-05x^2 + 0.0142x$
$R^2 = 1$

VITA

Mr. Peerasit Surakiatchai was born on 15 October 1980, at Bangkok. He got Bachelor Degree of Science from Department of Zoology, Faculty of Science, Kasetsart University, in 2002. He carried out his further study on Master program on Earth Science, Department of Geology at Faculty of Science, Chulalongkorn University, in 2003 and graduated in 2006. During his study, he got a research scholarships from the Japan Student Services Organization (JASSO) under the Ministry of Education, Culture, Sports, Science and Technology, Japan during the years 2004-2005. He has been working as a Research Assistant at the Quaternary/Archaeological Research Laboratory, Department of Geology, Faculty of Science, Chulalongkorn University. After that, he worked as a Schlumberger Overseas S. A. during the years 2007-2014. He has been a Ph.D. student in Geology at Department of Geology, Faculty of Science, Chulalongkorn University since 2011. He is a co-writer on a book entitled "โลก ดาราศาสตร์ และอวกาศ ม.4-ม.6 เล่ม 1: กทม อักษรเจริญทัศน์"