5th CLMTV Working Group Meeting
EXCURSION GUIDE BOOK

10th July 2019

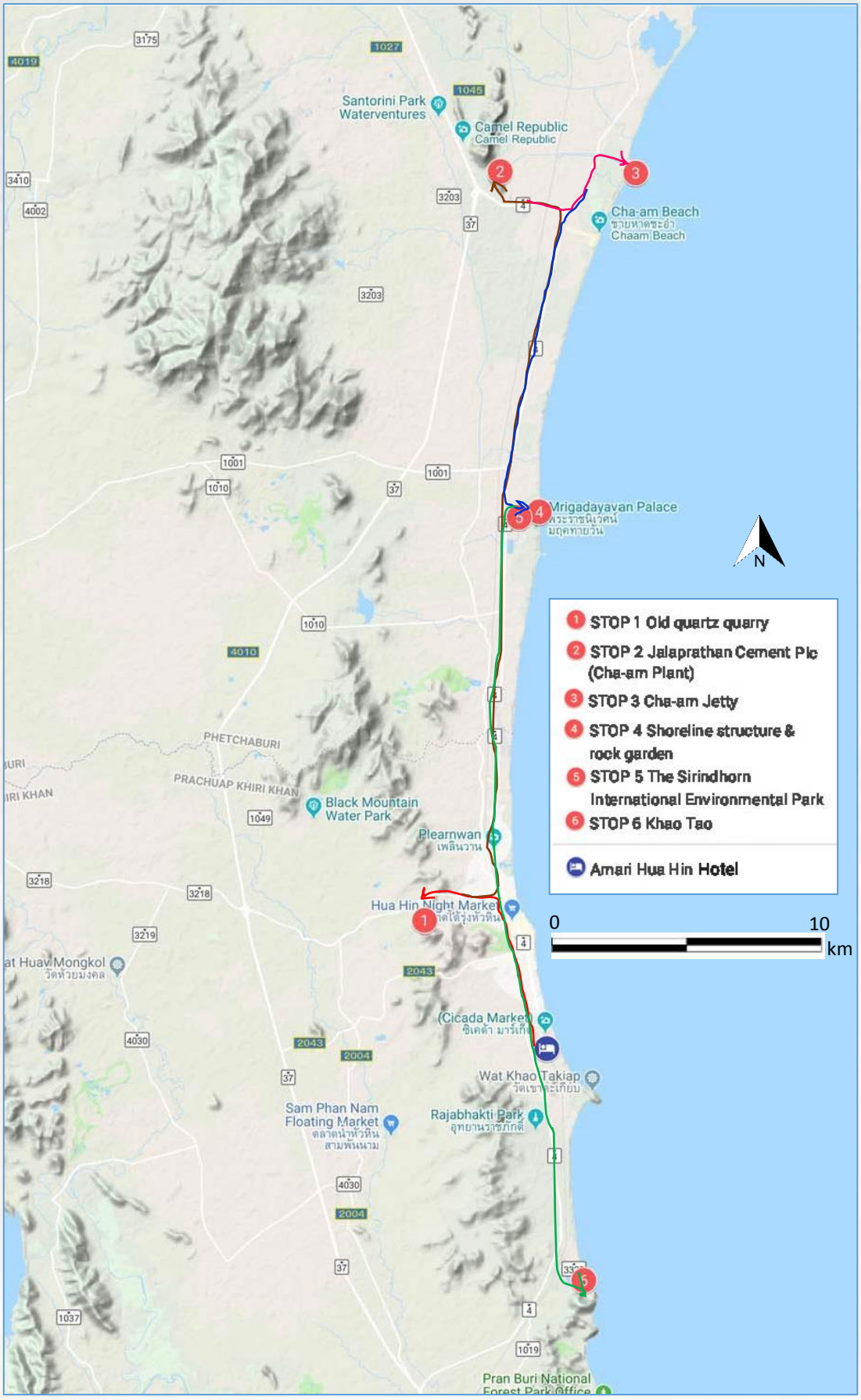
Prachuap Khiri Khan Province & Phetchaburi Province, Thailand

Prepared by International Cooperation Subdivision,
Geological Resources Conservation and Management Division
Department of Mineral Resources

CLMTV EXCURSION PROGRAMME

07.00-08.00	Breakfast at Amari Hua Hin Hotel
08.00-08.20	Depart for Stop 1
08.20-08.50	**Stop 1. Old quartz quarry**
08.50-09.30	Depart for Stop 2
09.30-11.50	**Stop 2. Jalaprathan Cement Plc (Cha-am Plant)**
11.50-12.10	Depart for Stop 3
12.10-13.00	Lunch at Krua Pa Yeun restaurant, Cha-am beach
13.00-13.30	**Stop 3. Cha-am Jetty**
13.00-13.45	Depart for Stop 4 and Stop 5
13.45-14.15	**Stop 4. Shoreline structure and rock garden** (Near Sirindhorn International Environmental Park)
14.30-15.00	**Stop 5. The Sirindhorn International Environmental Park**
15.00-15.30	Depart for Stop 6
15.30-16.10	**Stop 6. Khao Tao**
16.00-16.30	Depart for Pranburi river mouth
16.30-19.00	Dinner at OX seafood Restaurant
19.00-19.30	Depart for Amari Hua Hin Hotel

EXCURSION ROUTE MAP

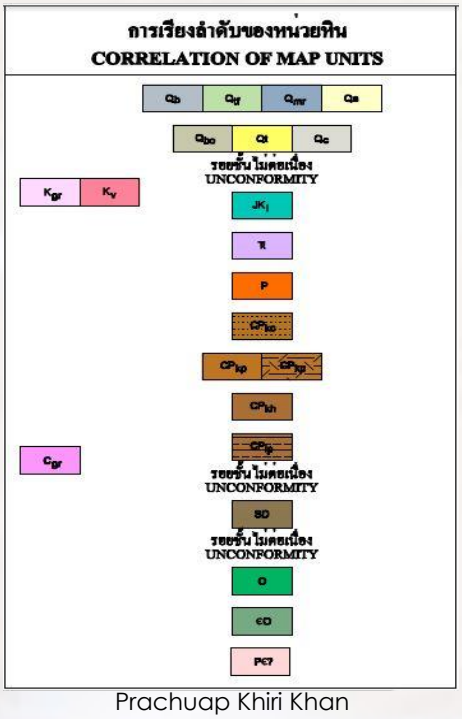


INTRODUCTION

Phetchaburi Province is at the north end of the Thai Peninsula, with the Gulf of Thailand to the east and the Tanaosi mountain range forming the boundary to Myanmar. Except for these border mountains, most of the province area is a flat plain. With an area of about 3,000 km^2, Kaeng Krachan National Park is Thailand's largest national park, covering nearly half of the province. It protects mostly rain forests in the mountains along the boundary to Myanmar, but also the Kaeng Krachan Reservoir is a part of the park. The only significant river of the province is the Phetchaburi River. (https://en.wikipedia.org/wiki/Phetchaburi_Province)

Prachuap Khiri Khan Province covers an area of 6,367 square kilometres (2,458 sq mi). The province is on the Kra Isthmus, the narrowest land bridge connecting the Thai Peninsula with mainland Asia. The province has the narrowest part of Thailand, just 13 km (8.1 mi) from the Gulf of Thailand to the border with Myanmar in the Tenasserim Hills. Geographically, Prachuap Khiri Khan is a moderate plain with elevations varying from sea level to 1,200 m (3,900 ft). The maximum elevations are found in the eastern north and central west regions, which make up approximately 30 percent of the province area. (https://en.wikipedia.org/wiki/Prachuap_Khiri_Khan_Province)

General Geology of Phetchaburi and Prachuap Khiri Khan Provinces



Prachuap Khiri Khan

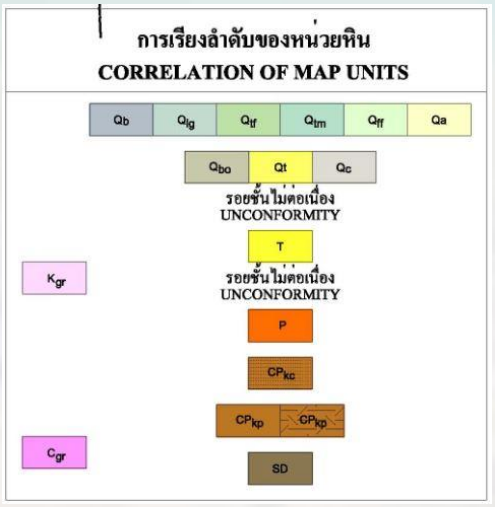
Prachuap Khiri Khan Province is an area with a slope from the west which is Tanaosri mountain range bordering between the Thai and Burmese territory down to the east at the Gulf of Thailand with scattered mountains. The Tanaosri mountain range compose of granite which is the base rock overlaying Carboniferous to Permian sedimentary rocks. The area of the eastern edge of the mountain range is a low mountain that mostly consisting of limestone and smaller amount of dolomitic limestone, chert and dolomite. The area of the valley, plains and lowlands is alluvial sediment. Along the coast, there is Quaternary coastal deposits.

The area of Prachuap Khiri Khan Province is supported by hard rock, aged over 570 million years to recent sediment. The proportion of rock in this area are 40 percent supported by sedimentary rock and metamorphic rock, 15 percent are igneous rocks and 45 percent are young sediments. The rocks can be classified into 12 rock units as of sedimentary and metamorphic rocks, 3 units of igneous rocks and 7 units of sediments.

(ธรณีวิทยาจังหวัดประจวบคีรีขันธ์และแหล่งเรียนรู้ธรณีวิทยา [Geology of Prachuap Khiri Khan Province and Geological sites], DMR, 2015)

Phetchaburi province

Stratigraphy and Igneous rocks



Phetchaburi

The age of sedimentary and metamorphic rocks are varies from inferred Precambrian to Permian succession. The unconformity has shown in this area as the Paleozoic rocks and covered Quaternary sediments.

Inferred Precambrian Rocks is to be the oldest rocks in southern and lower western region. The unit consists of high grade amphibolite facies comprise of schist, paragneiss, marble, calcsilicate rocks and augen gneiss.

Cambrian rocks consisting of thick brown beds of fine grained cross bedding sandstone, and interbedding of siltstone and shale. Alternating beds of siltstone and thin bedded limestone are at the top of Cambrian rocks. Depositional environments of them is interpreted to be shallow marine environments.

Ordovician rocks are generally consist of thick- to very thick- beds of gray to black limestone. Oolitic texture in limestone and dolomitic limestone were also found. In top of the group, inclusion of mud in limestone is observed. The rock unit is also interpreted to be quite shallow marine environment.

Silurian-Devonian rocks was deposited such as quartzitic sandstone, clayey sandstone interbedded with shale and siltstone. Tentaculite fossils was found that can interpret to depositional environment in quite deep sea. Rocks in some area are contact metamorphose to quartzite, phyllite and slate.

Carboniferous-Permian succession consist of the lower formation: greywacke, shale and thin bed arkose. In addition, quartzite, hornfel, and slate contact with igneous rocks are also found. The upper unit is consists of arkose, claystone with fossils of Brachiopod, crinoid and bryozoa. According to these evidence interpret to turbidity depositional environment.

Permian unit is Limestone, chert lenses, dolomitic limestone with fossils of fusulinids, brachiopod, coral, ammonoid, and crinoid. Deposition of Permian unit is this area was deposited in shallow marine.

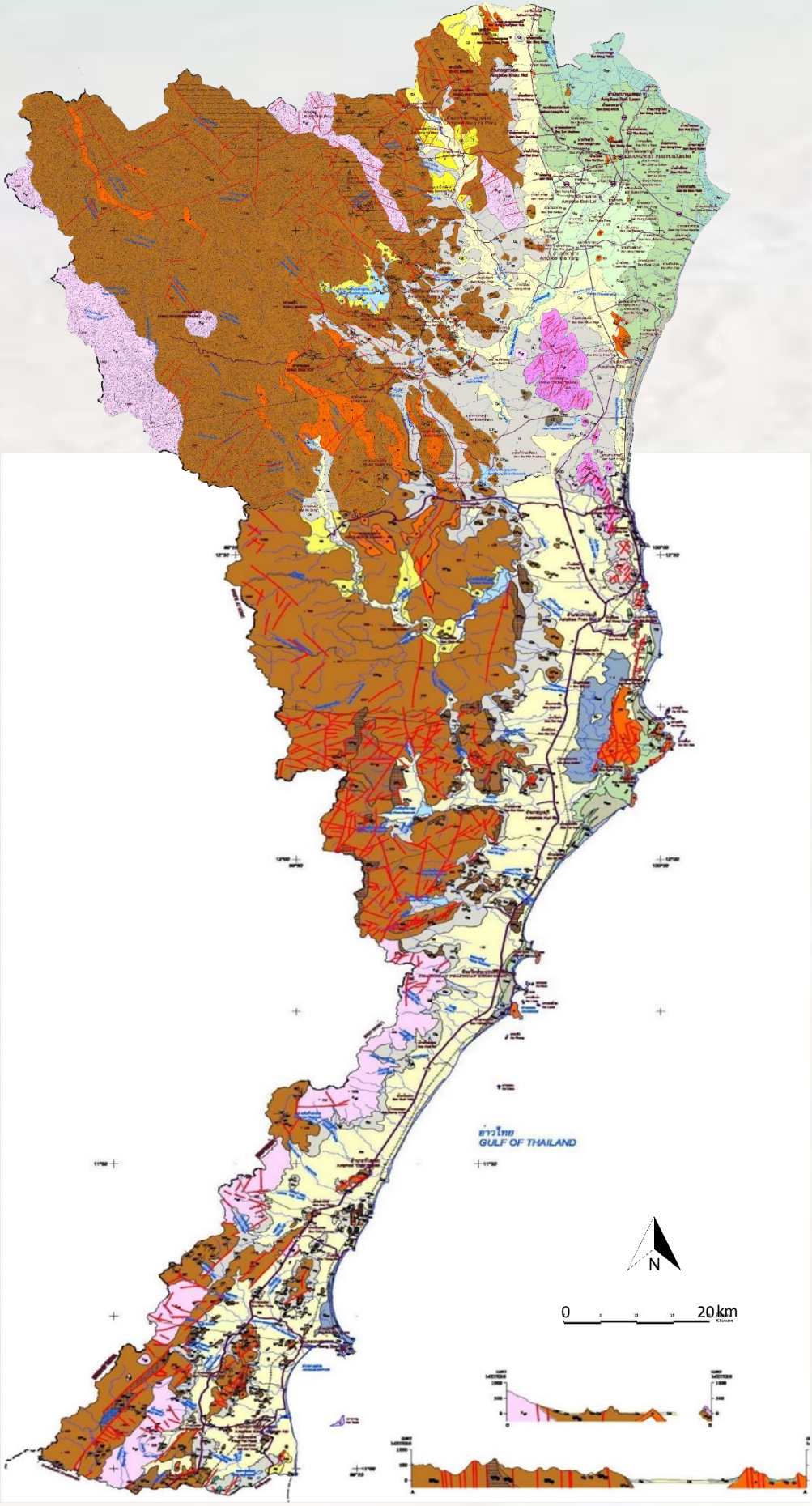
Tertiary rocks in this region consisting of conglomerate, gray and red sandstone, sandy shale, claystone, limestone and lignite.

Quaternary sediments were originated by stream and longshore current can be divided as follow. Stream terrace sediments consist of gravel, sand, soil, lateritic soil, and tufa. Terrace deposit occurs at foot of the mountain and low hills. Alluvial sediments were transported by river stream. They cover low land from sea shore up to foot of terrace. The sediments are comprised of gravel, sand, clay and mud. Beach sediments were deposited along sea shore, consisting of sand, quartz sand, shell fragments and coral and muddy sediment in mangrove forest is gray consisting of mud and silt.

Igneous rocks in this area is Carboniferous granite with coarse grain feldspar crystal found in the southeastern part of Phetchaburi province. Cretaceous igneous rock consist of medium-coarse grain granite and aplite granite separate in western part near Thailand-Myanmar border and northern part of this province.

(ธรณีวิทยาจังหวัดเพชรบุรีและแหล่งเรียนรู้ธรณีวิทยา [Geology of Phetchaburi Province and Geological sites], DMR, 2013)

GEOLOGICAL MAP OF PHETCHABURI & PRACHUAP KHIRI KHAN PROVINCE



EXPLANATION: GEOLOGICAL MAP OF PHETCHABURI PROVINCE & PRACHUAP KHIRI KHAN PROVINCE

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
Qlg	ตะกอนลากูน : ดินโคลนและดินเหนียวมีทรายเป็นเลนซ์ สีเทาถึงสีขาว การคัดขนาดปานกลาง เม็ดกึ่งมน พบซากพืชในส่วนบน Lagoonal deposits : mud and clay with sand lens, gray to white, medium sorted, subround abundant plant remain in upper part.			
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 with shell fragments.			
Qtm	ตะกอนที่ลุ่มราบน้ำขึ้นถึง มีป่าชายเลนปกคลุม : พีต ดินเหนียวปนพีต ทรายเม็ดละเอียด ดินเหนียวเนื้อปนทรายแป้ง Tidal flat deposits vegetated with mangrove : peat, peaty clay, fine sand and sandy clay.			
Qff	ตะกอนที่ราบลุ่มแม่น้ำ : กรวด ทราย ทรายแป้ง และดินเหนียว Fluviatile deposits : gravel, sand, silt and clay.			
Qa	ตะกอนน้ำพา : กรวด ทราย ทรายแป้ง และดินเหนียว Alluvial deposits : gravel, sand, silt and clay.			
Qbo	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.			
T	หินทราย สีเทาถึงสีเทาแกมน้ำตาล สลับด้วยหินทรายแป้ง หินโคลน หินเคลย์ และชั้นถ่าน พบซากดึกดำบรรพ์จำพวกใบไม้ และกระดูกปลา Sandstone, gray to brownish gray, interbedded with siltstone, muddstone, claystone, and coal beds, with plant leaves and fish bone.		เทอร์เชียรี TERTIARY	1.6-66.4
P	หินปูน สีเทาถึงสีเทาเข้ม เป็นชั้นถึงไม่แสดงชั้น มีหินเชิร์ตเป็นกระเปาะ หินปูนเนื้อโดโลไมต์ พบซากดึกดำบรรพ์ จำพวก ฟิวซูลินิด แบรคิโอพอด ปะการัง แอมโมนอยด์ และไครนอยด์ พบหินทรายและหินดินดานบ้าง Limestone, gray, bedded to massive, with chert or siliceous nodules; dolomitic limestone, with fossils of fusulinid, brachiopods, 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 เม็ดแร่เหลี่ยมถึงมน หินดินดาน สีเทาแกมเขียวถึงสีเทาปานกลาง แตกเป็นแผ่นเรียบ และแถบชั้นบาง หินทรายอาร์โคส สีขาว ถึงสีน้ำตาลแกมเหลืองอ่อน เนื้อละเอียดมากถึงปานกลาง การคัดขนาดปานกลางถึงดี เม็ดแร่ค่อนข้างเหลี่ยมถึงมน 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 หินฮอร์นเฟลส์ และหินชนวน พบบริเวณสัมผัสกับหินอัคนี Quartzite, hornfels and slate near the contact aureole.			
SD	หินทรายเนื้อควอตซ์ หินทรายเนื้อหิน สีน้ำตาล เทา และน้ำตาลแกมแดง เนื้อละเอียดถึงหยาบ เม็ดกึ่งกลม การคัดขนาดดี สลับด้วย หินดินดาน และหินทรายแป้ง บางแห่งถูกแปรสภาพเป็นหินควอร์ตไซต์ หินฟิลไลต์และหินชนวน ชั้นหินเชิร์ต พบซากดึกดำบรรพ์จำพวกเทนตะคิวไลต์ Quartzitic sandstone, lithic sandstone, brown, gray, and 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
	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
Cgr	หินแกรนิตที่มีการเรียงตัวของเม็ดแร่ เนื้อปานกลางถึงหยาบ เป็นการเรียงตัวค่อนข้างดีของผลึกแร่เฟลด์สปาร์ขนาดใหญ่ Foliated granite, medium- to coarse-grained, with fairly well oriented porphyroblastic feldspar	คาร์บอนิเฟอรัส CARBONIFEROUS		286-360

STOP 1 Old quartz quarry (1390533 N, 600764 E)

Occurrence: Quartz vein size approximately 5 m cut into Precambrian Gneiss known as Hua Hin Gneiss. Hua Hin gneiss also known as Pranburi-Hua Hin Complex (Pongsapich *et al*., 1980). Exposures of the Hua Hin gneiss are found in a NS trending elongate belt of *ca*. 50 km long in Amphoe Pranburi and Hua Hin. Lithologically, the complex are mainly gneisses, schists, calc-silicate rocks, quartzites, and marble. They are uncomfortably overlain by Carboniferous –Permian Kaeng Krachan Group and Permian Ratburi Group.

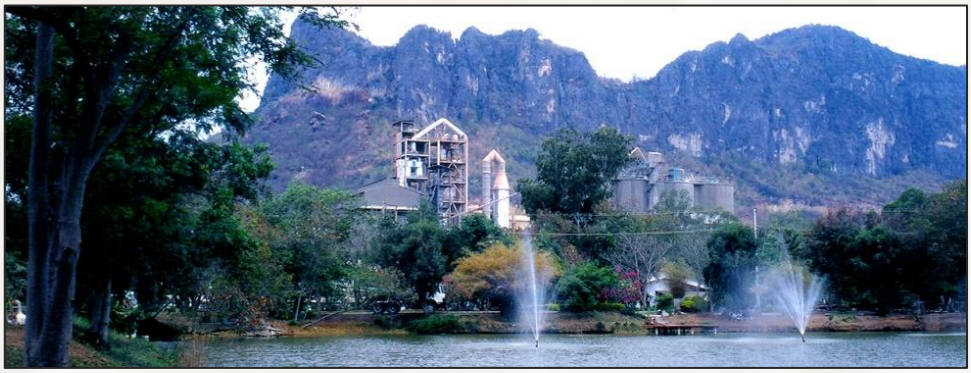
Usage: Quartz is an important mineral with numerous uses. Sand, which is composed of tiny Quartz pebbles, is the primary ingredient for the manufacture of **glass**. Transparent Rock Crystal has many **electronic uses**; it is used as oscillators in radios, watches, and pressure gauges, and in the study of optics. Quartz is also used as an **abrasive** for sandblasting, grinding glass, and cutting soft stones. It is also essential in the computer industry, as the important **silicon semiconductors** are made from Quartz.
In addition to all the practical uses, Quartz is essential to the gem trade. Many varieties are faceted as **gems**. Amethyst and Citrine are the most well-known gem varieties. Rose Quartz, Smoky Quartz, Rock Crystal, and Aventurine are also cut or polished into gems. Small colorless Quartz crystals are worn by some as pendants for good luck.
(https://www.minerals.net/mineral/quartz.aspx)

Distribution of the Quartz vein (NE-SW directions) in stop 1

STOP 2 Jalaprathan Cement Plc (Cha-am Plant)

(1416943 N, 603239 E)

Cha-am Plant officially started operation in 1971. The plant is located in Cha-am District, Petchburi Province. The limestone quarry is situated 0.5 km from Cha-am Plant. The plant has one rotary kiln. The production system of both Takli and Cha-am Plants was begun from a wet process and then developed to a semi-dry process. Currently, both plants are operated by a dry process using coal / lignite as a major fuel to replace bunker oil for less production cost and better product quality. In early 2006, Takli Plant installed the first rice husk feeding system that enabled the replacement of coal and lignite at a rate of around 5%, as heat substitution. (https://www.asiacement.co.th/en/jalaprathan-cement-plc)



Geology: Limestone terrains in Petchaburi area are map to be the Ratburi Group. The sequence, more than 500 m thick, was then divided into 3 units in ascending order:

1. The lower part, 80 m thick, comprises light gray to gray, medium to thick bedded limestone with abundant crinoid stems.
2. The middle part, 200 m thick, is consisting of thin to medium bedded (normally less than 20 cm thick), dark gray limestone interbedded with shale, mudstone and some chert nodules.
3. The upper part, 200-300 m and is composed of light gray, dense fine grained, thick to very thick or massive bedded limestone. Chert lenses are interbedded in the lower part of the limestone. Domolite is locally observed within the sequence.

In the Cha-am area, Phetchaburi Province, limestone samples were collected from two hills, Khao Nang Phanthurat and Khao Tachin. Khao Nang Phanthurat is a long hill built up by a grey thickly bedded limestone without chert nodules. Fossils are scattered and display corals consisting of fasciculate Tabulata, a few solitary Rugosa and more common massive Rugosa. At the first locality, a massive Rugosa reaches up to 20 cm in diameter. In transverse section, corallites are prismatic and 8–12 mm in diameter. At the second locality), a fasciculate Tabulata was discovered in which attains almost 30 cm in diameter and is 10 cm high. It was associated with small fragments of other fossils: a few algae, rare smaller foraminifers and a fusuline. This coral belongs to Sinopora asiatica Mansuy, 1913 which has already been found at several Middle Permian localities of Peninsular Thailand. (Fontain H. et al, 2012)

STOP 3 Cha-am Jetty (1416904 N, 608085 E)

History: Cha-am jetty was built by Jalaprathan Cement Plc around 1983 (B.E.2526) to use as a cement transport route.

Jetty is one of the coastal structure at the river mouth for preventing siltation at the river mouth and accommodate transportation within the channel for the cement cargo and near shore fishing.

Since it was constructed perpendicular to the coast line, this structure is obstructed the long shore current which transport coastal sediments northward. The coast has been changed since the appearance of the jetty. The beach was deposited on the left side of the picture while the beach was eroded on the other side. Hence the government need to protect the beach by other coastal structures. In the case, several offshore breakwater were constructed with consequence of erosion occur continuously.

STOP 4 Shoreline structure and rock garden (near Sirindhorn International Environmental Park)

(1404729 N, 604695 E)

History: Engineering structure along the beach in this area was built to protect shoreline from erosion. In addition, the rock garden landscaped by DMR for educate people.

The Studied of Sinsakul S. et al., 2002 showed that the coastal change of Petchaburi province throughout 75 km are as severe erosion (over 5 m/year) for 6.5 km and moderate erosion (1-5 m/year) for 29 km or 46.5 % of the total coast line. The erosion has been contributed to the development of the oldest sea resort of the country.

Ban Bangsai Yoi-Ban Bo Sia area is the southern part of Cha-Am coast line where the summer palace of the former king Rama the 6 was located. With the total 8 km distance, the beach was eroded due to the development of the area as the hotels, police base, the palace, and the fisherman villages. By comparing the topography map scale 1:50,000 with the current coast survey (1998). The beach was eroded about 100 m inland. The erosion can be severed during monsoon season especially during tropical storm and typhoon. Evidence of Guy Typhoon (1989) and Linda Typhoon (1998), the beach was eroded 10 m compare to the average rate of 3 m/year.

Currently, two headlands were constructed between the palaces with several groins in between. These coastal structures can stabilized the beach front of the palace area but generated the erosion in nearby areas. Therefore, groin and offshore breakwater were constructed but the problem still exist.

STOP 5 The Sirindhorn International Environmental Park

(1404531 N, 603966 E)

In 1994 that HRH Princess Maha Chakri Sirindhorn, the Crown Princess graciously mentioned an initiative to Dr.Sumet Tantivejkul, secretary-general of the Office of the Royal Development Projects Board at the time, at Mrigadayavan Palace to secure suitable land for mangrove planting and rehabilitation. On 17th August 1994, the princess planted several types of mangrove trees.

Until 2000, the Border Patrol Police Bureau (BPPB), Huai Sai Royal Department Study Centre, and the Foundation for Mrigadayavan Palace under the patronage of HRH Princess Bejaratana Rajasuda Sirisobhabannavadi jointly established an international environmental park at Rama VI camp in Amphoe Cha-am, Phetchaburi, for presentation to HRH Princess Maha Chakri Sirindhorn in 2003, to be named 'The Sirindhorn International Environmental Park (SIEP)' to celebrate on the occasion of Her Royal Highness Princess Maha Chakri Sirindhorn's Forty-eighth Birthday Anniversary. Its operation was designed to follow the initiatives and work during her work-stay at the camp in the hope that it will become a living natural museum which represent HRH the Princess's honourable deeds and ingenuity in conservation of nature, environment, history, and culture, to both Thais and foreigners. Its mission also to be a study centre for the recovery of mangrove, beach and mixed deciduous forests, and habitat of fauna. In addition, the park will help promote ecotourism, and historical tourism for Thailand and the world.

On 19th July 2008, Her Royal Highness Princess Maha Chakri Sirindhorn graciously granted a royal audience to officially open the Sirindhorn International Environment Park. The board, the staffs and every related sections were very delighted to be a part of this ceremony. (http://www.sirindhornpark.or.th/2019/about.php?id=292&lang=EN)

STOP 6 Khao Tao (1377149 N, 606393 E)

Khao Tao Reservoir is a royal project of H.M. King Bhumibol Adulyadej The Great that was built in 1963 (B.E.2506) as soil dam to prevent water flow from mainland to the sea. Local people use water from this reservoir for agriculture and Public utility in dry season.

Khao Tao gneiss/granitic gneiss/stress granite are in inferred Precambrian age, strong deformation with quartz vein.

Lin Y-L. et al.,2013 studied the Cambrian basement in Hua Hin, Peninsular Thailand. The rock sample is composed of feldspars, biotite, chlorite, quartz with minor hornblende. It was collected from Khao Tao formation which is situated at the southern section of the Sibumasu terrane within the Hua Hin area, 200 km south of Bangkok. This region is mostly composed of metamorphic crystalline rocks of the Hua Hin Group, with Quaternary sedimentary cover. The Hua Hin Group can be further divided into the metasedimentary Pranburi and orthogneissic Khao Tao formations that underwent an amphibolite facies metamorphism (Sinclair, 1997). The Khao Tao formation was previously interpreted as an I-type granite (Sinclair, 1997) that was crystallized at 210 ± 4 Ma during the Sibumasu–Indochina collision (Putthapiban and Suensilpong, 1978). Cobbing et al. (1992) interpreted the Khao Tao formation to have formed within an island arc-related setting which experienced subsequent deformation and metamorphism during the Early Paleogene collision of India and Eurasia. This is supported by a biotite K/Ar age of 63 ± 4 Ma (Beckinsale et al., 1979).

The protolith of Khao Tao orthogneiss was previously inferred as an extensional granitic plutonium formed during the Triassic subduction of Sibumasu beneath the Indochina terranes (Pongsapich et al., 1980). This interpretation is further modified by the new geochronology and geochemistry data reported herein. The U/Pb zircon age of 501.5 Ma from this study suggests that the Khao Tao gneiss could represent the Cambrian basement of Sibumasu terrane. The Lansang gneiss further NW of Khao Tao showed a considerable amount of inherited zircons with a minimum U/Pb age of 1530 Ma (Ahrendt et al., 1993), which is similar to the Hf model age (1244 Ma to 1827 Ma) of Khao Tao gneiss.

(Picture from ธรณีวิทยาจังหวัดประจวบคีรีขันธ์และแหล่งเรียนรู้ธรณีวิทยา [Geology of Prachuap Khiri Khan Province and Geological sites], DMR, 2015)

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