Interaction between Humans and Environment in Trang An, Ninh Binh from 30.000 Years to Date

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Abstract: Trang An (Tràng An) Landscape Complex, Ninh Binh, has been inscribed on to the List of World Heritages by UNESCO as a World Cultural and Natural Heritage, the first "double" property of Vietnam. The archaeological records found here has indicated that Trang An is an intact annal, which is outstanding with the environmental changes and human responses over the past 30,000 years. The human adaptation is best manifest in settlement, subsistence, behaviour and manufacture of labouring tools, the emergence of pottery; contributing to a view on a past structural transformation, a local landscape change and a faunal - floral variation over the time. The cultural diversity and the traditional customs of Trang An ancient residents in cave occupation, land use and sea use adaptive to the marine transgression and regression completely deserve an outstanding univeral example on the Culture and Nature of humankind. The marine region of Vietnam is currently under the influence of a rising sea level. A lesson of the response to the marine and island environment of Trang An prehistoric people must have been valuable to us today.

Key words: Humans; environment; World heritage; Trang An; prehistory.

1. Trang An Landscape Complex, Ninh Binh

Trang An Landscape Complex, Ninh Binh has been recognized as a World Cultural and Natural Heritage by UNESCO. This is the first "double" heritage site of Vietnam. Visiting Trang An, tourists contemplate not only the gigantic tower karst landscape in the final stages of karst evolution, but also cone karst, tower karst, depressions, poljes, swamp notches, submerged caves, subterranean rivers and caves with diverse speleothems in the landscape complex.

Nowhere in the world witnesses the transitional cone karst landscape as in Trang An, where they are linked with one another by sharp ridges and tower karsts scattered on the yellow summer rice fields of Gia Vien (Gia Viễn) - Nho Quan dolines, they go up and down similar to hundreds of towers broken then "reconnected".

A story on the karst evolution has been retold together with evidences of multiple oscilating sea levels during Pleistocene and Holocene. Here, the sea notches at various elevations are viewed as universal evidences, demonstrating the changing sea levels and subterranean water levels that are related to the final karst system of humankind dated back to the late Trias, 240 million years ago.

Coming to the Trang An Cultural and Natural heritage site, tourists also see the landform development over a long period of 240 million years with the blend of steep-cliff towering mountains and myriad

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of caverns, subterranean rivers running through valleys. Today, rowing boats through the cave passages under the high mountains brings a feeling of wildness, but tranquility, intimateness and safety.

2. Values of special quality

The geological and topographical values of Trang An are not separated from the archaeological records. Up to the present, approximately 30 prehistoric caves have been identified in Trang An.

These sites are the objective proofs on the history of human colonization and adaptation to the severe environmental changes due to the marine transgression and regression.

The excavation undertaken at Ong Hay (Ông Hay) Rockshelter revealed that the first people arrived in Trang An roughly 30,000 years ago. Its stratigraphy is 1.8 m in depth, a ^{14}C determination of a sample taken at 1 m deep gives a date of 27,750 ± 100 BP (at 68,2%), calibrated 29,491 BC [3, pp. 70 - 78].

No molluscan shells was observed in the cultural deposit dated 30,000 years ago. That is, either no freshwater mollusc species such as snails, mussels, unionid mussels appeared in Trang An, or they were not targeted by the local residents despite having come into being. Some faunal remains of stags, deers, pigs, cats, monkeys and so on, which were hunted by ancient people, have been documented.

After 30,000 BP, Trang An inhabitants extended their living space to the core zone of the limestone massif. The excavations conducted at the sites in the core zone showed that caves here are very old and elevated. For instance, Trong cave is 142 m high, with a ^{14}C determination of 24,438 BP; Boi (Bói) Cave 76 m high, aged 12,500 BP. The other remains recovered in these caves pointed out that past residents had seasonally occupied them, mainly in rainy season. In rainy season, the mountainous snails (Cyclophorus sp.) were most prosperous. Past people gathered them for food and left the shells in caves. Various molluscan shells and other cultural remains piled up into thick deposits that are called the cultural deposit by archaeologists. The cultural deposit of Trong cave is 3 m thick and dense with most mountainous snails (Cycloporus sp.), a few stream snails (Antimelania), nippers of crabs, pangolins (Manis sp.) and monkeys (Macaca sp.), and scarely big animals. The cultural deposit of Boi Cave is more than 2 m thick, composed of 98% terrestrial molluscan shells, most of which are the mountainous snails (Cycoloporus theodori and Cycoloporus unicus) and some freshwater species like stream snails, mussels and clams. Several animals including leopards (Panthera cf. pardus) were hunted. Leopards often live in a cold habitat, suggesting that the fauna of Trang An at that time was abundant and attractive to human occupation [18, pp. 135 - 169].

A question posed is that when did the ancient people of Trang An contact the sea and how did they adapt themselves to the marine habitat? As far as we have known, the earth has undergone at least 20 cycles of glaciation and interglaciation and corresponding periods of marine regressions (due to the glacial impact) and transgressions (due to the melting ice), let alone the minor fluctuations between periods or the neo-tectonic movements that elevated or lowered the landscape in different places, resulting in the varying fluctuation amplitudes of sea level in differential regions. What we are interested in is the changing sea level in the Quaternary period, at time humans played the most important

part on the earth. According to G.Kulla, sea level receded to -140 m from 150,000 BP to 20,000 BP [13, pp.207 - 232].

Recent studies also confirm that sea level in Southeast Asia receded to -130 m - - 120 m, connecting most of the islands to the mainland via the floating bridges, on which humans and animals could have migrated over the large area [15, pp.69 - 78], [16, pp.99 - 101], [17, pp.441- 443].

Approximately 18,000 BP, there was an universal marine transgression named Flandrian, sea level began rising and at 7,000 BP almost reached a height as it is seen today. R.Faibridge said that sea level was as high as today from 5,000 BP to 3,000 BP, then went up or down between 2 m and 4 m high [19, pp.99 - 185]. H.Fontaine also noted that the marine transgression Flandrian influenced the shore line of Viet Nam. He argued that sea level reached highest at about 4,500 BP that is appearent in the archaeological sites of Da But (Đa Bút) (Thanh Hoa) and Giap Khau (Giáp Khẩu) (Quang Ninh). Some rising sea levels have been recorded, whose vestiges are still observed in Cho Ghanh (Chợ Gành), Ninh Binh at 4,000 BP and Long An at 2,500 BP for example [14, pp.35 - 42].

Newly researched results on Tam Coc (Tam Cốc) - Bich Dong (Bích Động) (Ninh Binh) region by Boyd and Doan Dinh Lam indicated that sea level rose from 5.4 m to 4.0 m in the period of 5,500 BP to 2,660 BP compared to the National standard level [5, pp. 86 - 91].

The sites where prehistoric people occupied in Trang An are currently located more than 30 km away from the sea in straight-line distance. The valley surfaces in front of these caves are 1 - 2 m higher than sea level. In the period of 30,000 BP - 10,000 BP, Trang An people lived in the mainland environment, however they still went out of their living space, contacted and exchanged with other residential groups for high - quality rocks used to manufacture stone tools, which were not available in local area. For instance, Trong (Trống) Cave site (dated to 24,438 BP) yielded more than 80% tools made on limestone and only several cases made on andezite. Similarly, Boi Cave site (dated at 12,900 BP) presented most tools made on limestone, only some items made on quartzite. The types of andezite and quartzite pebbles are absent in Trang An, but often encountered at mountainous sites of Thanh Hoa and Hoa Binh. Perhaps, these places are where Trang An prehistoric people exchanged for rocks.

What products did Trang An people use to exchange for stone materials? It is possible that they contacted the sea from an early time or played as an intermediary role in trading the sea or forest products at that time. Trang An residents approached the sea at the early time, knowing how to use sea - molluscan shells to make ornaments. These ornaments present their development over time.

The cultural layers dated younger than 10,620±100 BP of Boi Cave and Trong cave indicated that past people had used ornaments made on sea snail shells *Netrita undata* or sea-fish osteomeres. The sea snail shells *Netrita undata* are small in size, but thick, fine-grained and white, whose bottoms were pierced and threaded to make ornaments as a string of beads.

After 10,000 BP, Trang An people prefered the ornaments made on sea snail shells *Cypraea* (popularly called cowries). This species has a leaf - shaped mouth with two lines of regular serrated grooves. Past

people ground their back until being perforated and flat, sometimes they pigmented the items in red to create beads.

After 10,000 BP, a number of residential groups of Hoabinhian and post - Hoabinhian living in far inland owned the sea gifts such as the sea shells. For example, in a Hoabinhian burial of Anh Ro (Anh Rồ) Cave (Thanh Hoa), 11 cowries (*Cypraea* sp.) distributed around a deceased's neck were recovered; or in Phia Vai (Phia Vài) Cave, Tuyen Quang Province, 2 cowries (*Cypraea* sp.) were found to be laid in two orbits of a mature women's skull. Nguyen Lan Cuong (Nguyễn Lân Cường) argued that this skull was dated back to the Hoabinhian, approximately 10,000 BP [2, pp. 3 - 11].

It can be said that in Vietnam's prehistory, the Trang An ancient residents were those who approached the sea early, if not the earliest. In the marine region of Quang Ninh - Hai Phong at present, some early - dated cave sites include Soi Nhu (Soi Nhụ) Cave (14,125 ± 180 BP; 15,560 ± 180 BP; 12,460 ± 60 BP and 14,300 ± 400 BP), Ong Bay (Ông Bảy) Rockshelter in Cat Ba island (16,630 ± 120 BP), Ang Ma cave in Cat Ba island (25,510 ± 220 BP). The cultural remains unearthed from these caves were composed of the terrestrial snail shells, no sea-shell ornaments to be found. Therefore, albeit in the close vicinity of the sea, the Northeastern marine residents lived in the mainland habitat and not as yet exploited the sea products at 10,000 years ago [9].

3. Human adaptation to the environments under the marine transgression and regression

Based on the studies of the sea notches on limestone cliffs in Trang An, geologists argued that the late Pleistocene marine transgression named Vinh Phuc (40,000 BP - 10,000 BP) flooded the karst of Trang An (except the closed karst valleys). These sea notches on limestone were found at an elevation of 10 - 15 m. Nonetheless, almost all these notches have been erased and become very scarce. The impact of the marine transgression after 18,000 BP on Trang An is apparent. The ^{14}C determinations on the molluscan shell samples taken from the notches at an elevation of 1.4 - 8 m give dates ranging from 6,500 BP to 4,350 BP. At that time, the sea water could not enter the closed valleys whose heights are more than 10 m in Trang An. Consequently, on the current landform surface of Trang An, those terrains that are lower than 10 m were affected by the sea erosion, occurring in the period of the early - middle Holocene at 10,000 BP - 6,000 BP [1, pp.11 - 19].

The sea molluscan shells and fish bones piled up into the thick cultural deposits in Moi Cave and some other caves in Trang An revealed how past people exploited the sea.

At Moi (Mòi) Cave site, the evidences obtained from layer 7 (dated at 9,215 ± 30 BP) to layer 4 (dated at 4,975±25 BP) indicated a period that the sea invaded the centre of Trang An and past people exploited the sea products here. At that time, people in Moi cave began to collect various species of the sea mollusc. The quantity of sea fish bones gradually increases, while there is almost no sign of monkey bones from layer 7. In layers 6 and 5 (aged 8,275 ± 30 BP), the number of the brackish water shells like mud clams and oysters sharply increases, coinciding with the highest marine transgression in the mid - Holocene. In Moi Cave's cultural deposit, the species living in the brackish water such as mud clams (Geloina coaxans) and

estuarine oysters (Crassostrea rirularis) occurs from layer 7, but in a low quantity. From layer 6A, they become common. The sea snails Nerita undata are found only from the layer 5A, whereas the freshwater snails like Antimelania, Costula và Melanoides Tubeculatus are seen from layers 10 to 8. The nippers of crabs are abundant in layers 7 to 9, and less from layer 6 upward. The number of various mammals that can be identified accounts for around 15% of all. Of which, the monkey remains (Macaca) are the most prevalent, followed by the predator ones. The former is only observed in layers 7 to 10, the terrestrial turtles found in layers 8 and 7, while fishes found much from layer 7 upward. The variation in the faunal component over time involves in the changing environment due to the marine transgression and the paleo - climate changes. In the sea habitat, gathering the sea products is related to the occurrence of pottery. Pottery occurs from layer 6A (aged 8,275±30 BP) in Moi Cave. These early-dated sherds looked like those of Da But culture, whereas those similar to the Man Bac site were documented in the layer dated at 4,500 BP [7, pp.62 - 69].

After 10,000 BP, Trang An became a limestone island, whose border with the mainland was marked by a range of high hills running in Northwest - Southeast direction from Nho Quan town via Ria (Rìa) to Tam Diep (Ninh Binh). In the period of the sea invasion, residents in the margin of the property like Thung Binh sites 1, 3 and 4, Oc (Ốc) Rockshelter and Vang (Vàng) Rockshelter approached and exploited the sea more effectively than those living in the closed core zone, that's why the shell middens came into being. The shell middens are composed of various marine molluscan species such as snail *undata sp.*, arcas, oysters, mud clams, estuarine barnacles and shipworms, 1.2 - 1.5 m in an average thickness. The shell middens were dated to 9,365 ± 30 BP at Oc Rockshelter, 8,720 ± 235 BP at Vang Rockshelter and more than 9,800 BP in the upper layers of Thung Binh 1 site [10, pp.79 - 92].

During the occupation and exploitation of the sea, local inhabitants used a collection of labouring tools made on limestone, producing the edge - ground axes, cutting knives and the labouring tools made on big oyster shells. This is a human adaptation to the sea habitat of Trang An as a cultural behaviour demonstrated through the tool collection. The ground axes were often used to chop the trees, clear the forest for cultivation or make rafts for coastal transportation. In order to exploit the sea, past people knew how to employ the stone and earthen sinkers for fishing, to spin the fibres into fishing lines and fishing nets and perhaps to cook fish salted in the simple pottery pots.

Like the occupants of Moi Cave, those who inhabited in the margin of the Trang An karst core zone invented earthenware. The pottery is similar to the Da But (Đa Bút) ones with coarse materials, thick wall impressed by unspun cord. The sherds found in Vang Rockshelter were aged at 8,720±235 BP and Oc Rockshelter at about 8,700 BP. Compared to those recovered in Da But site, these sherds are significantly earlier and the earliest ever known in Vietnam and Southeast Asia. The important thing is that pottery occuring early in Trang An is not associated with agricultural settled life, but the exploitation and processing of sea foods.

The period of the marine transgression (18,000 - 7,000 BP) was of an elevated

rainfall. Studies of the magnetic susceptibility in such caves as Moi Cave, Thung Binh (Thung Bình) Cave (Trang An), Con Moong Cave (Thanh Hoa) and Cho (Chổ) Cave (Hoa Binh) showed that from 8,800 BP - 11,400 BP, the rate of sedimentation in these caves was many times more than the previous and subsequent periods. It means that the precipitation of this period was higher than those of previous and subsequent time [8, pp.73 - 76], [12, pp. 62 - 72], [4, pp. 65 - 68], [6, pp. 117 - 120]. Heavy rain and wet cave floor made the ancient people of Moi Cave (in layer 7) to build the bamboo and wooden floors, the post - holes of which are still visible. In there, past people used limestone rocks with large planes as places of rest. Vang Rockshelter also displays such phenomena.

At time the sea level rose at a maximum approximately 6 m at 5,500 BP, Trang An became an independent island. The land area for human subsistence was considerably narrowed. Past people moved to live in higher caves or higher places in the same caves. Along with the sea invasion and shrunk land, various insects, snakes and centipedes also intruded the cave. Apart from building the bamboo and wood floors for a sleep or taking an advantage of big rocks for a rest, ancient people lighted a fire to keep warm and drive the poisonous insects away. The archaeologists have documented a number of hearths in this time. The use marks by past people are still left on the surface of some big rocks. In some cases, the circular depressions were created on the elevated limestone surface, or the bird was carved on the cliff in Vang rockshelter. Maybe these are as some kinds of beliefs. In some caves, the deceased was burried on - site.

At Oc Rockshelter, small cutting marks were found on human bones that were laid in different places, reminding a special way of burial by ancient residents in Mang Chieng (Mang Chiêng) Cave (Thanh Hoa) [11, pp.1 - 31].

After 7,000 BP, the occurrence of a reduced rainfall and a rising sea level invading far mainland caused an environmental change. According to geologists, from 6,000 BP to 4,000 BP, the Holocene marine transgression reached at a maximum from 4 m to 6 m above the present landform. At that time, the invading sea created the coastal shallow gulfs, swamps and lakes near the sea, in which there was an abundance of aquatic products. The climate was rather fine. There was a development of the humid tropical ecosystem of the monsoon climate; the widespread green tropical forests resulted in a rich diversity of the animal world. At the half later of this period, the sea began receding, step - by - step exposing the seabed and the coastal plains at an elevation of 4 - 6 m that are fertile today in Vietnam.

After 7,000 BP, there was a low precipitation and warm climate. Cave residents moved out and occupied the coastal plains and islands as well as specialized in sea exploitation: the Cai Beo (Cái Bèo) resident (7,000 - 4,000 BP) in the Coastal Northeastern Vietnam went for sea fishing; the Da But people (7,000 - 4,500 BP) in Thanh Hoa progressed from gathering the mussels in the estuary to fishing and collecting the molluscs on sea; the Quynh Van (Quỳnh Văn) people (6,000 - 3,500 BP) in Nghe An gathered the arcas and scallops in the coast. The above are as the beginners of the prehistoric maritime culture of Vietnam.

After 5,000 BP, in the sea and island areas of Vietnam, the archaeological

cultures flourishes, typically the Ha Long (Hạ Long) Culture (4,000 - 3,000 BP), the Hoa Loc (Hóa Lộc) Culture (Thanh Hoa), a group of Thach Lac (Thạch Lạc) sites (Ha Tinh), the Bau Tro (Bàu Trò) Culture (Quang Binh) and the Xom Con (Xóm Cồn) Culture (Khanh Hoa).

After 4,000 BP, this was fundamentally a period of a receding sea in spite of the occurrence of the rising sea at a small scale several times. Since then, Trang An occupants began to gradually move to the marginal area for their livelihood toward a sedentary agriculture. The archaeological records of the Bronze Age (4,000 - 2,500 BP) in Trang An demonstrated this tendency of residential movements. Some of the residential groups moved along the ancient shore line in Western Trang An and continued to use the low caves such as Dong Thanh (Đông Thanh) Cave, Tho (Thờ) Cave, Nui Tuong (Núi Tướng) Cave (Son Ha (Sơn Hà) Commune, Nho Quan). Some other groups occupied the low caves as temporary shelters in Southern Trang An like Cho (Chợ) Rockshelter, Dun Moi (Đụn Mối) Cave, Rang (Rặng) Rockshelter, Cong Binh (Công Binh) Cave, and Thien Huong (Thiên Hương) Cave. Some others moved up to the North, living in Ang Noi (Áng Nội) Cave, Ong Mi (Ông Mi) Rockshelter (Ninh Hoa (Ninh Hòa) Commune, Hoa Lu), Trau (Trâu) Cave, Chua (Chùa) Cave (Gia Sinh Commune, Gia Vien (Gia Viễn)), Nui Xua (Núi Xưa) and Doi Dong (Đồi Đống) (Son Lai (Sơn Lai) Commune, Nho Quan). Most notable is the groups who left caves and resided in the open air on the sand dunes, the edge of the mountains or high mounds in the southwest such as Oc (Ốc) Mountain, Op (Ốp) Mountain, Ong Can (Ông Cẩn) Hill (Yen Son (Yên Sơn) Commune, Tam Diep), and An Nau (An Nậu) Ground (Ninh Khanh (Ninh Khánh) Commune, Hoa Lu (Hoa Lư)). These groups also extended to the east or the sea, occupying the high mounds in the foots of Seu (Sệu) Mountain, Lien Son (Liên Sơn) Mountain and Phuong (Phượng) mountain (Ninh Binh city today). They invented the wholly - ground shouldered axes and quadrangular axes, fine cord and incised marking pottery, as well as collected products and molluscs from freshwater, mountain or brackish water in the inundated valleys. Farming was born in some places.

In general, residents in this stage showed a highest development in manufacturing stone axes and pottery, getting on well with the Dong Son residential group in the surroundings, demonstrated through their relationship with the contemporaries living in Nui Mot (Núi Một) Cave, Nui Hai (Núi Hai) and Cho Ganh (Chợ Gành) Cave (Bac Son (Bắc Sơn) Ward, Tam Diep).

The Pre - Dong Son people in the mid - land of the North gradually moved down to the high then low plains of the Red river delta, setting up villages at an increasing scale, extending to the sea, doing the rice cultivation, employing the plough and traction for the agricultural tillage, doing the metallurgic activities, casting the bronze and inventing a type of the traditional boat-shaped grave in the burial service of the ancient Vietnamese.

The ancient Vietnamese were found early not only in the Red river delta, but also in the Northeastern sea and islands. In there, they made themselves as a maritime group of Pre - Dong Son sites typified by the Trang Kenh - Dau Ram one. On that basis, the Dong Son culture was formed with the introduction of bronze axes with symmetrical edge, bronze spears, bronze javelins, bronze arrows, bronze points, chisels and fish hooks, which characterizes the bronze wares of the Dong Son Culture;

pottery impressed with cord and honeycomb patterns represent the early phase of the Dong Son culture.

In 968, Dinh Bo Linh (Đinh Bộ Lĩnh) came to the throne, named Dinh Tien Hoang (Đinh Tiên Hoàng), giving a name to the country Dai Co Viet (Đại Cồ Việt), choosing Hoa Lu as the first capital city. Here, he consolidated the foundation of the swamp, which was inherently the ancient sea terrace in an attempt to build the splendid palaces. During the excavations of the Hoa Lu capital city, the archaeologists have discovered the way that the foundation was strengthened. Sedges, reeds, bamboos and wood were used in the foundation for anti - subsidence, earth was also used to exalt the structures, houses and palaces. To avoid flooding, local people dug the trench to clear the water way and covered the wall sections with soil, linking various limestone cliffs to create the semi - natural citadels.

Since the 10th century, the Dai Viet (Đại Việt) residents in Trang An continued to exploit the resources from forest and limestone valleys. To go deeply into the centre, local people built a famous system of canals like Sao Khe (Sào Khê) River, Voi (Vối) River and Ngo Dong (Ngô Đồng) River. This aims to both generate a network of water traffic and connect to the sea in Than Phu (Thần Phù) Seaport to drain off the water in the flooding season. The local Vietnamese people still used caves to build pagodas, temples and shrines for their spiritual purposes. Such typical places include Hoa Son (Hoa Sơn) Cavern, Thien Ton (Thiên Tôn) Cavern, Thien Huong (Thiên Hương) Cavern, Bich Dong (Bích Động) Pagoda, Linh Coc (Linh Cốc) Pagoda, Tien (Tiên) Cavern, Hoa Lu Cavern, Bai Dinh (Bái Đính) Cave Pagoda, Tran (Trần) Temple Cave and so on. A series of built sea dikes and the improved flooded rice fields turned Trang An into a "dry Ha Long" with the strong human vestiges left through many millennia.

4. Some outstanding historic cultural values of Trang An property

The above - presented contents indicate that Trang An is a complete and outstanding annal on the environmental changes and human responses in the remote past, an outstanding example of a traditional human settlement, land - use, or sea - use which is representative of human interaction with the environment especially when it has become vulnerable under the impact of irreversible change of the nature and society.

The archaeological records in Trang An also give us the important information on the lost environment, history of evolution, the diversity, as well as how human being adapted to the condition after the period of the last glaciation. The evident findings on the past floral and faunal features in a close association with the archaeological evidences and ancient environment are not popular in Southeast Asia. And in this case, Trang An has promptly attained the scientific recognition as a regional type-sequence. The prehistoric cultural story in Trang An is a miniature picture of the global process of human responses to the marine transgression after the glaciation. It can be considered the best typical model for a comparison with other properties in the region such as Thailand, Philippines, Malaysia and Indonesia where were under the same influences.

Trang An is also the one among a few properties that retains the original and in situ characteristics hardly affected by humans, animals and other elements. A majority of the archaeological sites here expose the thick, in situ stratigraphies and have only been excavated in very small

areas. Apparently, the archaeological potential in Trang An is enormous, deserving a global invaluable repository for understanding the process of adaptation and changing landscape in the changing environment.

It can be said that the human adaptation to Trang An habitat is best represented in settlement patterns, subsistence strategies, behaviour and limestone tool technology and the appearance of the early pottery. The geo - archaeological evidences here have better confirmed that human activities attached to the environmental changes in the before, during and after the marine transgression, bringing a view on the past structural transformation, the local landscape modification and the floral and faunal variation over time. The cultural diversity and the traditional customs of the ancient Trang An people in land use, sea use, adaptation to the environment over thousands of years in this low limestone valleys and monsoon tropics absolutely deserve an outstanding universal example in Culture and Nature of the humankind.

At present, the maritime region of Vietnam is under the impact of the rising sea. On April 17th 2013, Ministry of Natural Resources and Environment of Vietnam announced a scenario of climate change and rising sea water in Vietnam updated to 2022, comprising three levels applied to the end of the 21th century. As for the scenario of low distribution of greenhouse gas, the average annual temperature of Vietnam would increase by 1.6 - 2.2 degree celsius, sea level would be added 49 - 64 cm. As for the scenario of an average distribution of greenhouse gas, the average temperature would increase by 2.5 - 3.7 degree celsius and sea level would rise by 78 - 95 cm, and possibly 105 cm maximum in Ca Mau - Kien Giang.

With respect to the inundating threat, it is calculated that sea level would rise by 1 m until the year 2100. Under its impact, there would be around 39% of Cuu Long River plain area, more than 10% of the area of Red River and Quang Ninh plains, over 2.5% of the area of the Coastal Central provinces and over 20% of the area of Ho Chi Minh City under the flooding threat. Nearly 35% of the population of Cuu Long plain provinces, more than 9% of the population of Red River and Quang Ninh plains, almost 9% of the population of the Coastal Central provinces and approximately 7% of the population of Ho Chi Minh City would be directly influenced.

A lesson of the response of the prehistoric people to the sea and island environment would have been valuable. Rising sea level would cause the disappearance of the archaeological sites as having ever occurred in the late Pleistocene. In the coming period, sea water would be added more, whereas such activities as destroying the mountain, leveling the hill and encroaching the sea to build the mega - structures that have permanently destroyed a number of sites. Each archaeological site is not only as an annal, but also a national identity in joining an integrated world. Losing the site is losing oneself at sea similar to a person who loses his mind could not lead the ship toward the victorious shore.

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