VNU Journal of Science, Earth Sciences 25 (2009) 48-55

Land resources usage and agricultural production organization for resettled people in Son La hydro-electric power station project

Case study in Yen Chau District, Son La Province

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Received 18 April 2009; received in revised form 26 April 2009

Abstract. Recently, the resettlement activities of Son La hydroelectric power station (SHPS) have been carrying out within three provinces: Son La, Lai Chau, and Dien Bien. The main problem is that with limited land fund for resettlement (each household has about 1-2 ha of agricultural land in average [6]), the land use and argicultural production organization should be ensure favorable conditions for resettled people.

Yen Chau District, Son La Province is one of the resettlement areas of SHPS project. Until 2008, 273 households have resettled in 8 areas belonging to 5 communes of the district. Based on the assessment of present conditions of land use, land use planning, and argicultural production organization for resettled people, the arcticle have proposed some measurements for sustainable land use and the models of ecological economic, household that have high economic, social, and environmental effectiveness.

1. Problem definition

Land use and argicultural production organization for resettled people are the important problems that need to be solved at the start of the Son La hydroelectric power station (here after as SHPS) project. In the Tan Lap resettlement area - one of the first resettlement sites of the SHPS project, each resettled household was allotted 3000 - 5000 m^2 for planting grass to raise milking cows with two cows, or an assigned area for growing tea trees. This model is evaluated as ineffective by the main reason that it is not suitable for the habits and capabilities of resettled people. Concrete planning by consultancy for resettling areas of Son La Project has recently taken that lesson by putting more attention to "what to produce" to stabilize condition and production activity. However, land use and agricultural production planning are based only on economic effectiveness, ignoring the social and environmental aspects. For example, for resettlement work of SHPS project in Yen Chau District, the planning reports are focused only

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Summarizing the interaction of endogenous factors, hydrosphere and the coastal zone shows that the erosion in Hai Hau shoreline was caused by the decline of Ha Lan mouth. Then, the eroding process was continuously developed because the area was not supplied enough sediment from the estuaries. In addition, the sediment transported offshore by sea waves of 1.940.400m^3/year (38% along shore and 62% offshore). At present, the shore from Hai Loc to Hai Dong is changed into accretion, in other sections the erosion speed may continuously increase. The strong dyke along Hai Dong-Hai Hoa has increased the sea wave energy destroying the shoreline at the southwest that created an eroding shoreline moving to Hai Thinh.

The Hoa Binh hydroelectric dam has reduced 56% of sediment in the lowerpart of rivers. In the future when Tuyen Quang, Son La and other hydroelectric dams will be put into construction and operating, the amount of sediment supplying for coastal areas will be continuously decreased. With influence of Hoa Binh hydroelectric dam, the accumulating speed in Ba Lat mouth has reduced from 84m/year (1965-1985) to 60m/year (1985-1995). So, the volume of sediment transported to near area of river mouths also reduced. This is the main factors affecting to the erosion process in Hai Hau.

Erosion has made impact to the coastal environment, altered the environment and affected to human lives.

First, erosion caused loss in land-an essential resource to human beings. The erosion process from 1905 up to now has lost a very large area. Only from 1965 to 2001 in Hai Hau district 2.1km^2 of land was lost, cultivated land changed into tidal flat (Fig. 8,9). By loss in land, the number of residents living near shore forced to move into land, made population density increased so that increasing the life difficulty.

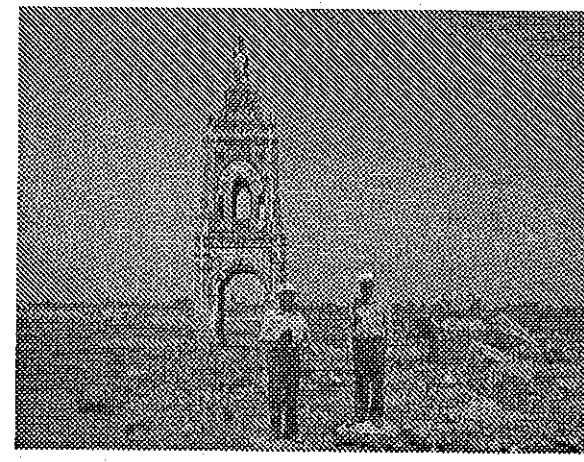

Fig 8. Church and village was destroyed by erosion.

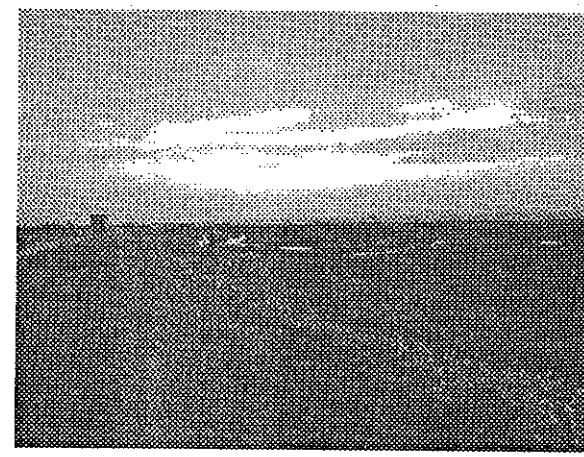

Fig 9. Tidal flat was formed by erosion

Erosion has destroyed sea dyke system and reduced the ability to prevent storms and flood tides. In addition, erosion has made shoreline backed to mainland that caused salinization, reduced quality of groundwater. Erosion has destroyed landscape, sea beaches and affected to tourism activities (Fig. 8,9)

Eroding changed the geological environment onshore, destroyed ecosystem of mangrove forest, destroyed habitats of many species.

depth are Giao Long and Hai Loc. Along the Hai Loc-Hai Thinh coastal zone, sediment is mainly transported along shore towards the southwest. Along the eroded Giao Phong-Giao Long coastal zone, the sediment is transported along shore toward the northeast. This is caused by waves directed from the northeast which stopped by sand bars in the estuaries causing less impact to the shore. Sediment taken from Lach Giang mouth is mainly transported to the southwest.

Quantitatively, balance of sediment supply in Hai Hau shoreline was calculated by sediment volume transported along coast and offshore. The sediment volume transported along coast was calculated by CERC formula based on monitoring wave data from 1976 to 1994. The cross-shore sediment transport was defined by Kajima formula (1982) with experimental coefficient calibrated according to real condition in Hai Hau. The calculation results pointed out that sediment volume transported along the coast to the southwest by northeast and north waves in the northeast monsoon wind was 654,078m^3/year. In the summer, the southeast and south wind dominated, the sediment was transported to the northeast (62,884m^3/year). But in general the main trend of sediment along the coast was towards the southwest. The sediment volume of cross-shore transport into the deep water was 1,286,322m^3/year. Some people consider that the erosion of the Hai Hau shoreline was related to active tectonic subsidence. In fact the tectonic movement trend in Quaternary and Holocene has maintained and continued upto the present. Though the shoreline had continuously moved offshore from the Flandrian transgression upto 100 years BP (accretion dominated) and then changed in erosion. That's why accretion and erosion were not related to tectonic activities

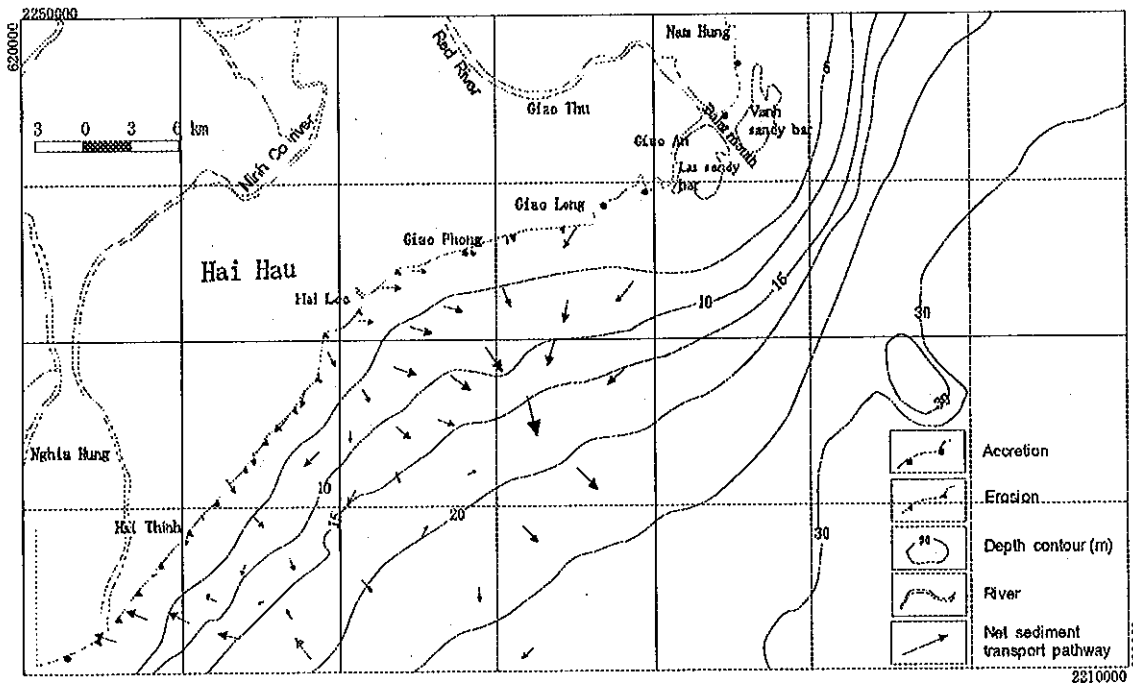

Fig. 7. Schema of sediment transportation in Hai Hau coastal zone [2].

The second phase of changing shoreline (from 1905 up to now) is characterized by following features:

- Section from Day mouth to Lach Giang mouth: the shoreline has been accumulated and continuously extended offshore.

- Section from Lach Giang mouth to Ha Lan mouth: the shoreline has been eroded and continuously moved into the mainland.

- Section from Ba Lat mouth to Thai Binh mouth: the shoreline is relatively stable.

There is lot of study dealing with accreting-eroding process of shoreline. However, the answer for eroding process in Hai Hau shoreline so far hasn't been satisfactory [4].

On the base of analyzing data of the accreting-eroding process and changing of shoreline in Hai Hau, this process is explained as follows:

- Until 1905, the shoreline in Hai Hau was convex. This shows that the accreting process was dominated. Compared with Hai Hau section, the Day, Lach Giang and Ba Lat ones expanded offshore with a slower speed. It showed that the sediment distribution before 1905 was different from present. The accreting process occurred rapidly, caused by condition in which there were not river dykes for a long period.

- From 1905 up to now shoreline in Hai Hau gradually has backed into the mainland and in the other hand the shoreline in Day mouth, Lach Giang mouth and Ba Lat mouth have rapidly expanded offshore with a speed of 100m/year.

The eroding process in Hai Hau is closely related to the change in sediment supply and shoreline form.

The shoreline in Hai Hau runs through 7 communes: Hai Loc, Hai Dong, Hai Ly, Hai Chinh, Hai Trieu, Hai Hoa, and Hai Thinh. The eroding process annually causes much loss in infrastructure and changes of geological environment that affects badly the socio-economic development in this area. The eroding process has started since the beginning of 20 century. This related closely to the degradation of Ha Lan mouth which used to be the major estuary of the Red River at that time. The clear evidence of the degradation of this estuary was the shoreline in Giao Long and Giao Phong communes continuously expanded offshore with speed up to 200m/year from 1905 to 1930 but after that in this shoreline accretion changed into erosion

The degradation of Ha Lan estuary and the development of Ba Lat mouth caused the deficiency of sediment in Hai Hau. Length of eroded section continuously increased, to the 1980s and then shortened gradually because the shoreline was protected by the sea dyke system. However, the eroding intensity clearly increased in the period of 1985-1995, it was 1.5 times more than that in the period of 1965-1985. Especially in Hai Chinh-Hai Hoa, the eroding rate reached 15-20m/year. The eroding process usually takes place strongly in monsoon and the erosion is moving towards Hai Thinh commune with average speed of 400m/year.

The Hai Hau commune is located between two large estuaries: Ba Lat mouth in the North and Lach Giang mouth in the South. Annually, the sediment amounts transported through the estuaries are 29.1 million tons and 5.82 million tons (for the period of 1956-1998), respectively. However, according to Gao and Collins methods [3] to define the net of sediment transport, the sediment taken from the estuaries does not supply for the Hai Hau coast [2]. Figure 7 shows that the sediment amount of the Red River has not accumulated near shore but transported offshore to the depth of 25m. Area of the sediment transported offshore to 5-25 m

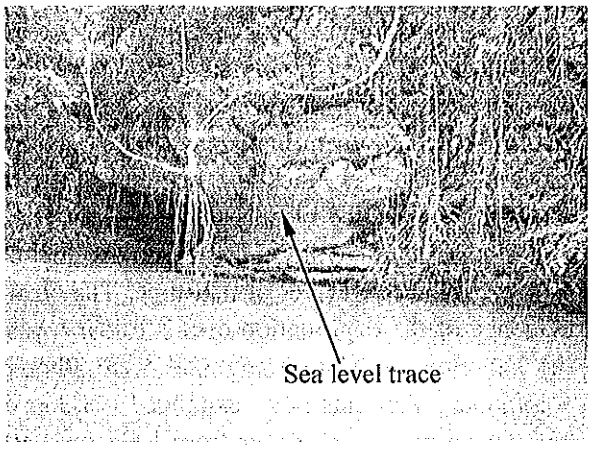

Fig. 4. Sea level trace in Hoa Lu (Ninh Binh province).

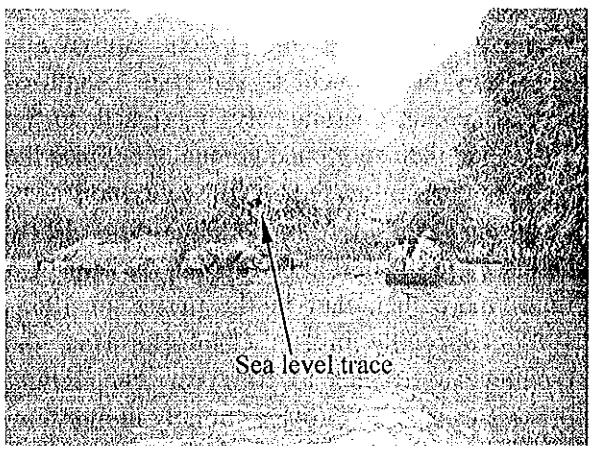

Fig. 5. Sea level trace in Hoa Lu (Ninh Binh province).

The vertical movement was illustrated by geological processes such as: Glacier occured in a large scale at the end of Pleistocene. The Red River basin and continental shelf have experienced a major period of weathering and eroding that created an eroded surface. After that at beginning of Holocene the eroded surface was broken by faulting and created blocks. Vertical movement of the blocks with feature: subsidence movement increased from edge to the center. This is shown clearly in the changing of thickness of Holocene sediment in the drilled-well data [1].

3. Changing of shoreline from 2000 years Bp to the present

From 2000 years Bp to the present, the sea level has been relatively stable. The fluctuation of sea level was not significant compared with the present level. At present, sea level is rising with a speed of 1-2mm/year. Based on the study of sediment process and human activities, the changing of shoreline after the Flandrian transgression up to now can be divided in 2 phases (Fig.6):

- The depositing phase: the shoreline continuously moved offshore (from 2.000 years Bp to 1905).

- The eroding and depositing phase (from 1905 up to now).

In the first phase, the Red River delta was expanded and the shoreline moved offshore with a speed of 100m/year. In coastal zone, generations of sea dykes in turn were formed in 1471, 1838, 1899 (in Ninh Binh, Nam Dinh, Thai Binh). The sea dykes system basically reflected the positions of shoreline. Until 1905 the shoreline in Hai Hau was the farthest one offshore and was taken as the shoreline marker to study the changing of shoreline later.

At that time, according to the characteristic form, Hai Hau shoreline was convex (fig.6).

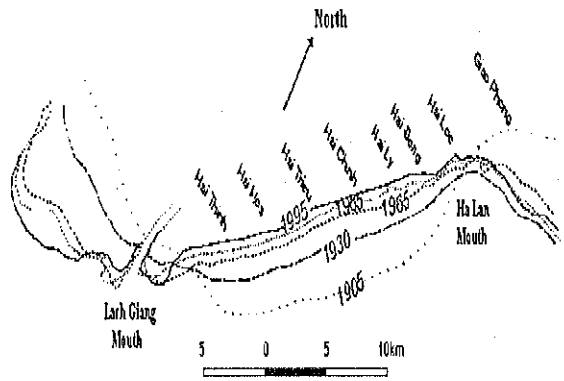

Fig. 6. Shoreline positions during period of 1905-1995 [2].

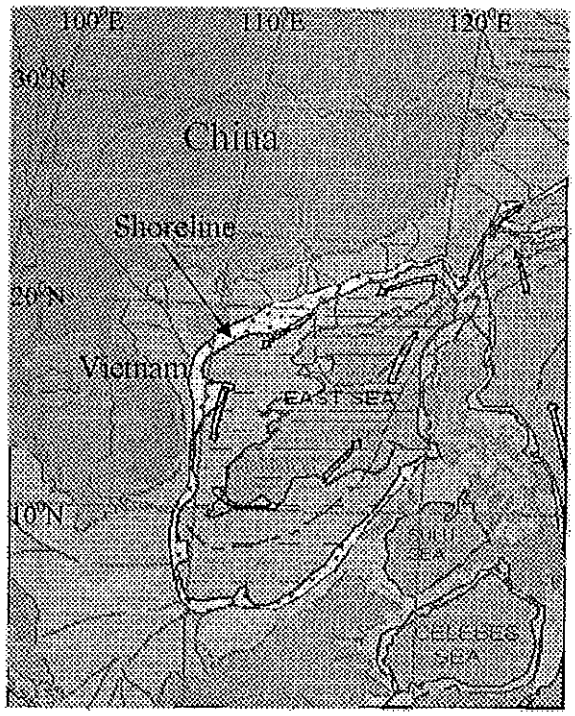

Fig. 2 Shoreline in the Late Pleistocene [6].

2. Changing of shoreline in the Holocene

After the sea regression, the shoreline changed within the space of 2 mentioned above shorelines. During the regression time, the Vinh Phuc formation was intensively weathered in the hot and dry climate. Then, at 17000 years Bp the Flandrian transgression started. The shoreline gently moved upward to the land from the depth of 100-120 m. The graph of transgression process was sinuous (Fig.3). The sea level of Flandrian transgression reached to maximum at 6000 years Bp, reached to Ha Noi, Bac Ninh and Dong Trieu, lasted about 1500 years, created a sea level trace of 4-6m high on the limestone scarps and the terraces of 4-5m high [5].

Shoreline positions between the Pleistocene transgression and the Flandrian transgression shows that the Flandrian transgression scale was smaller.

After the Flandrian transgression, the sea level continuously fluctuated up and down compared with the present level. This process lasted about 2000 years and was recorded by the sea level trace at high of 3-3,5m in Cat Ba, Ninh Binh, Ha long bay (Fig. 4,5) and the terraces at high of 2-2,5 m in Vinh Bao and Tien Lang [5]. From 2000 years Bp to the present, the sea level has been relatively stable (Fig. 3).

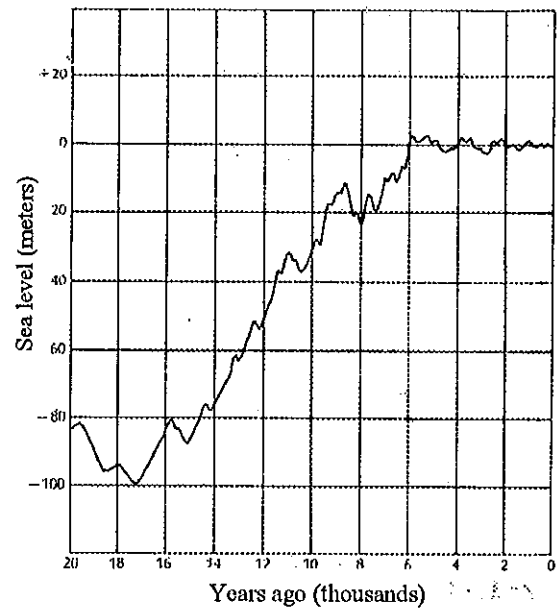

Fig.3. Sea level change in Pleistocene-Holocene [7].

The sea level after the Flandrian transgression slowly moved offshore. In Ninh Binh province the shoreline nearly overlapped with the shoreline of Flandrian transgression. This is suitable with the locally tectonic subsidence trend of the area in the Holocene. This trend has continued up to now.

Thus, vertical movement affected to the morphology and position of shoreline. In addition, the role of vertical movement also affected to sediment process in Holocene. The geological formation formed in Holocene had reflected the changing of sea level and characteristics of vertical movements.

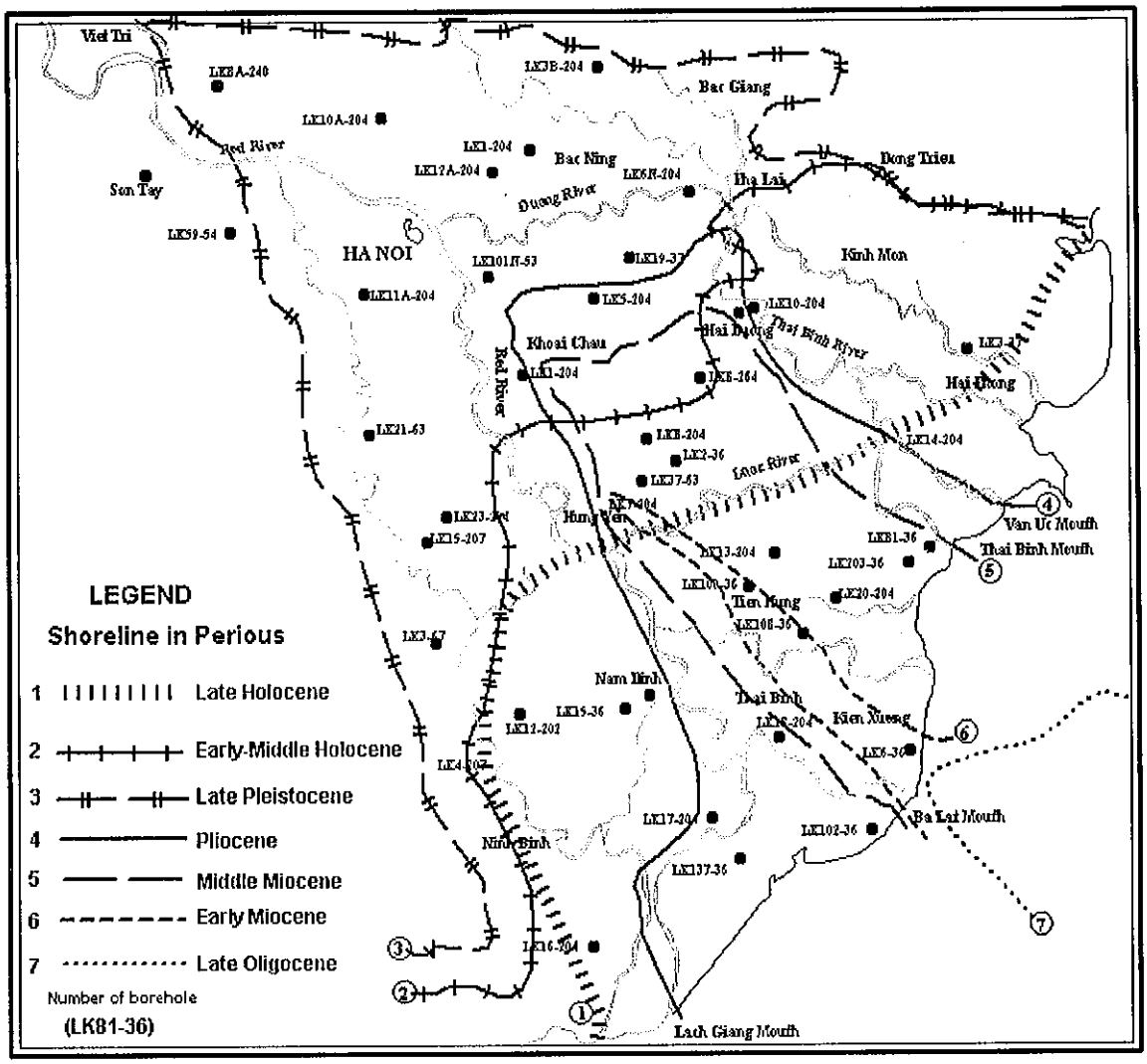

Fig. 1 Schema of shorelines in Red River Delta in Cenozoic.

After this transgression, it was a regression with large scale caused by the last glacier in Quaternary that the shoreline moved offshore to the depth of 100-120m below the present sea level. As a result of the regression, the Late Pleistocene formations were exposed, weathered and intensively eroded (Fig.2).

Thus, in the Late Pleistocene existed 2 shoreline positions: a shoreline related to the sea transgression and a shoreline in 100-120m depth related to the sea regression.

The Earth sequence corresponding to a sedimentary cycle has composed of 3 parasequence sets and 25 parasequences in with a parasequence was being equivalent to a lithofacies group.

2. There are of 7 older shorelines at the different depths: 2000 - 2500m (Q_1^1); 1000 - 1500m (Q_1^{2a}); 700 - 800m (Q_1^{2b}); 300 - 400m (Q_1^{3a}); 100 - 120m (Q_1^{3b}); 50 - 60m (Q_2^1); 25 - 30m (Q_2^{1-2}).

3. The lowstand systems tract comprise the incised valley fill of the river channel, continental shelf edge lowstand delta complex and deep - water turbidite of 1500 - 2000m deep at the Central Vietnam.

4. The process of forced regression and transgression phase deposits that developed seaward of the last clinoform of the lowstand progradational units.

References

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