CHAPTER II

CHARACTERISTICS OF GEOLOGICAL STRUCTURE

The geological structuresin the 199.1 $km^2$of northeast Vang Tắt were very complex includingexistence of various geological formations from Proterozoic to Paleozoic, and presence of sediment, metamorphic and intrusive formations with different compositions. However, they share common characteristics which are part of the Se Koong structure developed in regional geology:

I - LITHOSTRATIGRAPHIC FORMATIONS:

1) The Middle - Late Proterozoic metamorphicsediments (PR_{2-3}):

The Early - Middle Proterozoic sediment - metamorphic formations distribute in the project area have a strip formin the north-eastern and the east part of Noong Key Ụcarea of about 40 km^2.

Main rocks in stratigraphic units are feldspar - biotite schist originate from metamorphic aplite sources, biotite gneiss, biotite - quartz schist, and two mica - quartz schist.

Lithological characteristics of the rocks are as follows:

+ Quartz - biotiteSchist:

Rocks have a blastic texture withgrain-plate crystals, oriented slaty structure.

The main mineral components include quartz - 80%, altered biotite -12%, muscovite - 2% and feldspar - 3%. In addition to other sub-minerals, there aresillimanite, tourmaline, zircon and ore minerals. (Photo II - 1)

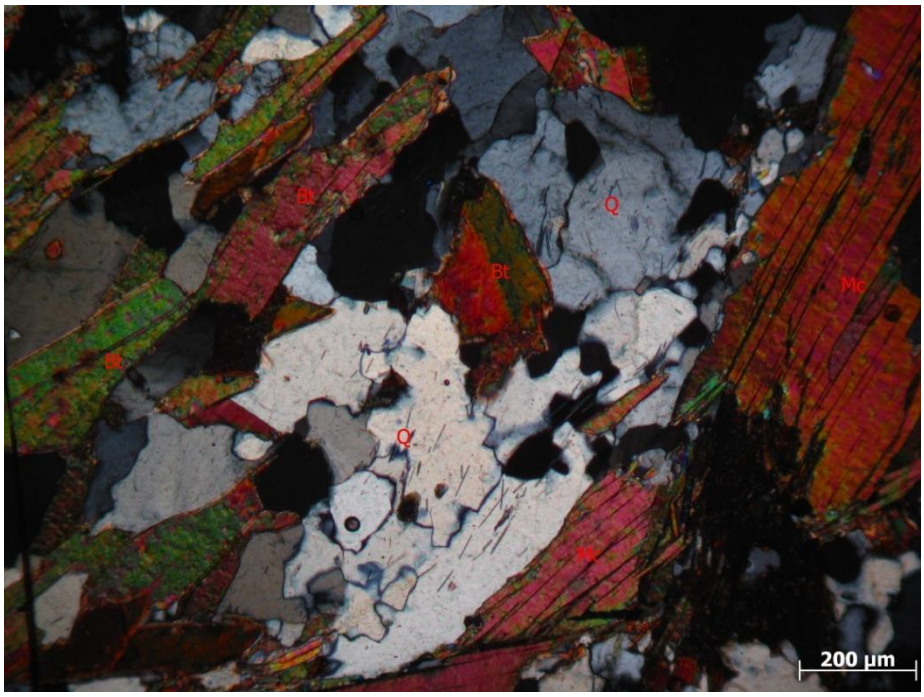

Photo II - 1: Quartz - biotiteschist. Sample A.1108. Nicon N +.
Q - Quartz, Bt - Biotite, Mc: Muscovite

+ Biotite gneisses:

Rocks have a grain-plate blastic texture, oriented parallel structure.

The mineral composition includes quartz: 33-35%, feldspar: 30- 35%, biotite: 30 - 35%, sillimanite: 1%,other minerals: sphalerite, apatite, zircon and not much tourmaline.

In this feldspar could be found both potassium feldspar and plagioclaz, in which potassium feldspar were almost completelyaltered into clay. Plagioclaz was altered into sericite, however there are polysynthetic twinning residues. (Photo II - 2)

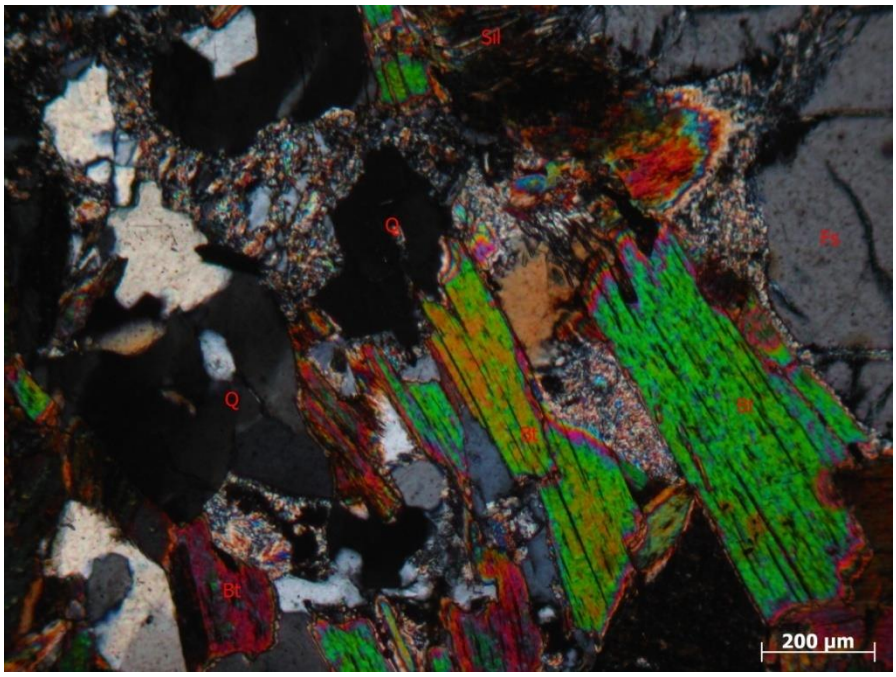

Photo II - 2: biotite gneiss. Form A1059. Nikon N +
Q - Quartz, Bi - Biotite, Sil: sillimanite, Fs: feldspar

+ Quartz - feldspar - biotite slate (metamorphic aplitesource)

Rocks have a grain-lamella blastic texture, oriented structure.

The composition of minerals including quartz: 40-45%, feldspar: 45-50%, biotite: 7-10%, Muscovite: 1%, apatite: a little, other minerals are tourmaline, sphalerite, zircon, epidote, andore minerals.

The rocks of these formations are being cut through by mafic intrusive amphibolite formations - they are Early Paleozoic formations belong toHai Van intrusive complexes. Their activities cause degeneration, some places could be found greizenation.

Compared with lithostratigraphic characteristics of the Kham Duc beds covered in the eastern part of Vietnam territory, it is showed that they have similarities, and they have Middle - Late Proterozoic age [1, 2, 5].

2) The Cambrian - Ocdovic terrigenous, carbonatesediments:

The terrigenous and carbonate sediments in the investigation area occupies a relatively large part distributed mainly in southwest area, north and northeast of Noong Key Ục and Vang Tắt.

The survey and mineral prospecting as well as geological observations indicate that sections characterized for this formations change from low to high as follows:

a) The north regions of Vang Tắt

Mostly sericite - quartz schist formations, sometimes as quartz - sericite - chlorite plates and sand-siltstone layers with alternation of thin quartzitelayers. The upper layers areinterstratified quartz – pebble layers forming strip stretching from north to south, over on this beds, thereare tuffaceous silty clays containing weathered sand. On top of this is the formation of black shale containing organic material as well as limestone lenses.

Thick white quartzitelayersare located on the top.

Lithological characteristics of rock are as follows:

+ Alternating quartzite formations in the lower part:

Rock has particletexture withcompressedand contact base. These formations are located in the lower part with sandwiched layers. Their composition: quartz: 90 ÷ 92%, in addition there are sericite and feldspar, and rock fragments, carbonates and oremineral.

+ Convenient conglomerate formations:

Convenient conglomerate formations constitute stratigraphic markerdistributedmainly in the center of Vang Tắt Kang. As the white, black, and gray debris with irregular size, their composition are mainly of rock fragments accounted for 50 – 80 ÷ 90%, others are raw materials, primarily cement clay, carbonates (image II - 3)

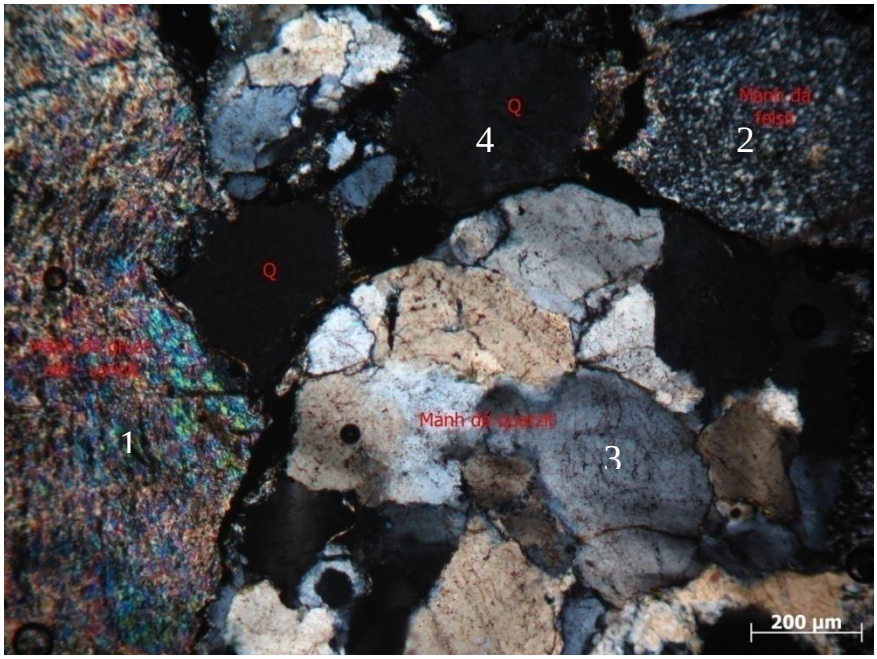

Photo II – 3 :Convenient boulders. A. Form 423. Nikon N +.
1: schist - sericite Debris. 2: felzit Debris.
3: quartzite Debris. 4: Quartz

+ Shale formations, sericite schists:

The distribution of this formations include both the upper and lower part of the stratigraphy. Rocks usually are greenish pale. Rocks have a micro-lamella aphanitic texture, oriented parallel structure.

The mineral composition is mainly quartz -silicon particles account for 45-50%, Sericite 30-35%, in addition there is clay, iron hydroxide minerals and ores.

However, depending on their position in the plan of distribution structures, the analysis of petrographic thin sectionshowed that as far as intrusions on the upper part of the stratigraphy, sericite numbersare up, some places to 80-90 % sericte and so the amount of quartz arereduced. (Photo II - 4)

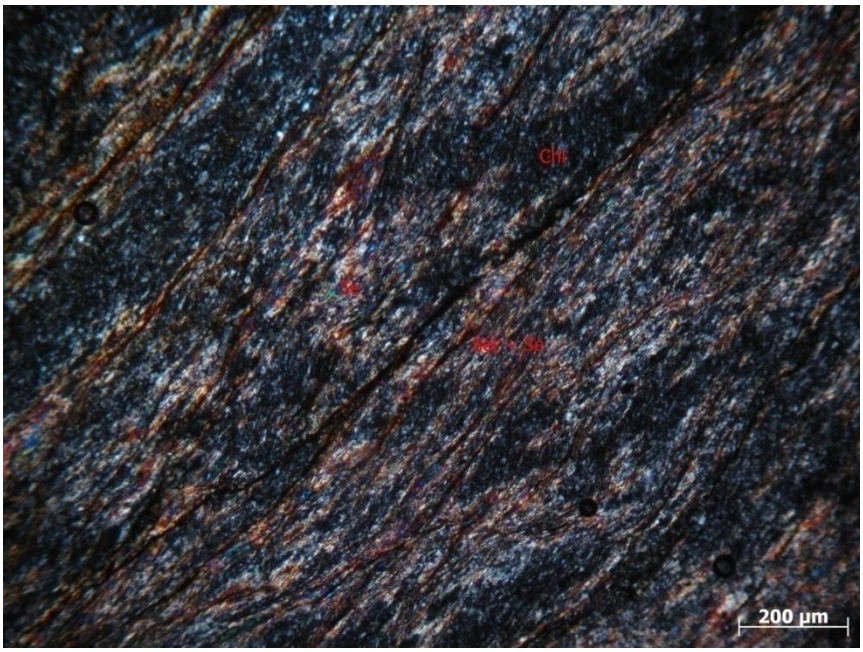

Photo II – 4 : sericite - chlorite Shale. clutsto-lepidoblastictexture.
Form A .056, Nicon N +. Se: Sericite, Chl: chloride

+ Carbonate Formations:

Carbonate formations in lithostratigraphic order were caught at the points A. 008, A. 038, A.215, A. 433, A.440, A.444. They have general direction with the cobbles - convenient stones as collective marks. These belong to the middle part of the strata in the investigation area.

Carbonate formations were altered in crystalline granules, sometimes being dolomitization. Main mineral compositon consists of calcite occupied from 70-90%, sometimes dolomite, tourmaline, quartz particles and organic and claymatter.

Texture of the rocks ismicro-granular, aphanitic - fine particles. Orientation structure (image II - 5), there was dolomitization. (Photo II - 6)

+ On the top there arethick layered quartzite beds, mainly quartz granules, distributed outside on the east range ofthe area.

b) The north and northeastarea Noong Key Ục :

The Early Paleozoic metamorphic sediments are manily distributed in the southern part of the survey area.

For the lithostratigraphic order, they have similarity withVang Tắt Kang, only differs in that there was no interstratified conglomerate as bed marks and lack of carbonate rocks.

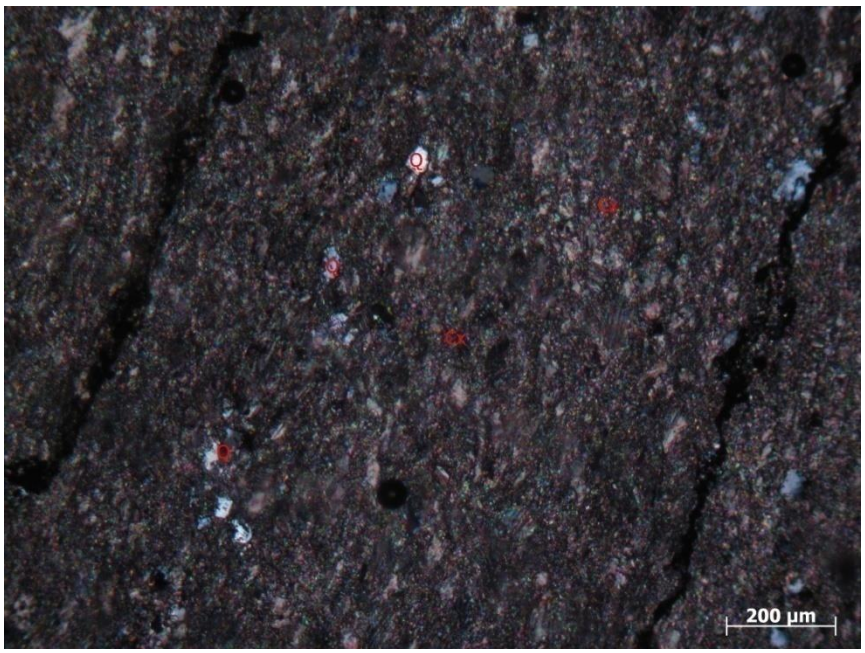

Photo II – 5 : Particles - fine particle Limestone. Sample A008. Nikon N +.

Q - Quartz

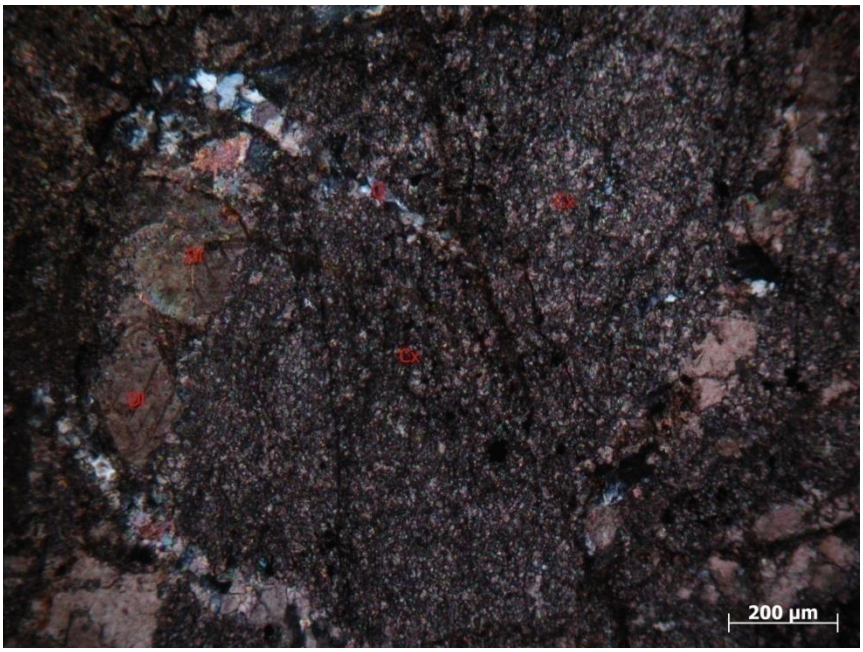

Photo II – 6 : Limestone with dolomitization. A. Sample 038. Nikon N +
Cx: calcite, Dl: dolomite, Q - Quartz

In the section between Vietnam and Laos - Se Kong,there was deployed resources survey which suggests the lower part in the south is sandstoneand silstone, alternating layers of quartz - sericite schist. There are thin layers of sandstone in quartzite form(image II - 7). The alternative rocksin the strata are not in order without regularity. To the easthighlandpart, quartzite seams covering thick layer of the sericite slate (image II - 8).

Photo II – 7: The light colored sandstone layer and sandwiched layers of siltstone, sericite shale. VL. SK - 036. Picture Do Quoc Binh

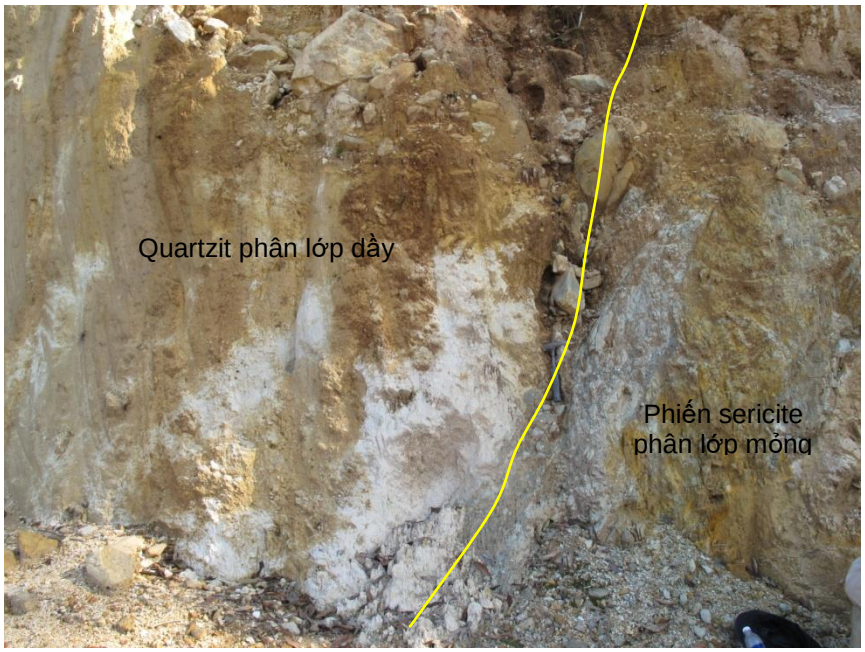

Photo II – 8 : Transition boundary of quartzite and sericite schists. VL. SK. 065. Picture Do Quoc Binh

Petrographic analysis results showed that they are formed fromsediments of metamorphosed rock. For example, sericite schist were derived from claystone (image II - 9).

Compare to lithostratigraphic sections with similar geologic section in the east of the area on the territory of Vietnam, the study showedthat they havesimilar lithostratigraphic sections of the A Vuong formation of Middle Cambrian - Early

Ocdovic. On this basis results, it allows to define formations above Middle Cambrian - Early Ocdovic (€ $_2$ - O_1) was justified.

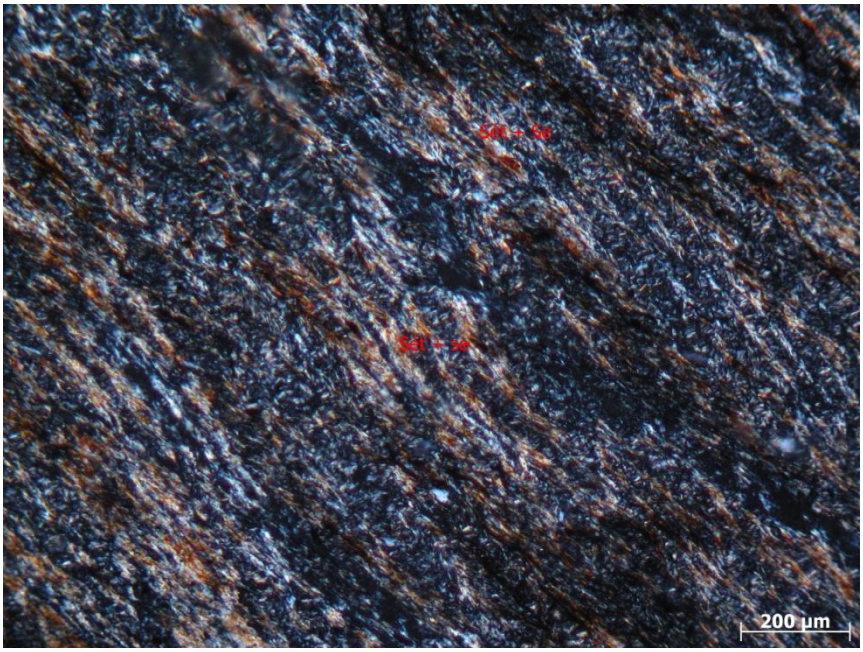

Photo II – 9 : Sericite schist (metamorphosed argillaceous source)

Sample A. 0020. Nicon N +. Set + Se: clay and Sericite

3) The unconsolidated Quaternary sediments (Q)

The unconsolidated sediments of Quaternary in the survey area is not at large scale, they are aluvian - proluvian formations developed along the valley of the flow.

Compositions vary according to material supply, we are the block, gravel, sand and clay coated on the same plant material.

In some places they may contain gold placer.

II –INTRUSION FORMATIONS:

These intrusive formations in the area of investigation, distributed based on comparative lithological characteristics and distribution location on the plan structure. It is easy to divide the areas and establish the magmatic complexes by studied orpublishedworks. On the basis of factual data and analytical results have been studied, the magmatic formationsin the area from oldest to youngestare as follows:

*a) The Late Proterozoic amphibolite formations(*µν PZ_1*)*

These intrusive formations with lithological composition mainly amphibolite exposed in the eastern part of the area north - northeast Noong Key Úc with an area close to 1km^2. Block iselliptical extended to NW - SE direction.

Results of analysis of rock lithological composition of formations identified as amphibolites with lithological composition as follows (sample A. 1030):

Hornblende: 62-65%; tremolite + actinolite: 12-15%, plagioclas: 15-17%, apatite: poor, ore: 4-5%, iron hydroxide: 2-3%.

Rocks have a grain-plate blastic texture, oriented parallel structure.

Hornblende are plates, blastic crystal, irregular grains, color from dark green, light brown to yellowish light green, some particles have clearly cut out rhombus. Along with hornblende is mixed actinolite and isomorphic tremolite of slabs, granules slightly stretched, colored felt burning continent as colorless pale, weak multicolored, garish interference. Plagioclas granules - isometric scattered, often twinned composite sparse and coarse strokes, fractured surface. (Photo II - 10).

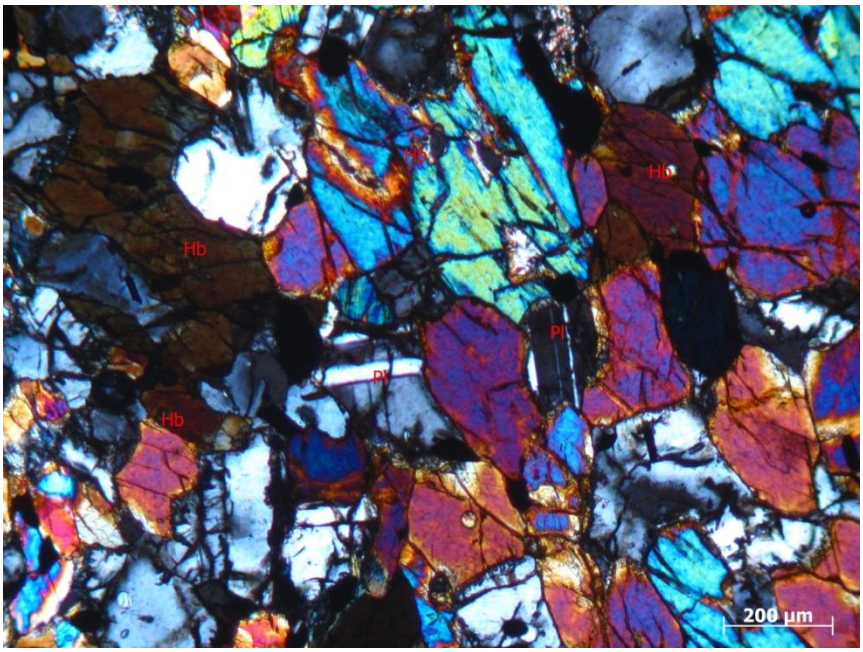

Photo II – 10 : Amphibolites. N. 1030. Nikon Form N +. Hb - Hornblende. Pl: Plagioclas.

Compared with the intrusive formations of the surrounding area towards Vietnam. In geological maps of 1 / 200,000 Dak [], they are quite similar to the intrusive formations with similar components such as granule amphibolite composition sandwiched with feldspar - biotite schist;in Sa Thay scope also has similar characteristics to these rocks [3], so that the rocks can be said to early Paleozoic is reasonable.

b) The intermediate intrusive formations of early Paleozoic age:

These intrusive formations of early Paleozoic section appeared in the north and northeast area of Noong Key Ục, an area of approximately 0.1 km^2 extended elliptical to the north - northeast. They arequartz diorite with alteration.

Lithology composition of rock consists of plagioclas 75%, 8% amphibole, quartz and chlorite 10%: 17%, epidote: 3%, less apatite; sphalerite and oresmineral. Rocks have asemi-granular texture, oriented parallel structure.

Compared with the intrusive formations with similar lithological composition of the adjacent area, which has been studied in details geochemical characteristics as well as change - deformation, they correspond to scooped second phase of Binh Dien intrusive complexes havingzircon isotopic analysis of 451 ± 3Ma[3] corresponds to Ocdovic.

c) Acid intrusive formations of Devonian (γD – 367 Ma)

These intrusive formations may reveal a large batolith area in the western part of the area investigated Kang Tắt Vang tied batolit blocks under Vang Tắt, has been established according to the data of isotopic analysis K - Ar JICA [4] has been described in detail in the investigative report - mineral prospecting Vang Tắt scope [4].

d) The intermediate - acid intrusive formations Late Paleozoic (γ PZ_3)

These acid - intermediateintrusive formations are closed to late Paleozoic and could be as large batolit distributed in the center of the north - northeast area Noong Key Ục.

Intrusive formations are biotite granodiorite rocks with lithological composition include plagioclas occupy 72-75%, poor potassium feldspar, quartz 13-15%, biotite, poor muscovite, apatite, zircon, ore. Rock has semi-granular texture and massive structure. Rock is from opalescent color to bright white.

Compared with the rock formations and intrusive formations with general structure of Se Koong in Vietnam, they have many similarities to be classified as intrusive complexes Ben Giang - Que Son with isotopic establishment is 242 ÷ 363 Ma on rocks or minerals (biotite, amphibole), as well as value-old TIMS U - Pb zircon is 272 Ma's - corresponding to Late Permian.

e) The late Paleozoic mafic intrusive (va P_2)

The mafic intrusive formations are classified in the late Paleozoic altered dolerite formations distributed mainly in the range of Vang TắtKang; they are in small satellite form. The gabbro, gabrodiabaz formations having major appearance under the north - northeast Noong Key Ục are small.

On the basis of these formations presented within the southern section and compare with the intrusive xenoliths within the territory east of Vietnam with the lithological characteristics and structure of the block they are late Permian; according to the data analysis on zircon isotopic age of gabbro pyroxenite phase large county in Cha Val blocks for crystallization age of 255 ± 4.7 Ma corresponding to Permian [3].

f) The acid intrusive Permian - Triassic (γ T) :

The granitic intrusive formations are classified in this age group can be large batolit distributed in the north of the area of north - northeast Noong Key Ục. As the light colored granite, biotite granite, biotite granite and

biotite granite coarse grained porphyritic form, sometimes being turned weak greizenation by younger formations.

Lithological composition with potassium feldspar up 40%, plagioclaz 25%, 25% quartz, 5% biotite, muscovite 4-5% and zircon, epidote and less ore minerals, sometimes with hornblende (image II - 11).

Rocks have a semi-granular texture, massive structure.

According to the analysis of isotopic U - Pb zircon in formations; the age interval ranged 242 – 224 Ma corresponds to S graniticof Early Triassic.

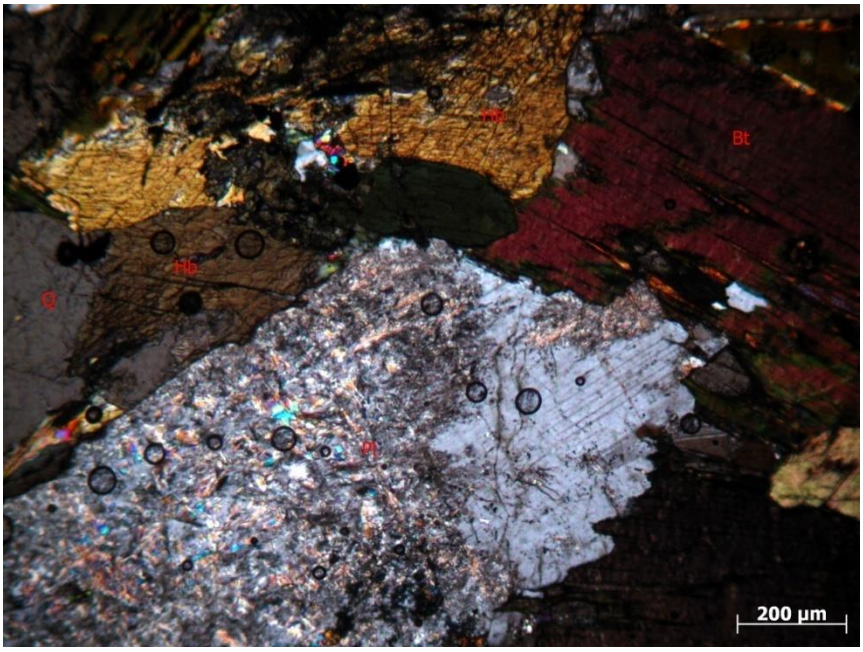

Photo II - 11: biotite hornblende Granite. A. 2183. Nicon Sample N +. Bi - Biotite, Pl: Plagioclaz; Hb: hornblende; Q: Quartz

g) intrusive formations acid - alkaline age Kreta (γ - γξ K)

Intrusive formations acid - alkaline Cretaceous age are believed to have revealed a small block section north area north - northeast Noong Key Ục. that stone granosienit, with major lithological composition of potassium feldspar occupy 56-57%, plagioclaz 15% to 20% quartz, biotite 7-8% addition there epidote, zircon, apatite and less oremineral.

Formations are temporarily classified in this age, based on comparisons with intrusive formations with similar age with lithological composition as granite - Nha Trang alkaline complexes under Vietnam's territory, adjacent access to the area of investigation

h) The bright colors aplite dykegranite:

Formations of unknown age, they frequently cut through the stone age of Cambrian - Ocdovic in the southwest covered a large area. They were strongly weathered, forming Kaolinite. Dyke system was developed under the sub meridian fault on length of nearly 1,000 meters. Compositions have only boreholes have

small anbiteparticles, regullar grain texture, light gray, they contain less sulfur pyrite.

III) THE TECTONIC AND FOLDING DESTRUCTION:

In relation to the destruction of the system in the investigated area suggests that there exists two primary system

1) Destroyed System developed largely in the northwest - southeast :

This system could be the oldest and was restarted several times. In a few places that they go to the meridian directioin. Along with this system, there exists fault system in northeast - southwest direction with small expression.

Sometimes destructive NW - SE system present themself as reverse fault system.

2) Destroyed system fault along the latitudinal:

This system are younger, they were cut and sometimes shows shifts of geological formations at a distance no greater to 2-3 meters under the horizontal sliding.

This system is destroyed slip system. Alongside this system, more granite formations with their pressed respective.

3) Folding characteristics:

On the map, the general structure of the two areas, basically showing us the pawn structure on the east monoclinal like Vang TắtKang, longer range north and northeast part Noong Key Ục expressed as the complex folds is somewhat complicated, however axis or complex folds mainly regional is the northwest - southeast.