Toward Sustainable Society with Natural Resources – Frontiers in Earth Resources Technologies and Environmental Conservation

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Sustainable Use of Geoheritage Values: A Case Study of Ba Vi - Son Tay Aspiring Geopark, Hanoi, Vietnam

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ABSTRACT: Vietnam has been known as a country possessed various types of mineral resources but a lot of them limit as only small occurrences with low exploitation value. In addition, minerals mining and trading activities have not been managed effectively. As consequences, landscape and environment of mineral exploitation area were damaged.

Ba Vi - Son Tay area, located in the Western of Hanoi capital – a mega city with an huge increasing of population, has been known as a famous landscape and spirit land of Vietnam. However, mineral exploitation activities in the small occurrences caused landscape destruction and environmental pollution. This report investigated geoheritage values of Ba Vi-Son Tay area including ancient mining area for sustainable use by constructing a geopark. Conservation and enhancement of geoheritage values of this area can be a good way to meet not only demand of recreation but also goal of sustainable development. In the context of limited destinations close to Hanoi center for weekend and holiday activities, a Geopark in Ba Vi - Son Tay area can attract more toursists to visit.

KEYWORDS: Geoheritage, geoparks, ining, geotourism, sustainable development

1. Introduction

Ba Vi – Son Tay area, locating at northwest of Hanoi, is characterized by different levels of terrain from mountains to delta plain. Locating at a meandering of the Red and Da river, with wonderful and spectacular sceneries (fig. 1), the area has been considered as a spirit land of Vietnam. Geoheritage values of the area especially the eastern part can be favorited for development of a future geopark. Mineral exploitation activities in small occurrences caused landscape destruction and environmental pollution. Many of these activities were stopped, but then remain landscape and environment has not been recovered. Therefore, the mineral exploitation does not guarantee a sustainable development for this area.

Establishing geopark with its huge significance and effect for protection and sustainable use of natural resources is still quite new to Vietnam. This report investigated geoheritage values of Ba Vi - Son Tay area including ancient mining area for constructing a geopark. Conservation and enhancement of geoheritage values of this area can be a good way to meet not only demand of recreation but also goal of sustainable development.

Fig 1. Ba Vi mountain range

2. Geoheritage values in Ba Vi – Son Tay area

2.1. Geodiversity

Geodiversity, the most important criteria for establishing a geopark, attracts large numbers of tourists. Arcoding to Gray (2004), geodiversity is the natural range of rocks, minerals, fossils, land form, processes and soil features. Ba Vi – Son Tay area was observed by a geodiversity that can satisfy the criteria. Geological history of the area, stretching during 540 milions years through Proterozoic, Paleozoic, Mesozoic and Cenozoic, is one of the longest geological history in Vietnam. In addition to geodiversity, many valuable geosites such as rock, geomorphological, and mineralogical geosites were found in the area. This article focuses on mineralogical geosites.

Ten deposits and ore occurrences were explored and exploited in the area. Many of them such as pyrite (Minh Quang, Ba Trai), copper [Lung Cua (fig. 6), Yen Cu, Da Chong], iron [Ba Trai, Xuan Son (fig. 2)], gold (Xuan village), asbestos (Quyt village - Yen Bai) are hydrothermal genesis. The others such as puzzeland [Thanh Thac (fig. 3)], kaolins (Thuan My, Ba Trai), construction materials (Son Tay, Sui village - Khanh Thuong, Khu Mon, Dong Chang, Chau village), Che mountain (limestone), Ban village (gravels) are exogenous genesis. Among them, ancient ores such as Minh Quang pyrite deposit, Lung Cua copper deposit, asbestos deposit at Quyt village… will be attractive and didactical geosites.

Fig 2. Ba Trai iron deposit

Fig 3. Thanh Thac puzzeland deposit

2.2. Current status of some mineralogical geosites

2.2.1. Che mountain

Che limestone mountain formed in shallow marine since Permian, about 250 million years ago. Record of tectonic activities also was found in cataclasitic rock of Che mountain (fig. 4). This mountain is also known as a high biodiversity area. The mountain is also associated with famous Son Tinh – Thuy Tinh legend of Vietnam folk. However, the limestone mountain had been exploited for construction activities since 1956 and was really destroyed from 1990s by mine firing. It remains only a mess of limestone in this area (fig. 5).

Fig 4. Cataclasitic rock in Che mountain

Fig 5. Che mountain will soon become a flatten area

2.2.2. Lung Cua ancient copper and ancient asbestos ores in Quyt village

Lung Cua ore is situated in Ba Vi national park, on the way to the highest mountain top.

Minerals such as bornite, chalcopyrite are still can observed although the deposit was stopped to exploit (fig. 6)

Ancient asbestos ore deposit in Quyt village formed associated with ultramafic rock of Ba Vi complex. Although, asbestos reserve in Ba Vi – Son Tay area is small but local people had has exploited. White cryzotile-asbestos fibrous

aggregates can still be observed (fig. 7). Exploitation activities destroyed landscape in the surrounding area.

2.2.3. Minh Quang pyrite ancient ore

Minh Quang pyrite ore belongs to polymetallic copper sufide ore formation of Hoa Binh and adjacent area including Ba Vi – Son Tay area. Among 7 ore bodies, the main body was about 1.000 m in length, 2-3 m in depth (Tri et al., 2000). Ore inludes pyrite, sphalerite, galenite, chalcopyrite (Nhan & Ha, 2005). Although exploitation stopped long time ago, remain landscape and environment in the area is still very bad (fig. 8, 9).

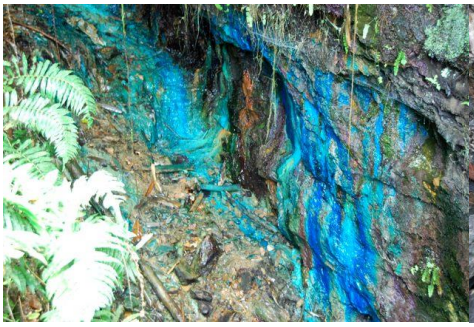

Fig 6. Lung Cua ancient ore deposit

Fig 7. A cryzotile-asbestos vent in ancient ore in Quyt village

Fig 8. Pollution in Minh Quang ancient ore

Fig 9. Overall picture of Minh Quang ancient ore

2.2.4. Laterite formation

Laterites were formed by the intensive and long lasting weathering in the tropical climate in Vietnam. Laterite, full of cavities and pores, containing a very large quantity of iron in the form of yellow and red ochres, is so soft in original state so that it is be easily cut and shaped (fig. 10). Numerous ancient architectures including Son Tay ancient

citadel was used the laterites. The laterite has been strongly exploited; however, the remains of the laterite should be conserved for recreation and science purpose.

Fig 10. Products from laterite

3. Sustainable use of geoheritage values

Remain landscape and environment in the mentioned mineralogical geosites including ancient and exploiting deposits were stronglly damaged. To protect geodiversity, landscape and environment, these natural resources should be used in more sustainable way. Improvement of environment and landscape for some above mentioned mineralogical geosites was proposed as followed:

- Lung Cua copper mine can be improved to a siteseeing for tourism like the case of Copper Coast Geopark of Republic of Ireland (fig. 11, 12).

- Che mountain and Minh Quang ancient deposit with a large space of surrounding area and specific landscapes can be favourited to construct a limestone park similar to Geological and mining Park of Sardinia, Italy. Che mountain will be attractive with its rock specific and karst topography like karren and cave (fig. 13) while Minh Quang ancient deposit will be favourited by mineral variety and volcanic landscape.

- At least one area of the laterite occurrence should be conserved for tourism and education. An outcrop in Binh Yen commune, Son Tay province can be chosen for conservation.

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Fig 4. Tankardstown mine (overground)

Fig 11. Tankardstown mine (overground) *(source: Copper Coast Geopark Ltd.)*

Fig 12. Tankardstown mine (underground) *(source: Copper Coast Geopark Ltd.)*

4. Conclusion

By establishing geopark, environmental pollution and landscape destruction in Ba Vi – Son Tay area especially in ancient and exploiting ore deposit can be solved. Sustainable tourism can be developed in the aspiring geopark.

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Fig 13. Karst topography in Hon Che mountain

REFERENCES

Gray, M. 2004. Geodiversity: Valuing and Conserving Abiotic Nature. John Wiley & Sons Ltd, Chichester

Nhan, N.V., & Ha, N.T.H., 2005. Mineralogical characteristics and formation condition of polymetallic copper sufide ore formation in Hoa Binh and adjacent area. *Journal of Geology* (291) : 38-42 (In Vietnamese).

Tri, T.V., Khuc, V., (eds) et al, 2011. *Geology and Earth resources of Vietnam*. Publishing house for science and technology.

Copper Coast Geopark Ltd., 2014. Tankardstown 3D Tours. http://www.coppercoastgeopark.com/geology/tankardstown-3d-tours.html.

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