

ADVANTAGES AND SHORTCOMINGS OF THE PROPOSED NATIONAL PARK THE COLCA CANYON AND THE VALLEY OF THE VOLCANOES

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INTRODUCTION

An initiative of a group of members of the Polish Section of *The Explorers Club* and geologists from AGH University of Science and Technology in Krakow to protect the unique area of the Colca Canyon and the Valley of Volcanoes in Peru was undertaken in 2003 (Galaś & Paulo 2008). The necessity of protection results from increasing investment pressure in the area, which has become the second popular region of mass tourism in Peru. Tourism significantly contributes to the growth of economy of the region but its spontaneous development and exploitation of non-renewable resources occurring there may cause degradation of natural values of the area and finally their complete loss.

Paradoxically, the natural values of the region are poorly recognized due to their low accessibility and they might be damaged before scientifically researched.

The canyon exposes a unique cross-section of the earth crust, therefore geologists were the first who started its research. Biota in this semi-desert region seems to have subordinate significance there in comparison to other protected areas within SINANPE system (Leon & Chang 2008) but local ecosystems need also conscientious recognition and conservation. Studies performed so far by the Polish Scientific Expedition to Peru (PSEP) add greatly to knowledge of geology, landscape and pioneering biota of the area and its importance to the world heritage of nature (Paulo & Galaś 2011). They are aimed to give scientific background to the project of the Colca Canyon and the Valley of the Volcanoes National Park in the south of Peru.

PROTECTION GOALS

Colca Canyon stands among the deepest and wildest gorges worldwide. Its depth after the Guinness Book is 3232 m. Unique values of the canyon include pristine landscapes resulting from various geological processes registered along magnificent, 100 km long, extremely deep section of the orogenic belt. Geodiversity of the area consists of a variety of geological formations and tectonic structures, active faults, a record of geomorphological and endogeneous processes in the rocks, the spring zone of the Amazon river, young volcanoes, hot springs, and geysers. The geological structure is perfectly visible due to poor vegetation cover. Deep erosive incision in the Colca Canyon and tributary streams, explosive calderas and topping of the Western Cordillera by volcanic edifices result both in landscape richness and occurrence of numerous climatic-ecological zones. The largest condor habitat in the Andes is known here. Biological studies performed so far by PSEP members concentrated on pioneering organisms like lichens, mosses and fungi. The investigations carried on shall answer important questions, eg. why the Colca Canyon and dwarf volcanoes from the Andahua Group formed in that particular place, at what rate the Canyon deepens, what is chemical content and genesis of thermal waters in the area, if there are any threats for the area caused by still active geological processes (faulting, seismicity, landslides), which outcrops (geosites) are worth protection. The landscapes, geosites and habitats are endangered by untamed development of the area. They should be recognized, evaluated and properly protected.

Protection of characteristic landscape features would support harmonisation of social, economic and environmental processes in the region. Interdependency of the animate world and the geological environment revealed by investigation support education, while protection of characteristic profiles and sites suits for scientific research. Understanding national and sometimes world importance of the protected area build pride of the local inhabitants and cooperation between scientists and the local society. The new park would strengthen relatively poor system of the protected areas in the Arequipa department, increase tourist attractiveness and determine constraints for sustained regional development. Designation of the national park would guarantee independence of protection from changes in political situations and short-term interests of social-economic groups.

THE PARK LIMITS AND CATEGORIES OF PROTECTION

Basing on natural values, the hydrological catchments, observed land-use, and mining concessions the limits of the park and its buffer zones are determined. They follow essentially marked landscape ridges. Areas of human economic activity are as a rule excluded. The zone of strict protection comprises Rio Colca Canyon (from confluence of the Rio Canahuas and Rio Colca below Madrigal to beginning of Rio Majes). This is a hardly accessible precipitous area, for this reason poorly developed. The most important protected objects there are wetlands, sources and streams which become niches of particular vegetation adequate to altitude-climatic zones. Five of eight natural regions of Peru defined by Pulgar (1967), i.e. *yunga*, *quechua*, *suní*, *puna* and *janca* occur within the investigated area. Damp environments are rare in SW Peru. Elements of inanimate nature, i.e. rock and soil exposures, springs and geysers, lithostratigraphic profiles, tectonic forms, relief and landscapes, which provide information for various scientific branches, will also be the subjects of protection. Single farms or villages were built where alluvial terraces formed and it was possible to supply them with water. Narrow paths and suspension bridges lead to them. They enrich the landscape, form elements of cultural heritage and seem not to endanger the park values. Total population in the canyon registered opposite Cabanaconde (census 2005) was 641, while in its deepest section and the lower part the Valley of the Volcanoes it was less than 50.

In the initial proposal, which shall be broadly discussed, the national park covers an area of 1457 km², the Amazon sources reserve zone 262 km², buffer zone in the Colca Valley 242 km², and buffer zone in the Valley of the Volcanoes 187 km². Their position is shown in Fig.1. Categories of protection zones compatible with SINANPE system of Peru, and suggestions on tourist accessibility are given. The strict protection zone should cover the most inaccessible part of the area where human economic activity practically does not exist. Traditional farming and animal husbandry, wildlife, cultural tourism and some forms of adventure tourism will be allowed in the zone of special usage. It is proposed in the following villages: Tapay, Cosnirhua, Malata, Sangalle, Llanca, Soro, Choco, Sucna, Canco, Ajpi, and single farms below Huambo. A basic net of services for adventure tourism is developing there. As long as they are small they do not interfere with the canyon landscape. However, some conflicts have already arisen and harmful decisions have been made. More interest from the Ministry of Environment is required, as well as quick establishing of the park with strictly designated zones of usage to avoid touristic and energy transmission over-investment. It is also necessary to strengthen the role of Autocolca by creation of the internal scientific committee, discussion with local self-governments and school education. Support from local ecologists is also expected. It seems reasonable to designate also the zone of revitalisation in the area west of Soro where unconcessioned primitive mining of gold is active, causing contamination by mercury from amalgamation practised.

North-eastern course of the park limit has not been determined yet and it is shown as reserve zone (Fig.1). It is recommended to protect highland zone the Amazon source area, i.e. the highest part of the Cordillera Chila and the valleys of the Carhuasanta and the Apacheta. These streams, tributaries of Rio Apurimac, in effect of accurate measurements (Johnston 2000) made Amazon the longest river of the world, reaching 6758 km. It is desolate zone of a harsh climate and poor vegetation, used mainly for grazing camellides. It evokes geological interest as Neogene caldera rim, eroded stratovolcanoes of Nevado Mismi and Nevado Sepregina, and still younger Andahua volcanoes, as well as stimulating discussion periglacial weathering covers and other geomorphological forms.

The Colca Valley buffer zone, including a small area of arable fields and build up terrain near Cabanaconde, is well situated in relation to the planned park and connected by paved road with Arequipa. An outstanding landscape of a mosaic of terrace fields was declared a national heritage of culture by the government resolution no.262/INC. It includes also terraces in Tuti, Tapay and Cabanaconde. According to the resolution, all new investments such as roads, water canals, dwellings, mining works, farm lands and other activities which might change the landscape must find acceptance of the National Institute of Culture. A fragment of the valley between Chivay and Maca and Madrigal is rich with various cultural monuments: churches of the 17th - 19th century, archaeological relics, traditional buildings. Appealing landscape of water-rich cultivated valley surmounted by snowy peaks, the hot springs of La Calera and Yanque, vivid folklore called the attention of foreigners. The fault zone Maca-Layo, the accompanying landslides and exposures of lacustrine sediments (Kalicki & Kukulak 2009) create unique objects registering development of the relief.

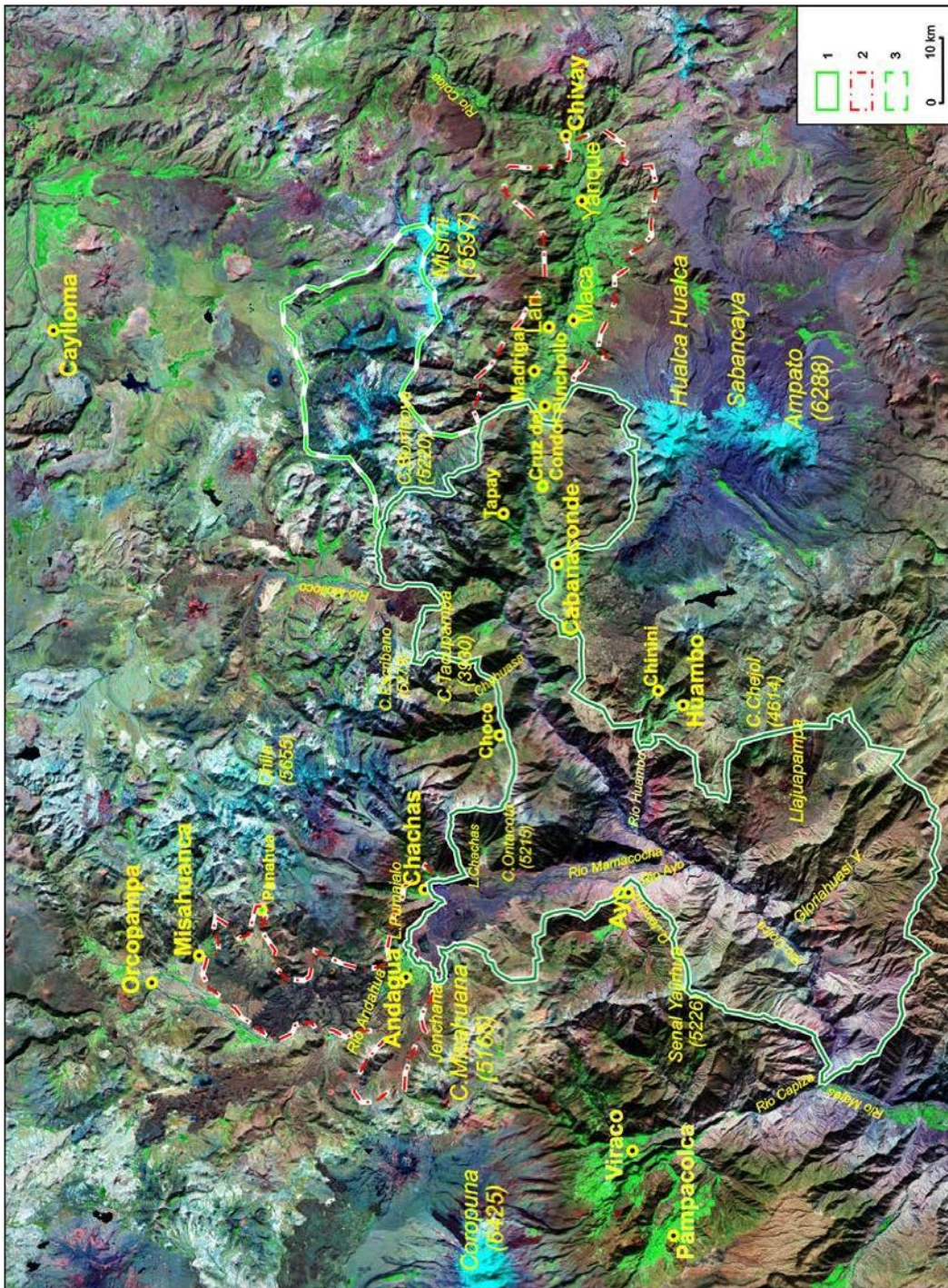


Fig.1. Map of the planned Colca Canyon and Valley of Volcanoes National Park (Landsat 7).
 1 – national park, 2 – buffer zone, 3 – reserve zone

Therefore, the road section Maca – Cruz del Condor should be declared a geosite and included in the exploring tourism programme. Madrigal and the historic mine of polymetallic ores together with an industrial cable car and mine residential buildings might become valuable tourist objects when the concession for Mountain Minerals Peru S.A. expires. The paths used by miners may be easily adapted to tourist trails leading to the Amazon sources and the Cordillera Chila peaks. The same place offers magnificent view towards Hualca Hualca - Ampato group of volcanoes. The discussed buffer zone may get the status of a landscape park (*santuario paisajístico*).

The Valley of the Volcanoes buffer zone comprises several villages south of Orcopampa up to Andagua and Chachas and small isolated patches around Ayo and Soro. Lava fields and pyroclastic cones of the Andahua Group fill major part of the valley giving it lunar landscape. It is enriched by

variable plant cover including *ichu* grass, big bright-green pillows of long living *yareta*, shrubs of *tola* and other herbs, thick, green groves of *sanqallo*, *chachacoma*, *shanqui*, and other cacti, trees of eucalyptus, alder and relics of native *quishua* and *quenua*. They contrast with irrigated and cultivated terraces of corn, potatoes, barley, lucerne, broad bean and other legumes in the vicinity of Andagua, Sopor and Chachas or gardens of fruit trees and even vineyards in Ayo. The plant associations reflect the *quechua*, *suní* and *puna* zones of Pulgar (1967). Natural sanctuary Panahua, waterfall Shanquillay, archeological sites at Alhuirí, Antaymarca, Sopor, Pajareta and Pumajallo, beautiful terraced fields of Chachas add greatly to touristic attractions of the zone.

THREATS AND CONFLICTS

Among various business activities carried on in the area the most important are: mining, farming, water management, energy industry and tourism. Conflicts with each of the branches are exemplified and discussed in the article. Designation of a legally protected area in the discussed region may positively influence current business activity and the neighbouring areas. It will result in environmental monitoring and necessity to negotiate investment plans with the park authorities. Both maintain high tourist attractiveness of the region and jobs for residents should be assured.

In order to guarantee access to mineral resources and future jobs the plots of mining concessions and main perspective metallotect, the Tacaza Group, were eliminated from protected area. Small quarries of road construction materials, travertine and artesanal salt mines are placed in the buffer zones. Illegal, primitive gold workings between Soro and Choco should be closed. Obviously, discovery of a major deposit in the canyon might ruin the plan to designate the park. However, according to the current geological research it seems to be very unlikely. Hence, the real conflict between the park and mining industry is small.

On the contrary the conflict of energy industry with protection goals is serious one. Transmission line Socabaya-Mantaro, built in 1998-2000 crosses the future park between Huambo and Andagua interfering brutally with the pristine landscape of the most beautiful parts of the Valley of the Volcanoes and Colca Canyon. Recently, the Transmantaro Project reconstructs and amplifies the transmission power system replacing towers with the higher one, disregarding consultations with local communities and NGO, which led to serious riots and international protests in the defense of the unique values of the Colca Canyon early in 2011. Small airport in Huambo very useful to support the future tourism and in emergencies was excluded from use by placing some towers in air strip. EIA of the Rio Molloco Project ignores the impact on the landscape of new transmission lines that are to connect hydroelectric plants Latica and Soro with Transmantaro line near Huambo and Sucna, running along the crests of the mountains on the both sides of the Colca Canyon.

Tourism is considered the main trend of development in the Colca Valley and the districts bordering the canyon (Cornejo et al. 2008) but its style remains undetermined yet. There is a great temptation to construct roads and bridges facilitating access to the deepest parts of the canyon and providing breathtaking emotions without effort. The constructions are extremely risky on steep and unstable slopes and harmful for the environment. The hotels cannot be placed at the edge of the canyon, shall be supplied with sewage systems and the tourist routes cleaned of waste. Tourism, being the great chance, creates the biggest threat to the idea of protection this unique region.

REFERENCES

- Cornejo, R., Mendez, M., Pastor, J., Perea, J. & Valdivia, G., 2008. Plan de desarrollo turístico de la provincia de Castilla, Arequipa. ESAN. Gerencia para el Desarrollo 5: 1-158.
- Gałaś, A. & Paulo, A., 2005. Dwarf volcanoes of the Andahua Formation in South Peru (in Polish, English abstract). *Przegląd Geologiczny* 53, 4: 320-326.
- Gałaś, A. & Paulo, A., 2008. Idea of protection of Rio Colca Canyon and Valley of Volcanoes. *Geologia* 34, 2/1: 17-33.
- Johnston, A., 2000. Mapping the Source of the Amazon. www.nasm.si.edu/ceps/research/johnston/amazon
- Kalicki, T. & Kukulak, J. 2009. Quaternary changes of river network on western slope of the Andes: key studies of Rio Colca (S-Peru). *Geomorfologický sborník* 8, 24-25.
- Leon, F. & Chang, J., 2008. Natural protected areas in Peru: valuing benefits and developing sustainable financing. *Parks*, 17 (1): 37-41
- Paulo, A. & Gałaś, A., 2011. Polish Scientific Expedition to Peru (in Polish, English abstract). *Przegląd Geologiczny*, 59: 58-68.
- Pulgar, J., 1967. *Geografía del Perú: Las ocho regiones naturales*. Editorial Ausonia. Lima.