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Topographical, Geological and Geophysical Measurements in the Diamer Basha Dam Area (Gilgit-Balistan, Pakistan)

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Agriculture and electricity are the backbone of Pakistan's economy. Pakistan today is one of the World's fastest growing countries with a population estimated to be around 170 million at the beginning of 2009. Due to the inability to regulate large rivers by means of sizeable storages, the country is already facing frequent power deficits in electricity and serious shortages in cereals production. If the present trend continues, Pakistan could become one of the food deficit countries in the near future. Therefore, there is a dire need to build new reservoirs for improving agriculture and increasing electric energy production.
Tarbela, Mangla and Chashma reservoirs have already lost about 6.2×109 m3 due to sedimentation. It is estimated [1] that by year 2012, this loss would increase to 7.4×109 m3. The Government of Pakistan has taken a very bold initiative by making the decision to construct the Diamer Basha Dam. The present demand of electricity in the country is over 17,000 MW, and is estimated to reach 22,000 MW by the year 2010 [1]. The contribution of 4500 MW from the Diamer Basha Dam will alleviate the present situation when it becomes operative.
The Diamer Basha Dam with its 272-metres in height, will be the highest roller compacted concrete (RCC) gravity dam in the world. It will be situated on the Indus River, about 315 km upstream from the Tarbela Dam site, 180 km below the Gilgit-Baltistan capital Gilgit and about 40 Km downstream from Chilas. The reservoir created behind the dam will extend for about 105 Km up to the Raikot Bridge on the Karakoram Highway. The project was started in September 2005 (with the preliminary geological investigations) and the deadline for its completion is 2016. The total cost of the project has been estimated at $12.6 billion.
Such an important project needs a constant monitoring of the geological and geophysical parameters of the area before, during and after the construction. Later the monitoring will be extended along the whole length of the lake. The present study shows the preliminary results of an initial topographical survey of the dam's area realized within the framework of a larger monitoring project called "Nanga Parbat – Haramosh Massif Monitoring Project" the target of which is to determine the uplift of the massif due to geo-tectonic compressions. In fact northern Pakistan comprises three former distinct and previously separate plates named Karakoram, Kohistan island arc and Indian plates. They collided with each other during the Cretaceous-Tertiary ages and formed the present day configuration of this region (Himalayan orogeny) [3]. The project presented here was started in April of 2009 and developed through three different phases:
a) Study of the area, contacts with the local authorities and identification of the points to be surveyed
b) Monumentation of the benchmarks
c) First measurement on the selected benchmarks.
Since the location of the dam was very close to the Nanga Parbat-Haramosh massif It was decided to devote to it a special attention setting up a small topographical network. Three benchmarks were put on each bank (right and left) of the Indus river in order to measure the relative movements of the banks before and after the construction of the dam. The measurements were performed with a Leica TS30. Total Station following the scheme of the double parallelogram reproduced in Fig. 1 [3].
The measurements taken, before, during and after the construction of the dam will be a remarkable index of the change in the geophysical parameters produced by the dam and the related lake.

References

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