

**Based on Jacek Palkiewicz's "The Amazon" –
"The Queen of Rivers and its mysterious source"
(Amazonka. Zagadka źródła królowej rzek, Zysk i S-ka Wydawnictwo, 2009)**

Principles of identifying a river's headstream

In classic spring hydrology, a river source is defined either as the place where a concentrated, constant outflow of underground water occurs, or as the confluence of two rivers with different names into a single larger one.

Pinpointing a river's headwater stretch poses many difficulties to researchers - there are no unambiguous, uniform rules, which would prejudge this fact, as somewhat different indicators are applied as the basis for the evaluation in various countries. No wonder that some scientists fall into the trap of randomness or selectivity. In the past, it was common to rely solely on the river's length or its volume flow rate. However, this criteria was too narrow and not convincing enough for geographers.

Contemporary science requires a number of facts to be taken into consideration while researching a river's headstream and source, including its volume flow rate (m^3/s) and length, as well as the altitude of the source above sea level, the relative flow-through rate of the drainage basin ($\text{m}^3/\text{s}/\text{km}^2$), basin activity, geomorphology, the river's longitudinal slope and the bed cross-section. Sometimes the traditions preserved through history and the culture of a region, are factors which influence the choice of the main river.

Conclusions

On the basis of comprehensive hydrologic and geomorphologic research conducted by a team of specialists involved in the "Amazon Source '96" expedition headed by Jacek Palkiewicz, the following information was ascertained:

1. The Apacheta stream is the main tributary of Lloqueta (upstream Amazon River).
2. A concentrated outflow of underground water of this watercourse occurs on the Nevado Quehuisha slope. Its coordinates are: $15^{\circ}30'52''$ S and $71^{\circ}45'46''$ W; altitude: 5,170 m a.s.l.
3. The Apacheta stream originates from surface and subterranean waters, and not from glacier waters as previously assumed.
4. The volume flow rate of the Apacheta ($0.15 \text{ m}^3/\text{s}$) exceeds that of all the other streams located in the upper Lloqueta drainage basin.
5. The Apacheta's length up to its confluence with the Carhuasanta totals 7,994 meters, while the length of the latter, calculated from the foot of the morphologic scarp where a non-concentrated water outflow occurs on a rocky slope, equals 7,303 metres.
6. The relief of the Apacheta valley is a more clearly formed and carved riverbed. The carving of the valley indicates the river's elongation at the place of its estuary leading to Lloqueta
7. Apacheta's lesser gradient in longitudinal profile is indicative of its greater importance.
8. Apacheta's basin is better developed (more tributaries) and higher hydrological activity (relative flow-through, expressed in liters/sec./ km^2 of the basin).
9. A significant factor is also that it was the Apacheta Valley that constituted a historical communication route of the Incas through the main watershed.
10. The research was conducted during the most suitable period, i.e. the dry season. Quechuas living in this area confirm that the Apacheta carries water during the whole year and that it

- was like this as far as their memory reaches.
11. In light of the above data, it is assumed that the Apacheta is the headwater of the Amazon River. Other popular theories related to the origins of the Amazon River have no scientific substantiation, as they are limited by too narrow criteria, inadequate to hydrologic requirements.
 12. On the basis of long-term analysis carried out in the Instituto Nacional de Pesquisas Espaciais (National Institute for Space Research) in São José dos Campos, Brazil, the overall length of the Amazon, from the source (the Apacheta) to the estuary, was determined as about 7,040 kilometres, which makes it roughly 200 kilometres longer than the Nile.
 13. Since the water cycle in a river network is the most dynamic element of the natural environment, the conclusions refer to the present situation only, and it is not impossible to rule out their possible future modifications.

The findings concerning the location of the source of the Amazon cannot be officially registered, as is the case with any other geographic discovery. In simple terms, in the world there is no “patent office” for geographic discoveries, where an author could register his or her project and expect it to be internationally protected as his/her property. Geographic discoveries, which reveal facts that have been unknown to the public at large but existed since the dawn of time, are not subject to such a procedure.

Science tends to be hermetic when it comes to discoveries. Each new scientific truth disturbs the orderly world of knowledge, with its deeply entrenched orthodox views. It is like a transatlantic liner – it needs a long time to change its course, and thus, before a new idea becomes a widely-accepted standard, it needs to take root in the popular consciousness. The German physicist and founding father of quantum physics, Max Planck, described the process as a sluggish one, arguing that “a scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it”.