

Alfarcito Area, Tilcara, Eastern Cordillera of Jujuy

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Stop 1. Garganta del Diablo (Devil's Gorge).

The deep fluvial incision worked by the Huasamayo River, located immediately to the south of Tilcara, is known as the "Garganta del Diablo" (Figure 5). The Huasamayo River is born in the Tilcara High to 4.300 m altitude, it crosses the Tilcara and Alfarcito ranges, and after 12 km it ends up in the Grande River, which is located at 2.500 m. The arid conditions of the area, just by 136 mm annual precipitations, are added to the steep slope; consequently, intense weathering and erosive processes occur. Main rains take place during the summer, season when discharges of the Huasamayo River can be catastrophic (making honor to its name: in Quechua language, Huasamayo means torrential river). The Huasamayo river crosses over basement rocks of the Mesón Group, the Salta Group, the Maimará Formation, and quaternary deposits of the alluvial fan that it finally dissects.

The planned walk will be carried out through a cornice way that goes across the Alfarcito range, and will allow us to see the rock succession previously described.

First view. Recent tectonic evidence. An inverse fault caused the thrust of Tertiary deposits (Maimará Formation) over Quaternary fans that are being dissected by the Huasamayo River.

Second view. The Tilcara unconformity. In fact, the Huasamayo river is the type area where this unconformity was defined.

Third view. It will be referred to the geologic features that are exposed in the Huichaira creek, on the western edge of the Grande river, just in front of the Huasamayo River.

Stop 2. Alfarcito area.

The Alfarcito area is located between the Alfarcito hills and the Tilcara range, in the Eastern Cordillera, to the East of Tilcara City, 85 km to the North of San Salvador de Jujuy City (Figure 28). In this locality, Harrington and Leanza (1957) defined an Ordovician sequence composed of the Casa Colorada, Alfarcito, and Rupasca formations. This sequence is crossed over by three rivers (the Casa Colorada, Rupasca, and San Gregorio creeks) that join into the Huasamayo river, which in turn drains into the Grande river (Quebrada de Humahuaca). Other studies in this area were carried out by Daniel (1940), López and Nullo (1969), Moya (1988), Zeballo (2002), and Zeballo *et al.* (2003).

The Casa Colorada, Alfarcito, and Rupasca formations are made up of mostly siliciclastic rocks with interbedded limestones in the middle part of the sequence, which correlate with the Santa Rosita Formation (Turner, 1960) originally defined at Santa Victoria area in the northern Eastern Cordillera (Figure 29). The Ordovician sequence (over 700 m thick) overlies to the Puncoviscana Formation (Precambrian–Eocambrian), which is the basement of the sedimentary column, and Mesón Group (Upper Cambrian). Ordovician rocks are underlying by Cretaceous–Tertiary units of the Salta Group, and Tertiary and Quaternary succession (Chaco Formation and recent deposits).

The Casa Colorada Formation contains conglomerate and micaceous sandstone beds in the basal part (López & Nullo, 1969), which are succeeded by black and green shales with trilobites: *Parabolina* (N.) *frequens argentina* (Kayser), *Onychopyge* sp., and *Parabolinella argentinensis* Kobayashi (Figure 30). The age of the formation is considered late Late Cambrian – Early Ordovician (Early Tremadocian). The heterolithic succession of the Alfarcito Formation conformably overlies the Casa Colorada Formation. The lower sandy part of this unit is bioturbated and shows *Skolithos* isp. In the upper part of this unit occur calcarenite layers, which yielded *Kainella meridionalis* Kobayashi (Harrington & Leanza, 1957), and conodonts of the *Cordylodus angulatus* Zone (late Early to early Late Tremadocian). The fauna contains *Cordylodus angulatus* Pander, *C. intermedius* Furnish, *Iapetognathus* sp., *Drepanodus arcuatus* Pander, *D?* sp. cf. *D. concavus* (Branson & Mehl), *Teridontus nakamurai* (Nogami), *T. obesus* Ji & Barnes, *Rosodus tennis* (Miller), ?*R. manitouensis* Repetski & Ethington, *Utahconus utabensis* (Miller), *Phakelodus elongatus* (An), and *Monocostodus sevierensis* (Miller). Graptolites referred to as *Rhabdinopora flabelliformis flabelliformis* (Eichwald) were recorded in the sandy upper levels (preserved on ripple marks bedding plane surfaces). Only a few proximal ends and young rhabdosomes have been found in the studied collection suggesting that the fauna is current sorted (Figure 31). Nematic structures (three–vaned) are present in most mature specimens (Zeballo, 2002).

The black to gray shales of the Rupasca Formation conformably overlies this sequence, indicating the beginning of a transgressive cycle. Trilobites are frequent in this unit. The occurrence of *K. meridionalis* is recorded in the basal strata of the Rupasca Formation suggesting the presence of the upper part of the homonymous biozone. The assemblage is composed by *Hapalopleura clavata* Harrington & Leanza, *Gymnagnostus* n. sp. A, and *Leptoplastides marianus* (Hoek), among others. Immediately above, trilobites of the *Bienwillia tretragonalis* – *Conophrys minutula* Zone range throughout most of the formation. *Peltocare norvegicum* (Moberg & Möller) was found in the lower part of this biozone, together with *Geragnostus lepidus* Tjernvik, *Pseudokainella keideli* Harrington, and *Pharostomina trapezoidalis* (Harrington). A conodont fauna corresponding to the *Paltodus deltifer* Zone (*P. deltifer pristinus* Subzone), present in the lower to middle part of the formation, indicates an early Late Tremadocian age for the bearer strata. The conodont assemblage is composed by *P. deltifer pristinus* (Viira), *P.* sp. cf. *P. subaequalis* (Pander), *Variabiloconus variabilis* (Lindström), *Phakelodus elongatus* (An), and *Coelocerodontus* sp., among others.

The lithostratigraphic and taphonomic characteristics of the Ordovician sequence suggest euxinic conditions in an outer shelf, at the base of the sequence, with shallowing features in an intertidal environment in the Alfarcito Formation and a subsequent deepening of the basin in the Rupasca Formation. The faunas correspond to the cold–temperate paleobiogeographic domains (Albanesi *et al.*, 2001).

Stop 3. Pucará of Tilcara (Tilcara Fort).

The Pucará of Tilcara is the bastion of the Omahuaca Nation, which presented the biggest resistance to Spanish conquerors. This Pucará was the last refuge of the Omahuaca Nation, where native rebels under the Cacique Viltipoco's control died by the conquerors in 1594. After that episode a new history began between races, which is written with hate, love and forgetfulness.

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