



## Short population report

## HLA in Colombia Wayu from Guajira Peninsula Amerindians: Pacific Ocean relationships

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## ABSTRACT

Wayu Amerindians live around Guajira Peninsula shared by Colombia and Venezuela. Wayu from Colombia have been studied for their HLA profile and these data put in context with both genetic and cultural relatedness to Pacific Islanders.

HLA-A\*24 and HLA-B\*35 (most likely HLA-A\*24:02 and HLA-B\*35:05) and HLA-DRB1\*04:03 and HLA-DQB1\*03:02 are shared both by Wayu and other Amerindians and Pacific Islanders in specific high frequency. Our findings further suggest a genetic relationship between Amerindians (also Wiwa/Arsario and Chimila from Colombia; Uros from Peru) and Pacific Islanders. Titikaka Lake (Peru/Bolivia) Amerindians (Aymara, Uros and Quechua) share also cultural traits, like Tiwanaku (Titikaka Culture giant statues) and Easter Island Culture giant statues or “Moais”.

It has been established that more than one wave of people gave rise to the American Indians (American First Inhabitants or Amerindians) [1,2]. It was put forward a theory that American Indians came from Asia through a Bering land bridge 30,000–6,000 years ago in three waves [3], but the most ancient human settlements recorded have been found in South and not North America (Monteverde, Chile; Pedra Furada, Brazil). However, recent evidences of human settlement have been found in North America (California) 130,000 years before present [4], i.e.: peopling of Americas pathways are nowadays recognized to have been complex, more ancient and not only accomplished through Bering Strait from Siberia but also from Pacific and Atlantic Oceans [5–8]. Even concept of “American Peopling” now assimilated to “New World Peopling” is misleading since it implies that America was previously not populated by man comparatively to Eurasia [1,2], which is not supported by evidences. Indeed, we have already concluded from

our previous studies on HLA genes that: 1 – First America Natives, have had genetic flow with Pacific Islanders: the latter share high frequency autosomal HLA alleles and haplotypes with them. This fact may have been bidirectional [2,6], 2 – more important, Easter Islanders show a probable cultural and genetic exchange with Titikaka Lake Aymara and Uros Amerindians (Tiwanaku culture) [6,9]; this civilization also shares specific traits with European-Iberian megalithic builders [8], and also, 3 – a two-way Trans-Atlantic traffic may have occurred before Columbus discovered America; archaeologists in New Mexico and other North America places have recently found tools used 20,000 years ago in Spanish Solutrean culture [5,7,8]. This present study also contributes with significant information about the complex America peopling.

Wayu Amerindians are primarily established in Guajira Peninsula, both Colombian and Venezuelan part [10]; this area is placed East and Southeast of Sierra Nevada de Santa Marta (Fig. 1 from Supplementary

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Material). They call themselves Wayu, live in small familial groups scattered throughout arid Guajira Peninsula around water wells [10]. They have a matrilineal endogamic group organization [10]. During the dry season, many Wayu cross border to Maracaibo (Venezuela) to work, but they usually come back in the rainy season [10]. They speak an Arawak language named Wayuunaiki [10] (<http://www.etniasdecolumbia.org/indigenas/wayu.asp>).

Forty-eight healthy, unrelated individuals from the Guajira Department in Colombia, belonging to the isolated Wayu ethnic group were used for HLA typing and phylogenetic calculations. Each individual from this population was born in this Guajira Department and their 4 grandparents had also been born there. The sample size is relatively small but is adequate for isolated populations [10]. They were blood donors that signed a written consent.

Generic HLA class I typing (-A and -B) and high-resolution class II (-DRB1 and -DQB1) typing was performed by using PCR-SSOP Luminex technique and ambiguities were resolved by direct DNA sequencing. Statistical analysis was performed with Arlequin v3.0 [11,12].

Six different HLA-A alleles and fourteen different HLA-B alleles have been found in Wayu. However, only four HLA-A alleles and five HLA-B alleles have frequencies higher than 4% (A\*02, A\*24 (most likely A\*24:02 [12]), A\*31, A\*68, B\*15, B\*35 (most likely B\*35:05 [12]), B\*39, B\*40, B\*51) (Table 1 from Supplementary Material). Also, twelve different HLA-DRB1 alleles have been characterized, five of which have frequencies higher than 4% (DRB1\*04:03, DRB1\*04:07, DRB1\*04:11, DRB1\*08:02, DRB1\*16:02) (Table 1 from Supplementary Material). Finally, six HLA-DQB1 alleles have been found, three of them (DQB1\*03:01, DQB1\*03:02, DQB1\*04:02) have frequencies higher than 4% and add up to a frequency over 90% (Table 1 from Supplementary Material). The extended HLA haplotypes (A-B-DRB1-DQB1) found in Wayu are depicted in Table 2 from Supplementary Material. Within the 10 most frequent extended haplotypes, the class II haplotype two loci HLA-DRB1\*04:03-DQB1\*03:02 is present in three of the most frequent extended haplotypes (in combination with A\*24-B\*51, A\*68-B\*15 and A\*24-B\*35) and accounts for approximately 16.5% of all haplotypes. This two-loci haplotype is also present in high frequency in Pacific Islanders [6,9]. HLA-DRB1\*16:02-DQB1\*03:01 is present in combination with A\*02-B\*15. These haplotypes have been found in high frequency in other Amerindians (Table 2 from Supplementary Material) [10].

Most frequent HLA-A alleles are: A\*02, A\*24, A\*29, A\*31, A\*68 and most frequent HLA-B alleles are: B\*15, B\*35, B\*39, B\*40, B\*51. Some of these typical high frequency Amerindian alleles are present in very low frequency in Asians, Australian and Pacific Islanders [6,12]; this may suggest existence of gene flow between these populations and Amerindians. Moreover, HLA-A\*24:02 allele has been found specifically in high frequency in different South Pacific and Amerindian populations like Taiwan, New Zealand, Papua New Guinea, Samoa and South America Amerindian populations [12]. Particularly, Wayu high frequency alleles are also shared with Pacific Islanders: A\*24, B\*35, DRB1\*04:03 and DQB1\*03:02. Thus, the peopling of Americas may have occurred through the southern and northern both Pacific and Atlantic coasts and not only through Beringia [5,6,7,8,12].

Even though it is widely believed that Pacific Isles population had spread from southern China/Taiwan (5,000 years BP), traveling through Melanesia (North and East Australia), Tonga and Samoa and, finally, arriving to Easter Island (1,000 CE) [6], there are evidences that indicate some kind of relationship with South American Amerindians. These evidences include the fact that bottle gourd and sweet potato were cultivated in Easter Island and South America before Europeans

arrived to Easter Island at the end of 18th century, linguistic and other cultural traits [6,9]. Cultural evidences, such as the similarities between the giant stone statues in Titikaka lake (like Monolito Ponce, Monolito Fraile and Monolito Bennet, from Tiwanaku culture) and the statues in Easter Island “Moais”, strengthen the hypothesis of a cultural flow between Easter Islanders and South Americans [6,9]. E. Thorsby using HLA and other genetic markers suggested prehistoric Amerindian/Easter Islanders contact [6]. Thor Heyerdahl route demonstrated in his project that from Callao harbour (Peru), where he sailed the Kon-Tiki raft through the Pacific currents, to the West, that people from Tiwanaku area (Titikaka Lake) could actually travel between the Pacific Isles, including Easter Island [13].

All genotype data included in this paper is held in [www.allelefreqencies.net](http://www.allelefreqencies.net) and identifier number is 3567 [14].

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.humimm.2018.12.003>.

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