

Y-chromosome Genotyping and Genetic Structure of Zhuang Populations

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Abstract: Zhuang, the largest ethnic minority population in China, is one of the descendant groups of the ancient Bai-Yue. Linguistically, Zhuang languages are grouped into northern and southern dialects. To characterize its genetic structure, 13 East Asian-specific Y-chromosome biallelic markers and 7 Y-chromosome short tandem repeat (STR) markers were used to infer the haplogroups of Zhuang populations. Our results showed that O*, O2a, and O1 are the predominant haplogroups in Zhuang. Frequency distribution and principal component analysis showed that Zhuang was closely related to groups of Bai-Yue origin and therefore was likely to be the descendant of Bai-Yue. The results of principal component analysis and hierarchical clustering analysis contradicted the linguistically derived north-south division. Interestingly, a west-east clinal trend of haplotype frequency changes was observed, which was supported by AMOVA analysis that showed that between-population variance of east-west division was larger than that of north-south division. O* network suggested that the Hongshuihe branch was the center of Zhuang. Our study suggests that there are three major components in Zhuang. The O* and O2a constituted the original component; later, O1 was brought into Zhuang, especially eastern Zhuang; and finally, northern Han population brought O3 into the Zhuang populations.

Key words: Y chromosome; Zhuang; internal genetic structure

The nonrecombining portion of the human Y-chromosome (NRY), which is paternally inherited and does not undergo recombination during cell division, is prone to form population-specific polymorphisms. In addition, single nucleotide polymorphisms (SNP) on the Y-chromosome, which has a lower probability of recurrent mutations and higher reliability, are more group- and area-specific and can record more accurately human historical migrations and evolutionary events, a quality because of which they are rapidly being accepted as one of the most effective

markers for studying human evolution and origin^[1,2]. Using the techniques of denaturing high-performance liquid chromatography (DHPLC) and single-stranded conformation polymorphism (SSCP), Underhill *et al.*^[1,2] have investigated several Y-chromosome biallelic markers from populations worldwide in the past and constructed 131 Y-haplogroups and mapped human evolution genealogy. In Asia, on the basis of 19 East Asian-specific polymorphic markers on the Y-chromosome, Su *et al.*^[3,4] established 17 Y-haplogroups, 7 of which were specific to

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the East Asian population. By clearly tracing the paternal migration route in East Asia and the Pacific Region, Su *et al.* found that the South-Asian group had more Y-haplogroups compared with the North-Asian group, indicating that the East Asians originated from the south. On the basis of the data of Su *et al.*, Li *et al.*^[5,6] studied dozens of ethnic groups in southern China using these Y-SNP markers and explained their origin, migration, mixture, and evolution, thereby adding important genetic information and evidence to the origin of these groups.

With a population of more than 16 million, Zhuang is China's largest minority population, with 94% of its population living in the Guangxi autonomous region. The Zhuang language belongs to the Kam-Tai linguistic family, the Tai-Kadai sublinguistic family, and the Tai-Sek branch^[7], which can be subclassified into Southern and Northern dialects bounded by Yongjiang River (for details on the distribution of the Zhuang branches, see Fig. 1). It should be noted that the Bouyei ethnic group in the Guizhou Province actually belongs to the same popu-

lation as Zhuang, as shown by their language and culture, and the so-called Shui Hu in the Yunnan Province, which is completely different from Shui people in Guizhou, is in fact Bouyei. Therefore, all of these ethnic groups are considered Zhuang academically. Unfortunately, the Zhuang population does not have its own written script and has to use Han characters to record events historically, and these records might be incomplete. On the basis of the few available historical records, Zhuang can be traced back to the 'Luo-Yue' and 'Xi'ou' groups, 2000 years ago^[7]. However, the origin of Zhuang might be more complicated than expected because Zhuang might have experienced complex evolution and migration and to a great extent, may have a close relationship with the origin of Thai and Lao in southeast Asia. At the same time, Zhuang might be mixed with other surrounding ethnic groups, especially with Han. Therefore, many questions emerge: what is the exact origin of Zhuang? Is there any genetic evidence to support their historical migration events? Is it reasonable to classify Zhuang into South and North groups just

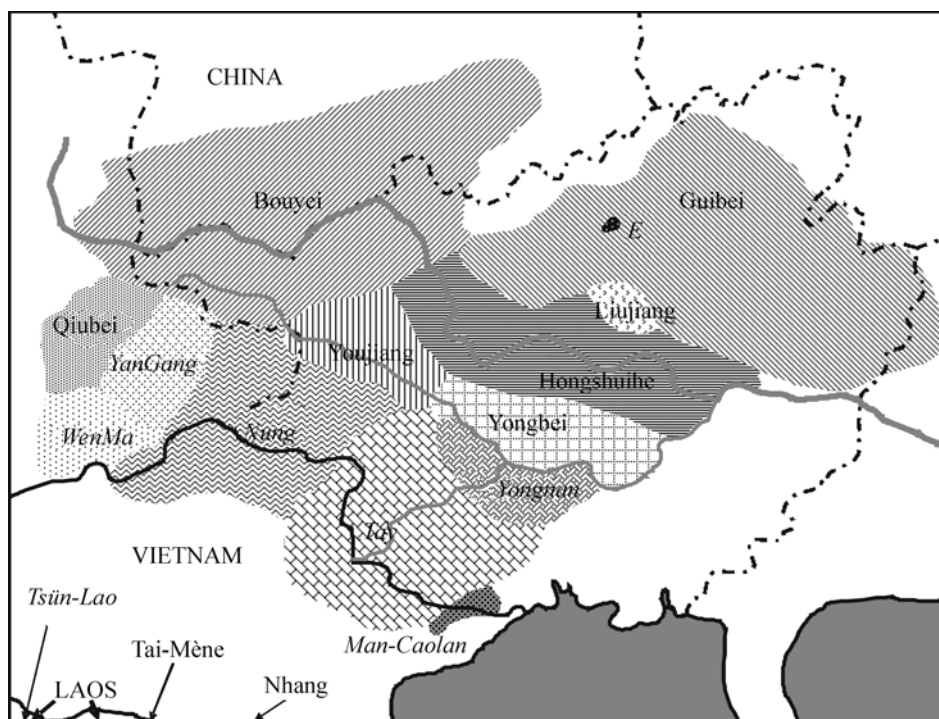


Fig. 1 Distribution of Zhuang branches

North Zhuang dialect group: Guibei, Liujiang, Hongshuihe, Yongbei, Youjiang, Bouyei, Qiubei, Nhang, Tai-Mène. South Zhuang dialect group: Yongnan, Tày, Man-Caolan, Nung, YanGuang, WenMa, E (Wuse), Tsün-Lao.

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