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## HOLOCENE VARIATIONS OF THE YANZIGOU GLACIER (GONGGA SHAN MASSIF, DA XUESHAN, CHINA) (\*\*)

**ABSTRACT:** SMIRAGLIA C., *Holocene variations of the Yanzigou Glacier (Gongga Shan Massif, Da Xueshan, China)*. (IT ISSN 0391-9838, 1997).

Extending from the Sichuan basin to the Tibetan Plateau in the Da Xueshan Mountains, the Gongga Shan is the highest massif (7514 m) in China east of the Himalaya and also one of the principal glaciated areas (255 km<sup>2</sup>) controlled by a monsoon climate. Geomorphological and historical research was carried out on the Yanzigou Glacier, which is located on the eastern slope and is one of the longest ice bodies on the massif. The objective of this research was to reconstruct Holocene fluctuations. Many end and lateral moraines were identified, some of which are completely covered with vegetation, while others are only partially covered with grass. The moraines were attributed to Little Ice Age advances and to 20<sup>th</sup>-century fluctuations of the glaciers, respectively. Many layers of organic material (wood, soil, peat) were observed in the highly eroded inner wall of a right lateral moraine at about 3900 m a.s.l., consisting of a complex of superposed debris units. The radiocarbon dating of samples indicated at least six periods of glacier expansion prior to the Little Ice Age, between 4000 years BP to 700 years BP, as well as two glacier advances during the Little Ice Age. For the past 100 years, the Yanzigou Glacier has been in a phase of retreat (for a total of about 4 km), except for a short period of stability in the early 1980's. At the point of the glacier's maximum extension in the Little Ice Age, the equilibrium line altitude was situated at about 4920 m, 180 m below the current one.

**KEY WORDS:** Glacial variations, Holocene, Yanzigou Glacier, Gongga Shan, China.

**RIASSUNTO:** SMIRAGLIA C., *Le variazioni oloceniche del Ghiacciaio Yanzigou nel Massiccio del Gongga Shan (Da Xueshan, Cina)*. (IT ISSN 0391-9838, 1997).

Il Gongga Shan, che si estende nei monti del Da Xueshan fra l'altopiano tibetano e il bacino del Sichuan, è il più elevato massiccio montuoso cinese (7514 m nella cima omonima) ad Est dell'Himalaya e costituisce anche una delle principali aree glacializzate (255 km<sup>2</sup>) controllate dal clima monsonico. Sul Ghiacciaio Yanzigou, situato sul versante orientale, uno dei più lunghi apparati glaciali del massiccio, sono stati condotti studi geomorfologici e ricerche storiche per ricostruire le sue fluttuazioni oloceniche. Sono stati identificati numerosi complessi di morene frontali e laterali, completamente ricoperte di vegetazione o solo parzialmente inerbite, che sono state attribuite rispettivamente alle avanzate della Piccola Glaciazione e alle fluttuazioni del XX secolo. A circa 3900 m, sul versante interno profondamente eroso di una morena laterale di sovrapposizione, formata da numerose unità di *till*, sono stati osservati molti strati contenenti materiali organici (legni, suoli, torbe). La datazione dei campioni al radiocarbonio indica almeno sei periodi di espansione glaciale prima della Piccola Glaciazione, fra 4000 e 700 anni BP, e almeno due avanzate glaciali durante la Piccola Glaciazione. Durante gli ultimi 100 anni il Ghiacciaio Yanzigou è costantemente arretrato per un totale di circa 4 km, se si eccettua un breve periodo di stazionarietà all'inizio degli Anni Ottanta. Durante la massima estensione della Piccola Glaciazione la linea di equilibrio era situato a circa 4920 m, 180 m al di sotto del limite attuale.

**TERMINI CHIAVE:** Variazioni glaciali, Olocene, Ghiacciaio Yanzigou, Gongga Shan, China.

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### 1. INTRODUCTION

The Gongga Shan area (from the Tibetan word, *gong* = ice and the Chinese word, *shan* = mountain; also called *Minya Gongkar* in Heim, 1936; *Minya Konka* in Imhof, 1974; *Gongga Shan* on official Chinese maps, such as those found in the *Atlas of the People's Republic of China*, 1989) is certainly one of the areas most unfamiliar to the western world from the geographical point of view, but also in terms of its glaciological features. The Gongga Massif is located in the central area of the Da Xueshan mountains, between the Sichuan basin to the east and the northeastern sector of the Tibetan Plateau to the west. It extends north to south for a length of 80 km and a width ranging from 15 to 40 km, constituting one of the largest glaciated areas in a monsoon climate. The highest peak, which lends its name to the massif