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Historical evolution and Middle to Late Holocene environmental changes in Lake Shkodra (Albania): New evidences from micropaleontological analysis

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ABSTRACT

The 7.5 m long SK13 sediment core, drilled at Lake Shkodra (Albania) at a bottom depth of 7 m in the central southern part of the lake, was selected for multidisciplinary analysis. The sediment core age spans from 4560 cal yr BP to present. The origin and the evolution of the lake are still debated and were never investigated in detail. In historical records, until the 15th century Lake Shkodra was never mentioned as such, but as a marshland or as a confluence between two rivers. Our research aims to reconstruct the past biodiversity and the Middle-Late Holocene palaeoenvironmental and palaeoclimatic changes using Ostracods, Characeae, and comparing the micropaleontological data with pollens and stable isotope curves. Thirteen ostracod and five charophyte species were identified. Amongst the ostracods *Candona montenigrina* and *Limnocythere scutariense* are endemic of the lake; *Candona meridionalis*, *Paralimnocythere georgevitschi*, *Metacypris cordata*, *Candona* ex gr. *bimucronata*, and *Cyclocypris* sp. have been collected for the first time in Lake Shkodra; the last three taxa occurred only in the lower portion of the sediment core. Amongst the charophytes, *Lychnothamnus barbatus* and *Nitella hyalina* are recorded for the first time in the lake and occurs with high frequency throughout the lower portion of the core. A drastic change occurs between 1274 and 1197 cal yr BP, when 8 ostracod species out of 13 and all charophytes disappear, and the frequency of the remaining 5 species dramatically increases. The micropaleontological data suggest a decrease of the lake biodiversity since around 1200 cal yr BP linked to the transition between an ancient marshland to a lacustrine environment. This drastic event seems to be independent from any global or local climate change but linked to the complex hydrographic setting of the lake and of its only outlet, the River Bojana, discharging in the Adriatic Sea.

1. Introduction

Amongst the Balkans lakes, Lake Shkodra (Shkodër, Skadar or Scutari) covers the largest area, shared between Albania and Montenegro, the boundary between these two nations crossing the southern part of the lake (Fig. 1). The investigations about the limnology and biodiversity of Shkodra started already in 1972, when the former Yugoslavia, USA and the Smithsonian Institution of Washington organised 5 yrs of survey. These researches led to the publication of "The Biota and Limnology of Lake Skadar" (Karaman and Beton, 1981), a volume still providing fundamental information about the lake. More recently, several EU, World Bank and GEF projects were focussing on the modern hydrology (Radulović, 1997a,1997b; Boskovic et al., 2004; World Bank, 2006; APAWA, CETI, SNV, 2007) and the biodiversity of the lake (Pulevic et al., 2001). Hosting a high percentage of endemic taxa and being an important place of rest for migratory birds, the lake is subject to different degrees of environmental protection. The 40,000 ha of the Montenegrin side have been declared as National

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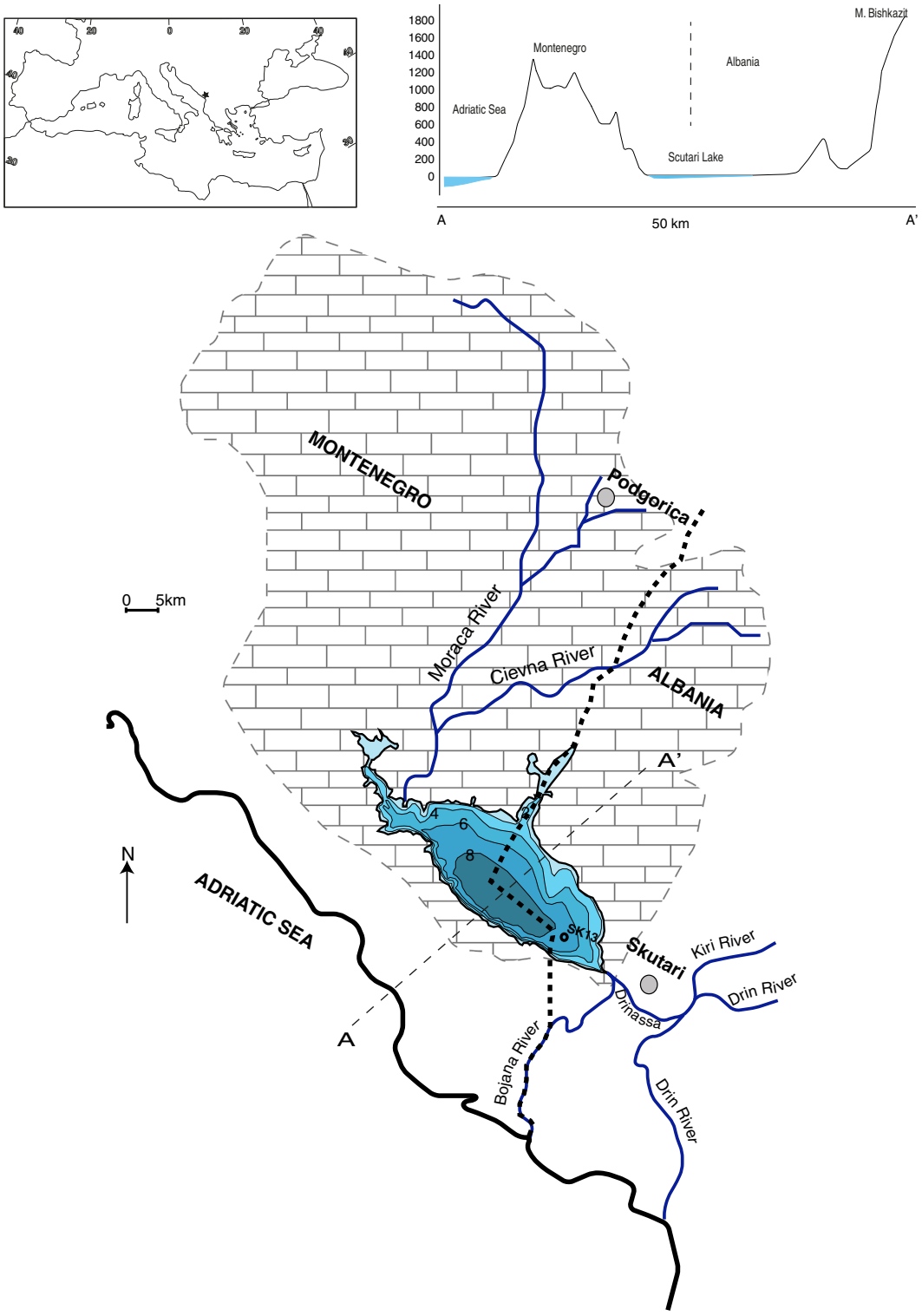

Fig. 1. Location map of Lake Scutari (simplified lithology, hydrology and catchment area modified after van Welden et al., 2008 and Karaman and Beeton, 1981). The black empty circle indicates the position of the SK13 sediment core. The topographic profile is drawn along section A–A′.

Park in 1983 and the lake has been designated as Ramsar site in 1995. The Albanian side of the lake has been declared "Managed Natural Reserve" in 2005. Notwithstanding these actions, the geological origin and the Holocene evolution of Lake Shkodra are still unclear (Boskovic et al., 2004), affecting the estimates of biodiversity loss and the identification of recurrent hazards.

In 2003, several cores were drilled in the soft Holocene sediment fill on the Albanian side of the lake (Van Welden et al., 2008) with the aim to detect palaeoseismic events in the sediment archive. More recently, the tephrostratigraphy of two of the longest cores was investigated (Sulpizio et al., 2009) providing good chronological constraints and age models and a palaeoclimate reconstruction was proposed based on the stable isotopes and pollen data from core SK13 (Sadori et al., 2012; Zanchetta et al., 2012).

Our research aims to fill the gap about the changes in the biodiversity and the palaeoenvironmental evolution of Lake Shkodra during the