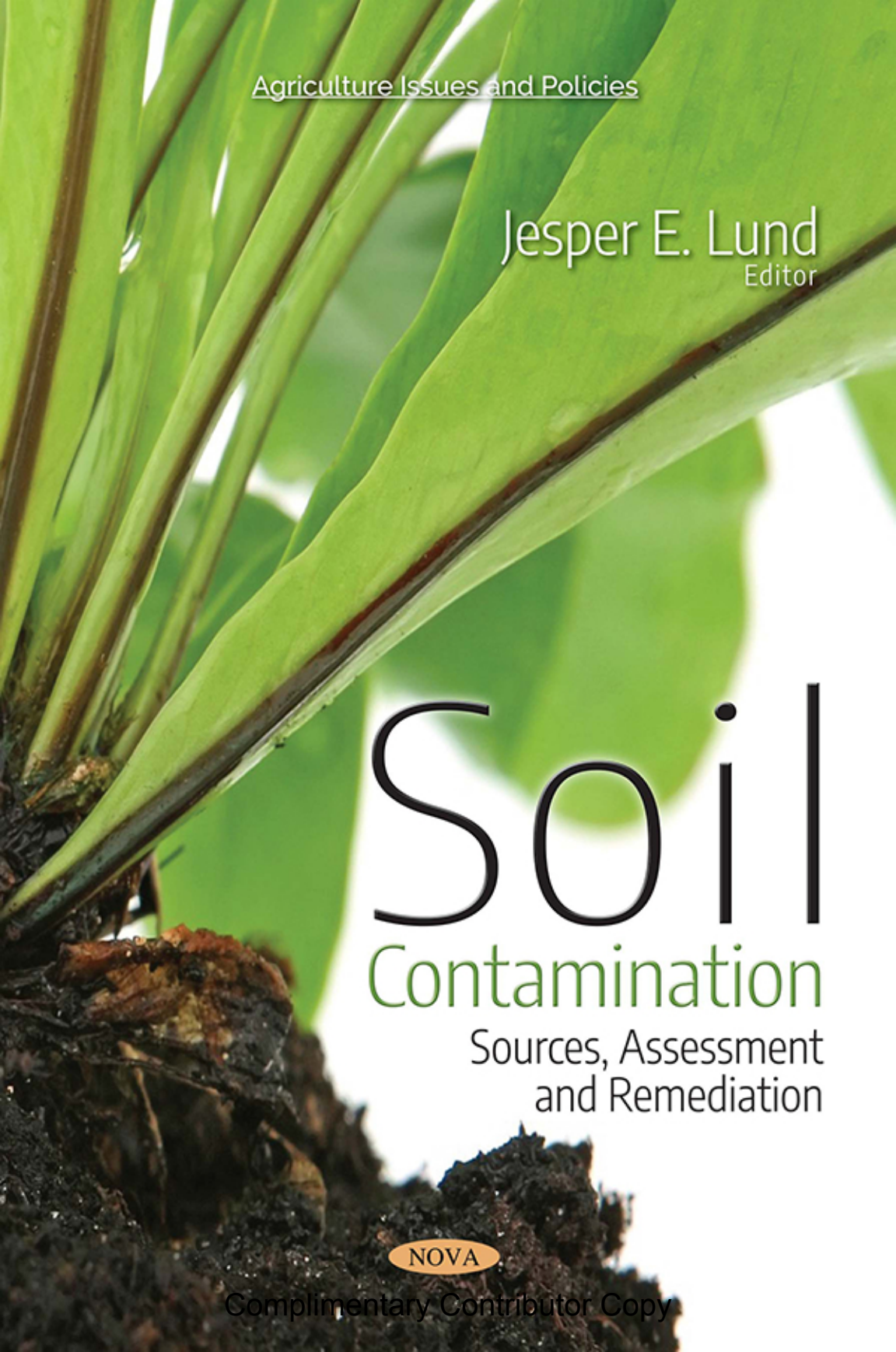

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Chapter 2

MONITORING THE POLYMETALLIC GEOCHEMISTRY OF SOIL ALONG THE KRIVA REKA RIVER BASIN DUE TO THE ANTHROPOGENIC IMPACT OF THE PB-ZN TORANICA MINE

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ABSTRACT

Anthropogenic activities related to the exploitation of natural resources, technological processing and waste management represent a global problem of environment pollution. Previous studies have shown that certain areas in the territory of the Republic of Macedonia are affected by the anthropogenic introduction of high levels of different chemical elements into the soil. The area in the vicinity of the Toranica lead-zinc mine near the town of Kriva Palanka, eastern Macedonia, was examined regarding the lithogenic and anthropogenic distribution of 17 elements (Al, As, Ba, Ca, Cr, Cu, Fe, K, Li, Mg, Mn, Na, Ni, Pb, Sr, V and Zn). Alluvial soil samples (sediments and fluvisol) and automorphic soil samples (from the topsoil) were collected from the Kriva Reka River basin. The elemental contents were determined by atomic emission spectrometry with inductively coupled plasma (ICP-AES). Data processing was applied with combinations of multivariate statistical methods (factor analysis, principal component analysis and cluster analysis). The summary data for automorphic soil (topsoil and subsoil samples) reveal strong correlations between the elemental distribution in topsoil samples vs. subsoil samples along the Kriva Reka River. Anthropogenic impacts were observed in Zone 1 (the area affected by hydrothermal Pb-Zn exploitation). The soil surface layer was affected by enrichment with As, Mn, Pb and Zn (220, 3400, 1700 and 1100 mg/kg, respectively). Regression analysis revealed significant correlations for Cr, Ni, Pb and Zn in topsoil vs. subsoil (r: 0.92, 0.90, 0.91 and 0.95, respectively).

Keywords: chemical elements, toxic metals, monitoring, soil, environmental pollution, Kriva Reka River basin, Republic of Macedonia

1. INTRODUCTION

The emissions of metals into the environment occurs *via* a wide range of processes and pathways, including into the air (e.g., during combustion, extraction and processing), to surface waters (*via* runoff and releases from storage and transport) and to the soil (and hence into groundwater and crops) (Athar and Vohora, 1995; Dudka and Adriano, 1997; Agarwal et al., 2009; Acton 2013). The distribution of certain chemical elements, which at