CONCORSO PUBBLICO, PER ESAMI, A N. 1 POSTO DI CATEGORIA D, POSIZIONE ECONOMICA D1, AREA TECNICA, TECNICO-SCIENTIFICA ED ELABORAZIONE DATI, PER LE ESIGENZE DEL CENTRO DI RICERCA INTERDIPARTIMENTALE SULLA "EARTH CRITICAL ZONE" PER IL SUPPORTO ALLA GESTIONE DEL PAESAGGIO E DELL'AGROAMBIENTE (C.R.I.S.P.) DELL'UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II (COD. RIF. 2015), INDETTO CON DECRETO DEL DIRETTORE GENERALE N. 468 DEL 09.07.2020.

QUESTI <u>NON ESTRATTI</u> ALLA PROVA ORALE DEL 7.10.2020 SUDDIVISI PER ARGOMENTO

A) PROCEDURE PER LA COSTRUZIONE E ALLESTIMENTO DI SISTEMI WEBGIS OPEN SOURCE PER IL SUOLO E PER IL PAESAGGIO AGRARIO, CHE INCLUDANO APPLICAZIONI QUALI GEOSERVER, QGIS ARCGIS, ECOGNITION, OLTRE ALLE APPLICAZIONI INFORMATICHE PIÙ DIFFUSE, CON PARTICOLARE RIFERIMENTO AI SOFTWARE APPLICATIVI DELLA SUITE MS OFFICE (WORD, EXCEL, POWERPOINT) E DEI SISTEMI OPERATIVI WINDOWS

- Il candidato descriva una procedura per l'implementazione di un webgis per fini partecipativi (ad es. participatory planning)
- Il candidato descriva le procedure per l'allestimento di un WEBGIS da utilizzare per aggiornare banche dati (ad es. di profili di suolo)

B) POTENZIALITÀ E LIMITI DEI SISTEMI GEOSPAZIALI WEB DI SUPPORTO ALLE DECISIONI PER IL SUOLO, PER IL PAESAGGIO AGRARIO E PER L'AGROAMBIENTE

- Il candidato analizzi le potenzialità dei sistemi geospaziali web di supporto alle decisioni per le minacce del suolo
- Il candidato descriva le prospettive future nell'uso dei sistemi geospaziali web di supporto alle decisioni

C) IMPORTANZA DEL SUOLO, DELLE CONOSCENZE DI PEDOLOGIA APPLICATA E DELL'EARTH CRITICAL ZONE PER LA GESTIONE DELLE PROBLEMATICHE AGROAMBIENTALI

- Il candidato descriva l'importanza del suolo nel garantire i servizi ecosistemici di protezione degli acquiferi
- Il candidato descriva l'importanza del suolo e dell'Earth Critical Zone nella gestione degli ecosistemi forestali

D) PROCESSAMENTO GIS ED ELABORAZIONE IMMAGINI DA SATELLITE

- Il candidato descriva le procedure GIS per la realizzazione di una generica land suitability
- Il candidato descriva le procedure per il calcolo di indici di vegetazione (ad es. NDVI, EVI) partendo da immagini satellitari

Per ordine del Presidente della Commissione
Il Segretario
F.to dott.ssa Claudia Chiantese

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Micromorphology of soils and palaeosoils in Belgium. An inventory and meta-analysis

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ABSTRACT

A study of the literature dealing with micromorphology of Belgian soils and palaeosoils is presented. Most soils in Belgium developed in Quaternary covers, sandy in the north, becoming more silty towards the south, and mixed with more or less important amounts of substrate material. In addition, azonal soils occur in the recent dunes, the marine Polders and the alluvial areas. The main pedogenic micromorphological characteristics are bioturbation, clay illuviation features in the more silty materials, and spodic features in the more sandy materials. Glauconite plays an important role in pedogenesis. Throughout most profiles, features related to a subrecent pedogenic environment are recognised, pointing to polygenetic soil formation. Impact of periglacial conditions is often visible. Bog ores in alluvial plains have a complex mineralogical composition and microfabric. Buried palaeosoils and soil sediments are discussed separately according to their age whereas polygenetic soils are treated together with the recent soils according to their geographic position. For some areas, e.g., the Polders, the sandy area of Flanders and the Pays de Gaume in the southernmost part of Belgium, only little micromorphological information is available. Most soils studied were situated under natural vegetation; studies of cultivated soils are rather rare.

1. Introduction

Notwithstanding the fact that Belgium was one of the first European countries to complete a detailed soil map, no systematic micromorphological survey of its soils was conducted and some soil types were never studied from this point of view. The first micromorphological analyses of Belgian soils date back to the end of the 1950's. At the *Institut Agronomique de l'Etat de Gembloux*, now the Faculty of Agro-Bio Tech of the University of Liège, Delecour and Manil (1958, 1962) studied humus forms of soils in the Ardennes. At the same time Laruelle, stimulated by Prof. Dr. R. Tavernier, Director of the Belgian Soil Survey, established a micromorphological laboratory at the Geological Institute of the *Rijksuniversiteit Gent* (now *Universiteit Gent*), focussing on mineral soil horizons (Laruelle, 1958a,b). This was the start of a successful centre of education, training and research in soil micromorphology, linked to the International Training Centre for Post-Graduate Soil Scientists (Faculty of Sciences, Ghent University), now considered one of the oldest, still partly active soil micromorphological centres, and, according to bibliometric data, the world's most productive one during the 20th century (Stoops, 2014). Here most studies on the micromorphology of Belgian soils and palaeosoils were made by students and staff-members.

A first attempt to relate systematically the micromorphological characteristics of some soil horizons with mapping units, as defined in the Belgian soil classification system, was made by De Coninck et al. (1986). The aim of this paper is to present an inventory of the knowledge of micromorphology of Belgian soils and palaeosoils, based on published material, supplemented by a number of unpublished MSc and PhD dissertations, technical reports and excursion guides. Many technical reports of archaeologists published in recent years contain micromorphological studies, but only those contributing to the knowledge of natural soils are mentioned on the appropriate places in this review; those restricted to urban soils (e.g., urban black earths) or archaeological deposits being omitted.

Data will be presented for all the main important natural regions, starting from the coast in the north-west and moving to the Ardennes massif and Belgian Lorraine in the south-east. In many of the work consulted, the terminology of Brewer (1964) and even that of Kubiëna (1938, 1948 or 1953) was used for micromorphological descriptions. As far as possible these terms have been replaced with the concepts and terminology proposed by Bullock et al. (1985) and Stoops (2003) throughout the text.

Three main groups of palaeosoils can be distinguished: (i) polygenetic soils, i.e., soils containing micromorphological features of two

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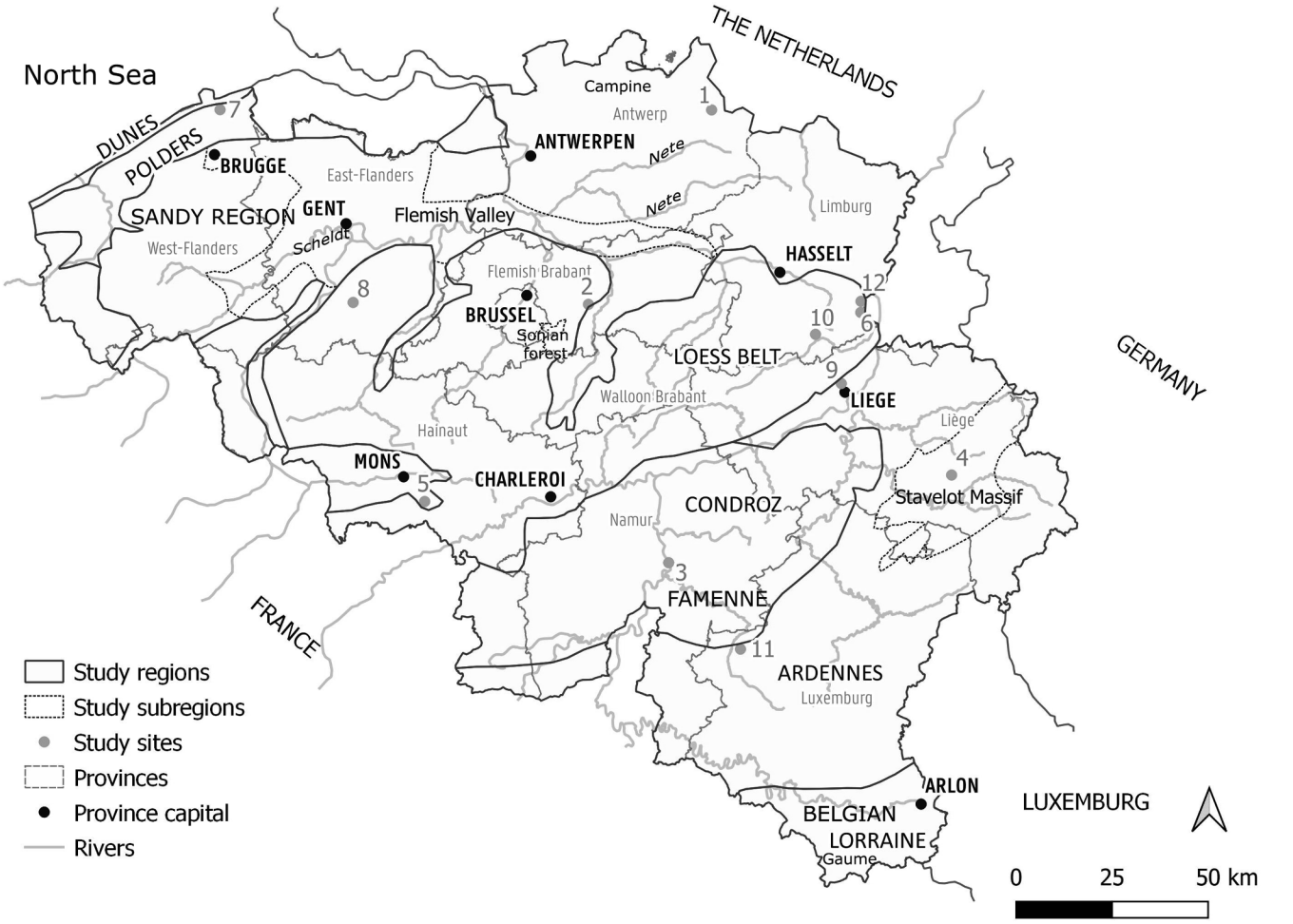

Fig. 1. Map of Belgium with study regions and subregions, province boundaries and specific study sites indicated by numbers: 1 Arendonk, 2 Bertem, 3 Dinant, 4 Francorchamps, 5 Harmignies, 6 Kesselt, 7 Ramskapelle, 8 Roborst, 9 Rocourt, 10 Tongeren, 11 Transinne and 12 Veltwezelt.

pattern is chitonic. In the A horizons the organo-mineral clay forms weakly oriented, discontinuous grain coatings. Strongly oriented, yellowish clay coatings occur in the Bt horizons, gradually increasing in thickness and continue in the lower B and C horizons. Iron oxide nodules are observed in the less well drained soils.

2.4. The Antwerp Campine and Limburg

The Antwerp Campine in northern Belgium, largely situated between Antwerp and the Netherlands, encompasses two regions with geologically different substrates (De Coninck and Laruelle, 1960, De Coninck et al., 2001). In the northern part clayey, sandy- to coarse sandy fluvial deposits of Pleistocene age occur, in the southern part sandy, iron rich Cainozoic marine deposits with glauconite or ironstone are observed. Everywhere the substrate is covered by sandy deposits of either Last Glacial age (Pleniglacial and Late Glacial cover sands) or Holocene age (human induced drift sands) as described in previous section 2.3. The coarse fraction of the groundmass consists in the north dominantly of quartz with some feldspar and mica and in the south of quartz, a little feldspar and variable amounts of glauconite.

Although different soils (Cambisols, Retisols, and Podzols) were formed in this cover, the most typical are the Podzols, studied in detail by Frans De Coninck in this region. Very little information is provided however on the exact location of the profiles studied.

The O and A horizons consist of plant residues and excrements resulting from their fragmentation by mesofauna (De Coninck, 1980a, 1983). These excrements often contain recognisable cell residues. Both relatively fresh and aged organ and tissue residues occur, the latter showing dark staining and less intense, or no interference colours. Hyphae and sclerotia are common constituents. Excrements occur in and around plant fragments and as infillings of channels and sometimes form small dark polymorphic aggregates that, in the A horizon, constitute the micromass of the enaulic c/f related distribution pattern. In the E horizon of the Podzols the amount of organic matter is restricted to a few plant residues and a little organic polymorphic excrements, forming an enaulic to coarse monic c/f related distribution pattern.

From a macro- and micromorphological point of view different types of B horizons fulfilling the criteria of spodic horizon can be distinguished. *Friable spodic horizons* (Bh horizons with loose to friable consistence) contain many roots and aggregates composed of an intense mixture of fine mineral material (clay, silt) and polymorphic organic matter. Microprobe analyses show that the latter also contains, apart from organic constituents, Si and Al, pointing to an admixture of silicate clays. The material often adheres to the coarse grains, resulting in a partly chitonic to gefuric c/f related distribution pattern (Eswaran et al., 1972). *Cemented spodic horizons* (Bhm or Bhsm or Ortstein Podzols) are the result of a gradual increase of monomorphic organic matter. In the best developed facies, the coarse grains are coated by monomorphic organic material, giving rise to a chitonic to close porphyric c/f related distribution pattern. Upon drying a typical cracking pattern develops in the monomorphic material that is composed mainly of fulvic acids and, according to microprobe analyses (De Coninck, 1980b) Al and sometimes Fe, but not Si. The Bs horizon is, according to Eswaran et al. (1972) characterised by a chitonic to gefuric c/f related