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PhD THESIS

THE SILVANIA MOUNTAINS, A COMPARATIVE AND INTEGRATED GEOMORPHOLOGICAL STUDY

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PHD THESIS SUMMARY - THE SILVANIA MOUNTAINS - A COMPARATIVE AND INTEGRATED GEOMORPHOLOGICAL STUDY

KEY WORDS : Integration; Varistic remains; Alpine nappes structures; Alpine termotectonic cycle; Intra-Carpathian Yoke; Collisional tectonic setting; Fold and thrust belts; Compressive and distensive tectonic cycles; Tisia lithospheric block; Tisia-Dacia crustal entity; Processes of accretion, Intensive deformations; Cretaceous belt of the Silvania Mountains; Block mountains; Horst-graben structures; Insular massfis; Paleozoic terranes; Some lithogroup, Orogenic collapse; Morphostructure; Morphosculpture; Ecological reconversion; Landscape; Integration; Regional division.

The Silvania Mountains, as an Alpine collisional chain, represent a fascinating and controversial geomorphological entity, formed during the Hercynian and Alpine thermo-tectonic cycles, on different levels of integration.

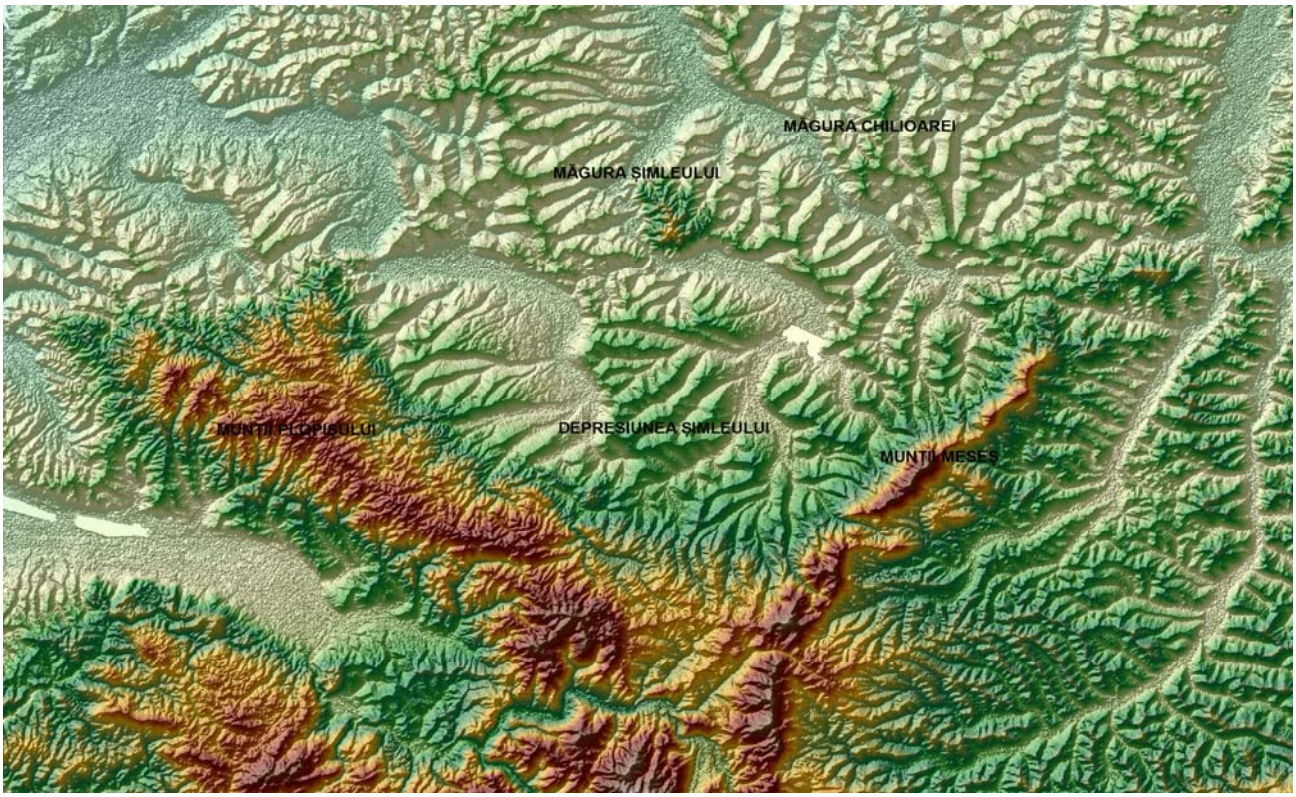


Fig.1.The Silvania Mountains within a DEM model.

Thus, one can identify in their structure the marks of a "Hercynian paleomorphology" in the shape of varistic remains incorporated in structures of alpine nappes of the Apusenides, characterized by an eclogite metamorphism of Varistic age, later involved in the Alpine termotectonic cycle. Nowadays it is represented by some "islands of crystalline schists" in the north-western part of the Transylvanian Depression, in the area occupied by *Ridicarea imleu/ Centura Cretacică of the Silvania Mountains* from a geological point of view and by the *Intra-Carpathian Yoke* from a geographical perspective.

In this respect, we can only talk about varistic remains incorporated in structures of alpine nappes of the Apusenides and internal Dacides, as known in the geological literature. The position, the location and the integration of these mountains into the Mediterranean "Fold-and-Thrust Belts" system were and remain one of the most controversial issues in the domain of geology and geomorphology in Romania. The Mediterranean domain and mainly the Silvania Mountains are the result of a "collisional tectonic setting", specific to some continent-continent final collision phases, respectively a collisional orogen, characterized by the presence of some "fold and thrust" belts, with the associated forelands and the back-arc basins, behind the subduction zone, active during the Permian and the Mesozoic Era.

The tectonic setting of edification of the Silvania Mountains is represented by *distensive and compressive tectonic cycles,* which affected the lithospheric block – Tisia and the crustal entity - Tisia-Dacia, subject to accretion processes, intensive deformations and regional metamorphism, followed by a transpressional tectonics that led to the development of some molasse basins during the late post-Variscan phases, in this case the Şimleu Basin, geodynamic realities due to which they are considered the "Cretaceous Belt of the Silvania Mountains". The Cretaceous folded belt of the Silvania Mountains is thus distinguished by deformation, tectonic setting and internal architecture, which underline the characteristics of Block Mountains, defined by the presence of horst-graben structures, respectively "massifs" integrated into a cratonic area, namely the Preapulian/Tisia Craton which originated in Gondwana according to the latest research. Within the "Intra-Carpathian Yoke system", a name that marks the physiographic connection between the Apuseni Mountains and the Eastern Carpathians, by the medium of mountains, hummocks, hills and depressions, "the Silvania Mountains" stand out as an orogenic entity with a varied genesis, both Hercynian and Alpine from a geological perspective.

Located in the South-West of Sălaj County, the Silvania Mountains represent an orogen of mixed origin, both Hercynian and Alpine, which has been submitted to fragmentation and dislevelement, due to the tertiary tecto-structural movements. The territory presents a series of specific marks for the "Block Mountains", having an architectonics composed of horsts and grabens. This tectogene, both Hercynian and Alpine, was submitted to an intense subaerial modeling, which led a "palimpsestic morphology, unique within the Romanian territory".

This PhD thesis proposes a comparative and integrated geomorphological study of the Silvania Mountains taking into account the fact that the current trend of geography and geomorphology is the integrated approach of geospatial entities, under a wide range of aspects, from the natural to the anthropic ones (from a social, economic, environmental and landscape point of view). It mainly emphasizes the "intimate cooperation" between the substrate, supporting the course of life, and all the resulted forms of interaction, including the tolerance limits imposed by the ability to support these complex territorial systems.

The Silvania Mountains are a particular geospatial entity within the geomorphological landscape of Silvania, which fully deserves the name of mountain. It brings together the Plopi□ (Vf.Măgura Mare 917m) and Mese□ Mountains (Măgura Pria 996m) and only comparatively Măgura Şimleului (597m) and Măgura Chilioarei (420 m), taking into account their degree of erosion, in one family of mountains, forming a boundary of the vast Neogene □imleu gulf from west to east and north-east. From a geological and structural point of view, the studied area overlaps the □imleu Basin "Ridicarea □imleu", one of the five basins or Neogene gulfs formed through the collapse of the crystalline basement of the Tisia Craton, in the peripheral area of the Apuseni Mountains, located in the immediate vicinity of the Pannonian Depression.

Fig. 2.The Silvania Mountains-overall images within the Plopi□ and Mese□ Mountains, Măgura □imleului.

The *purpose* of this PhD thesis is the comparative and integrated geomorphological study of the Silvania Mountains, an attribute given by their geographical location in relation to the □imleu basin (tectonic meaning) or to the Depression, the morphological meaning of the Silvania Depression. The Alpine thermo-tectonic cycle within our area of study was characterized by a *transtensional and rotation tectonics of the ALCAPA and Tisia-Dacia blocks* ((Fodor et al., 1999; Csontos & Vörös 2004) due to important "strike-slip" movements following their final location, fact which led to the structural shaping of the Romanian Carpathians and in particular of the Silvania Mountains.

The dominant note of the landscape in the Silvania Mountains is the predominance of these metamorphic domes or, in other words, crystalline and eruptive hummocks, with altitudes between 300-700 m, resulting from the *dislocation and sinking a formerly unitary crystalline mass*. On the basis of some complex morphogenetic processes, these saddles of crystalline schists, following the erosion to which they were submitted, will be exhumed from under the layers of tertiary sediments. They appear in the overall morphology as a paleorelief or "exhumed relief", in which the remains of the ancient erosion platform - Danian – Paleocene- were individualized. Nowadays, these hummocks, due to the low altitudes (about 1000m), are considered low mountains. The thesis is divided into six chapters and we tried to create a complex radiography, mainly geomorphological, and to connect it with social and economic aspects in order to design a synthetic territorial model for the actions of planning and rearranging

the territory. In the first chapter (1), we presented the methodological arguments, the purpose and the objectives of this research, the methodology, the research history of the Silvania Mountains, the conceptual framework of the integrated geography, the geographical reality of the Silvania Mountains and their connections with the Apuseni Mountains and the Eastern Carpathians (therefore, within this subchapter, we integrated Silvania - semiological interpretations; the dynamic evolution of the Mediterranean area, the connections of the Silvania Mountains with the Eastern Carpathians and the Apuseni Mountains, other opinions about the Silvania territory).

In the second chapter (2), we looked at the "geo-identity elements of the Silvania Mountains", respectively the limits and the spatial relationships with the adjacent units, the geologo-geomorphological configuration, the Silvania Mountains, orogen unit, the tecto-geomorphogenetic units of the Silvania, units of grabens, depressions and couloirs, magmatic and volcanic edifices. In the third chapter (3), we presented the "morphostructure and morphosculpture" in the Silvania Mountains, with a detailed approach of the geomorphometry elements (the hypsometry, the density of the horizontal fragmentation of the landscape, the depth of the landscape's fragmentation, the slopes and the versants), the morphostructure and the morphotectodynamics of the Silvania Mountains, the morphological associations of the structure of the sedimentary complex, the aggradation structogenesis, the physical-geographical premises of the modeling of the geographical area within the denudation relief, the rock's answer to the differentiated modeling (with a presentation of the relief on crystalline and metamorphic rocks, on marls and clays, on sandstone and conglomerates, the karst relief), to which we add the periglacial, fluvial and anthropic relief. For the chapters (4-5), we took into account a practical application of the relief, as support for the human activities and all the aspects involved in the "anthropic manifestation", in the dynamics of natural and anthropic territorial systems, with an overview of the resources and their anthropic exploitation, the hazards associated with natural and anthropic processes, the spatial organization and the types of landscapes, and we conclude with a geomorphological regionalization of the Silvania Mountains in chapter six (6) in which we delimitated the sub-region of the mountainous levels, of the hummocks and depressions and of depression basins.

Chapter 1. INTRODUCTION

In what concerns the objectives of this comparative and integrated geomorphological study, we mention: choosing a methodology for analysis and geomorphological investigation (methods and techniques) in agreement with the current requirements in the field; implementing the GIS spatial analysis in the general and specific geomorphological maps; highlighting the morphological characteristics of the Silvania Mountains and of the typological differences of the relief, the elaboration of some regional models of the Silvaniei Mountains.

The methodology consists of several stages. We started the study with the documentary stage which involved the use of a framework of reference - the "Intra-Carpathian Yoke" and setting the limits of the study, respectively the geographic reality – the Silvania Mountains, the Plopiş Mountains (vf. Măgura Mare 917 m), the Mese□ Mountains (Măgura Pria 996 m), Măgura □imleului (597m) and Măgura Coşeiului (420 m). Based on the results of geological and geographical research (within the bibliographic documentation stage), we outlined the hypotheses, starting with the geologo-geomorphological reality of the Silvania Mountains and Depression. We supported the "the attribute of Silvania Mountains" due to their geographical location in relation to the Transylvaniana Depression. These were followed by preparing the bibliographic index, consulting useful works, the cartographic documentation, the analysis of the existent graphic material, establishing the basic cartographic supports, of the cartographic representation systems and the elaboration of graphic materials.

This stage was completed with a preliminary contact with the terrain, which meant planning some general and specific itineraries, followed by the first direct observations and the identification of information sources in the field (institutions and experts). The terrain stage consists of the correlation of bibliographic information with the preliminary observations from the field. During this stage, we used the maps prepared in the documentation and collection of information stage. The terrain stage meant the geological and geomorphological mapping of the territory and establishing relationships between morphostructure and morphosculpture, respectively the differentiated response of rocks and structures to the exogenous modeling. The laboratory and GIS analysis stage allowed us to outline study's conclusions. The archive of

topographic maps and aerophotograms, geological maps and geomorphological maps of the region were used during the laboratory stage.

The research history of the Silvania Mountains confirms the predominance of geological studies, followed by the geographical and geomorphological ones, without a unitary opinion as regards the territory of the Silvania Mountains, which still generates arguments for debate. Recent and more important contributions regarding the region include the geological (Balintoni Ioan, Mutihac Vasile) and geographical research (Mac Ion, Irimu□, Ioan Aurel).

The conceptual framework of integrated geography is supported by the fact that in the field of geography, the description is essential; consequently this discipline underlines the importance of quantitative and qualitative analyses of the land, namely, the "Silvania geosystem", understood as a material, energetic and informational geostructure in its current state and ends up by explaining it in terms of ongoing processes and geological and historical process (from the past). The Silvania Mountains are not only a mass of matter raised above the neighbouring landforms, but a result of the collaboration and integration between rock, climate, vegetation and hydrography, a merge, respectively an integration of all these elements. The integral approach in geography uses levels of integration, and in this regard it requires a harmonization of natural, social and economic realities, from the point of view of sustainable development. The semiological interpretations of the Silvania area have underlined the existence of a close connection between toponyms of Slavonian origin, landforms and human presence, with a predominance of names related to vegetation, respectively the toponym Silvania (it comes from the Latin word Silva, which means forest) or the toponym Zalău (which means belt, as it is surrounded by mountains that form a semicircle).

The elements that connect the Silvania Mountains, the Apuseni Mountains and the Eastern Carpathians are represented by the tectonic style in Alpine nappes structures and superposed tectonic units, which is reflected through the presence of horst/graben structures as a consequence of the extensional development of the Transylvanian and Pannonian basins.The Silvania Mountains, as an integral part of the "Tisia block", as well as the Carpathians, as an integral part of ALCAPA, are made of terrains with Paleozoic basement, derived from the NW margin of Gondwana and accreted to Laurussia during the Devonian throughout the Hercynian/ Variscan termotectonic cycle. The Silvania Mountains bear a resemblance to the Apuseni Mountains, because the structure of both massifs reflects the convulsions of Hercynian and

Alpine termotectonic cycles, on the basis of a complex integration of transtensional tectonic processes, obduction and translational process of the Euxinic, Getic an Preapulian microcontinent/microplates and of the branches of the Alpine Tethys Ocean from Mesozoic: Halstatt-Meliata Ocean, Tethys Ocean and Dacic External Rift.

The current geological research and that of the past decades outlines many hypothesis and opinions, some of them quite contradictory: the first and the most recent one is the "Terrain" theory or of these exotic blocks found in the metamorphic constitution of the plates in the form of metamorphic sequences/ lithogroups. In our case, the Someş lithogroup is relevant (within the Tisia-Dacia microplate), transported from large distances (the Gondwanian margin, nowadays North Africa) and brought based on some collisional tectonic settings to the Easter European Plate, Tisia- Dacia tertiary Mega-units, Tisza Mega-unit, Tisia Microcontinent, the "Silvanides" Silvania Belt, district of the Alpine regional metamorphism, complex structural block, "Ridicarea Şimleu", Cimmerian Caledonian chain, hidden mountains of Northern Transylvania, crystalline islands from the North of the Transylvanian Depression, northern Transylvnian chain, Bihor Platform/ Preluca-Gilău island, Dorsala Preluca. An analysis of the geological literature requires three evolutionary scenarios in terms of the formation of the Silvania Mountains: therefore they can represent an extension of an adjacent orogenic setting (in this case the Apuseni Montains), "Terrane" unit, and the last and more plausible, a belt with a more individual evolution, "Cretaceous/Silvania Belt".

The geographical and geomorphological research on the other hand proposes several hypotheses and the most important are those regarding the "Intra-Carpathian Yoke" and the Someş Platforms belonging to Vintilă Mihăilescu (1934, 1966) and unanimously accepted in the geographic field. Along the way, this area was studied by other geographers who brought additions. We chose the interpretation belonging to the following professors: Mac Ion and Ioan Aurel Irimu□. According to them, the pronounced morphological division of this territory represents a reflex of the tectonic and hydrographic fragmentation, being an expression of the differentiated modeling within Intra-Carpathian Yoke.The characteristic note of the relief is given by the presence of a "relict and exhumed relief", kept in Hercynian crystalline massifs. In terms of the landforms' morphology, the authors have distinguished four subunits: marginal mountainous subunit, intramontaneous depressions' subunit, which includes low intramontaneous areas, the hummocks, hills and piedmonts' subunit, with a relief on crystalline

and eruptive hummocks, respectively the subunit of couloirs and of low areas due to erosion. All these aspects underline the integrated character and the geological and geomorphological complexity of the block Mountains of the Silvania (Plopiş Mountains and Meseş Mountains, Măgura imleului and Măgura Chilioarei).

Chapter 2. ELEMENTS OF GEO-IDENTITY

The geo-identity elements of the Silvania Mountains have brought to the fore the geographical location, the boundaries and evolution of the Silvania geosyncline which was a complex one during the tectonic Eras. Therefore, during the Hercynian orogenic cycle, the the Silvania Mountains are the result of that orogenic continuum of subductions /obductions between Laurussia and Gondwana Plates, the chain thus formed will be submitted, during the Alpine termotectonic cycle, to shortening processes, subduction, obduction, which brought it to the shape, dimensions and aspect of varistic remains incorporated in structures of alpine nappes of the Apusenides. From the point of view of location, the Silvania Mountains share a border with Dealurile Crasnei, Masivul Codrului, Dealurile Sălajului to the north, Almaş –Agrij Depression to the east, Valea Criului Repede to the south, respectively Vad-Borod Depression separates them from the Northern Apuseni Mountains.

In what concerns the Northern Apuseni Mountains, only the Pădurea Craiului Mountains (Vârful Hodrâncua 1027 m), Vlădeasa Mountains (Vârful Vlădeasa, 1836 m) and Gilăului Mountains (Vârful Chicera Comării, 1475 m) are in direct contact with the Silvania Mountains, while, towards West, the boundary is represented by Dealurile Plopiului. The geological and geomorphological configuration of the Silvania Mountains imposed the presentation of some general aspects regarding the sedimentary environments in the Silvania Mountains, their tectonic setting of edification and its influence on the development of the tectonic processes, tectonic environments, to end this chapter with the presentation of the Silvania orogen and the tectogeomorphogenetic units of the Silvania.

Fig.3.The Creatceous Belt of the Silvania, Plopi□, Mese□, Chilioara,□imleu Mountains in the form of block structures, integrated into the Tisia/Preapulian Craton.

The geological and tectonic complexity of the Silvania Mountains is confirmed by the very geological map, whether they are seen as Paleozoic Terrane, Variscan fragments consisting of mezometamorphic (the Someş crystalline) and epimetamorphic (greenschist facies) metamorphites, with an arrangement of the metamorphic strata opposed to the Someş crystalline and as a reflex of contact and regional metamorphism. The evolution of the Meseş sedimentary area was linked to the Permian-Mesozoic extensions and rifts which led to individualization of the Tisia or Preapulian Craton.

Fig.4. Shelf sedimentation within a carbonaceous platform with continental suits; predominantly carbonaceous deposits in the Plopiş Mountains, Măgura Şimleului and Măgura Coşeiului (conglomerates, clays, oolitic and recifal limestone, marno-limestone, marls).

The Silvania Mountains, as an orogen unit, presents many similarities with the Hercynian massifs in Central Europe, in particular, with the Moravia area, based on the same intrusive and effusive magmatism, on the magmatic/metamorphic geosynclinal rocks and sedimentary rocks, recycled within the sedimentary basins subject to folding and faulting; on the presence of the same clastic and reciphal facies; on the development of carbonaceous platforms and granitic in/post collisional granitic intrusions; including the same orientation in the form of " Y" of the Silvania Mountains.

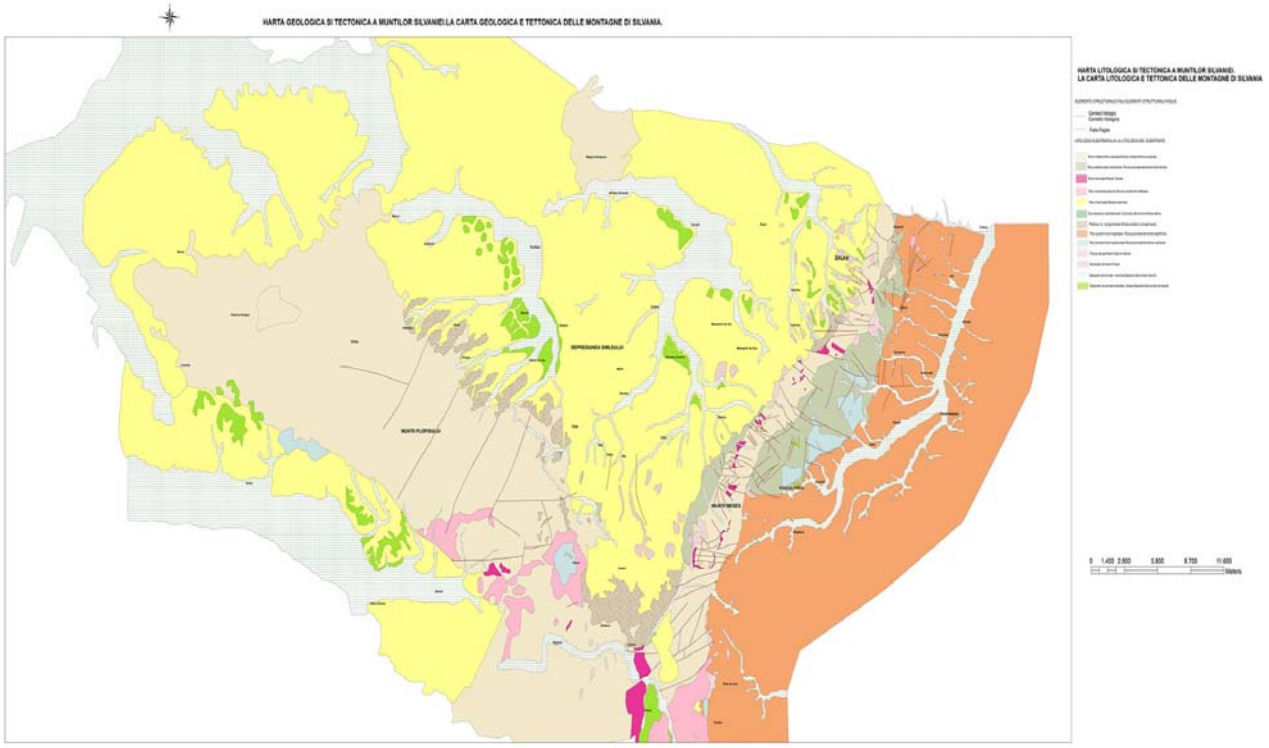
The geological evolution of the Silvania Mountains took place against a background of convergent geodynamic settings between the Tisia-Dacia microplates and the Eastern-European Plate. The Silvania Mountains, as part of the Tisia-Dacia Craton, has a basement consisting of Neproterozoic-Paleozoic "peri-Gondwanan terrains" shaped on tectonic settings with active, passive margins, aspects of rifts and arc belonging to the Variscan termotectonic cycle and strongly disjointed during the Alpine orogeny. The tectonic and sedimentary environments in the

Silvania Mountains were mostly related to the evolution of the Someş lithogroup within the Tisia-Dacia microplates, with an accretionary prism role which responded to the stresses applied through extensions, contractions, faulting and its collision with Baia de Arieş lithogroup with the role of passive margin, the collision resulting in the formation of the Biharia Volcanic Arc.

The Some lithogroup was strongly downgraded during the (M3) event thus confirming the collapse of the Varistic orogen of the Silvania and the generalized exhumation of metamorphites at average crustal depths. Baia de Aries lithogroup is characterized by the presence of "large masses of carbonaceous rocks" and a pre-metamorphic tectonic setting of passive continental margin. Thus the lithogroup Some within the Tisia –Dacia Plate answered to stresses applied through elongation, contractions and faulting, respectively vertical movements due to a convergent tectonic regime. The Cretaceous folded belt of the Silvania Mountains is thus distinguished by deformation, tectonic setting and internal architecture, which underline the characteristics of block mountains, defined by the presence of horst-graben structures, respectively "massifs" integrated into a cratonic area, namely the Preapulian/Tisia Craton which originated in Gondwana according to the latest research.

The basin evolution of the Tisia Craton as primary geological, lithological and structural matrix of the Silvania Mountains was characterized by the presence of sedimentary clastic environments (deltaic, basin and platform environments), as well as of carbonaceous sediments (platform environments), specific to the three areas of sedimentation: Mese, Gilău, Preluca, each with its contributions to the basin evolution of the Silvania Mountains. The Cretaceous sedimentary environments in the Silvania Mountains within the so-called Gilău-Preluca Archipelago evolved within Gosau-type basins, when pre-Neogene (Lower Triassic, Upper Cretaceous and Danian-Paleocene) and Neogene (Badenian, Sarmatian, Pannonian and Quaternary) sedimentary deposits were laid-down. The geological and tectonic complexity of the Silvania Mountains is confirmed by the very geological map, whether they are seen as Paleozoic Terrane, Variscan fragments consisting of mezometamorphic (the Someş crystalline) and epimetamorphic (greenschist facies) metamorphites, with an arrangement of the metamorphic strata opposed to the Someş crystalline and as a reflex of contact and regional metamorphism. During the rifting period of the Biharia arc in grabens and semi-grabens, volcanoclastic sediments were accumulated, in the characteristic forms of submerged rifts, lined by masses where gravitational deposits prevail. The geological setting of the Silvania Mountains is given its

border and basement strata, represented by the Bihor Autochthonous, characterized by two crystalline series, Someş and Arada, and a sedimentary suite (Permian, Triassic, Cretaceous), divided into horsts and grabens, as a result of diastrophism during the Cretaceous until the Pliocene and which affected both the crystalline basement and the sedimentary cover.



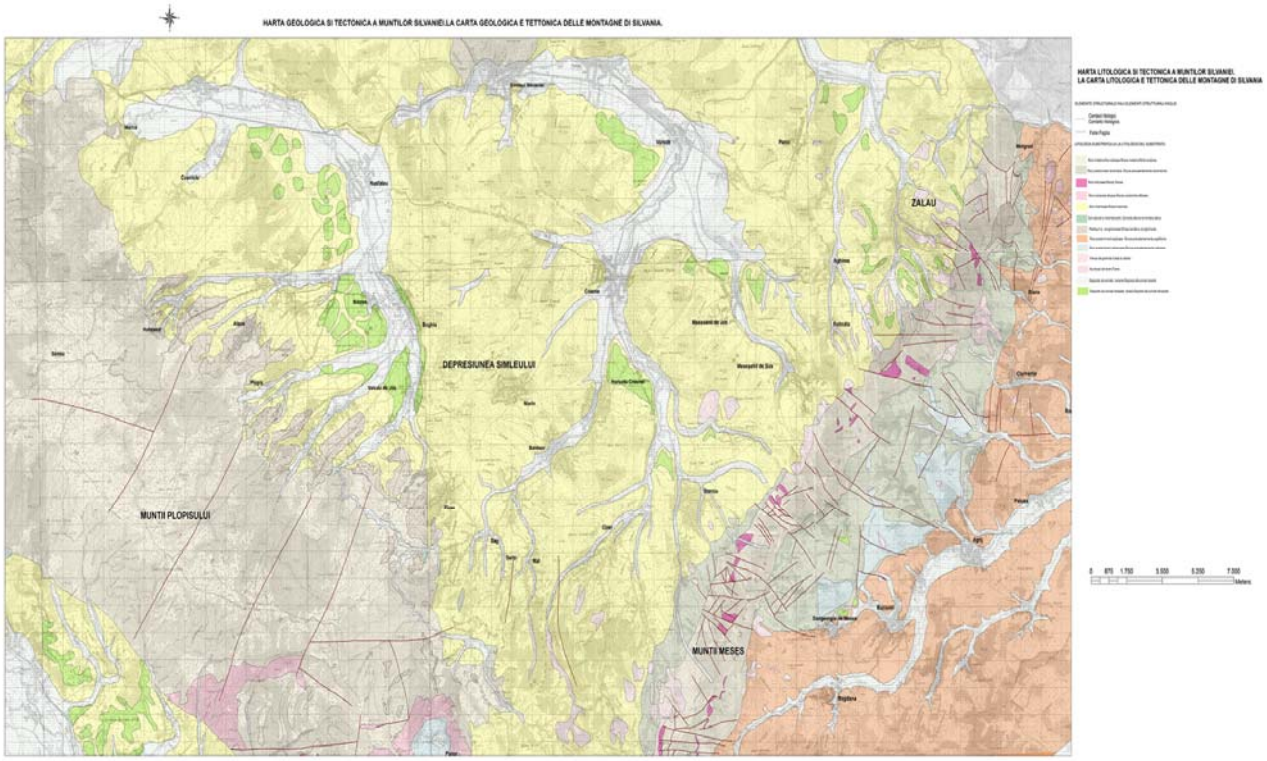


Fig.5. The lithological and tectonic map of the Silvania Mountains.

The reflection of the crystalline basement structure at the surface is given by the presence of crests, of the crystalline lines unfolded longitudinally on North-South direction and bounded by sedimentary basins. The Silvania Mountains have the shape of block structures, because they are predominantly made of crystalline schists in close and intimate tectonic/morphological relationships with Paleogene, Miocene and Pliocene basin sediments. The horsts and grabens from the Silvania Mountains, integrated into the Gilău, Preluca and Mese□ sedimentation areas, represent a reflex of the crystalline structure on the overall morphology.

The horsts are marked by crystalline mountains (Plopi□), hemianticlinal (Mese□) and crystalline domes or hummocks (Măgura □imleului, Măgura, Co□eiului).The Plopiş horsts, Măgurile □imleului and Co□eiului, respectively the Mese□ hemi-anticline have a special tectonic complexity, as the formation geo-tectonic settings, being noticed especially the the Mese□ hemi-anticline due to the dynamics, intensity and magnitude of the faulting phenomenon and the Plopiş horst through the dinstinguished extension of crystalline in comparison with the other subunits. The last two are relevant due to their similarity with the Plopi□ as petrographic constitution and with the Mese□, at least Măgura Co□eiului presents traces of explosive volcanic activity.

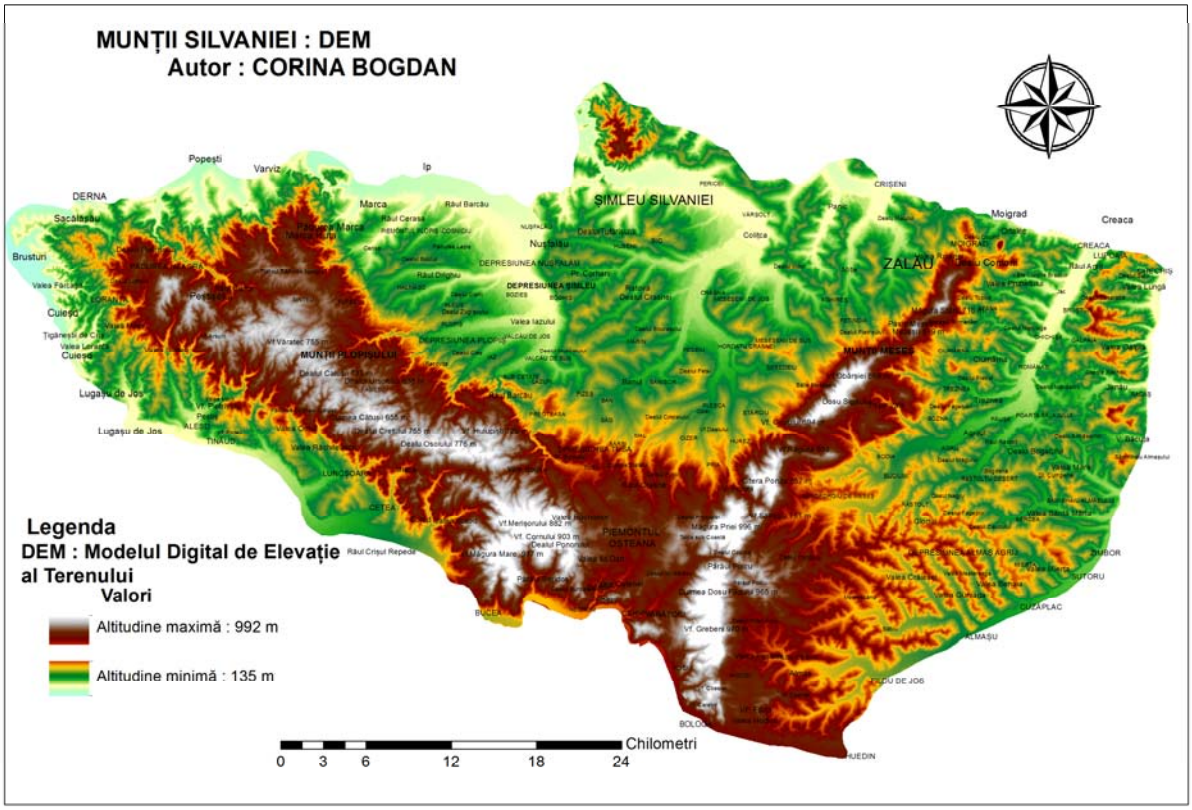


Fig.6. The Silvania Mountains within a DEM model.

From the perspective of an integrated geomorphologic approach, the subunits of the Silvania Mountains are intimately integrated into the Tertiary sediments of the intramontaneous basin of imleu as its basement part, more or less lifted in the shape of these crystalline islands according to their distensive tectonics on the sector.

The Alpine termotectonic cycle reactivated numerous fault lines which fragmented the ancient Tisia Craton on which the Silvania Mountains overlap and vertical displacements and folded blocks, submitted to the transgressions and regressions of the Alpine Tethys, events that will complete the current aspect of the Şimleu basin along many tectonic phases (Kimmerian, Laramian, Savian, Moldavian, Attic, Styrian, Rhodanic and Wallachian).

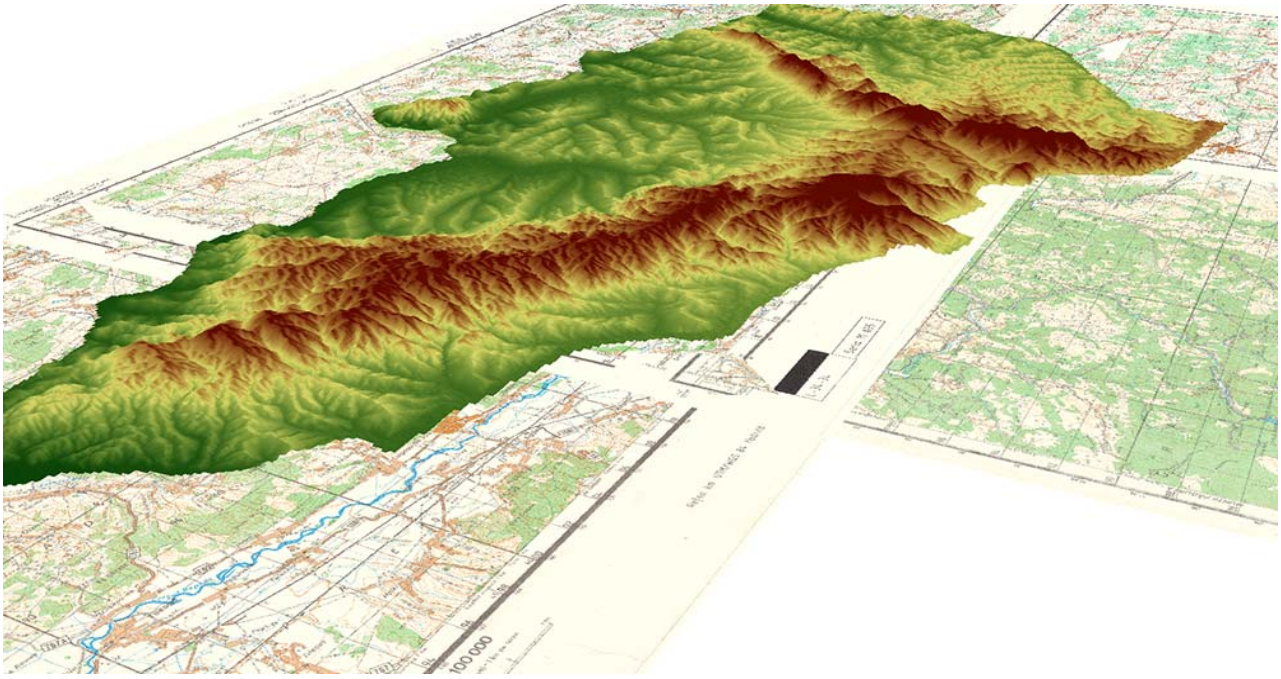


Fig.7. The Silvania Mountains, 3D perspective.

Unlike these two hammocks, the Plopiş and Meseş Mountains blend into an angle of 90° in the framework of □aua O□teana, a connection between the two peaks, broad and relatively low (under 600 meters), separating towards South the vast Basin/Gulf Depression of □imleu from the Northern Apuseni Mountains (Pădurea Craiului, Vlădeasa and Gilău) through the Cri□ul Repede graben. The intramontaneous basin of □imleu is the biggest basin in the Intra-Carpathian region surrounded by the Alpine–Carpathian chain of mountains. The □imleu basin, as structural unit, □imleului, was completed in the Neogene and in its basement to prevail two types of structures.

In the first category, we have the Mesozoic compressional structures from the Alpes, the Dinaric Mountains and Internal Carpathians and in the second category structures related to a Paleogene strike-slip type tectonics of Tisia-Dacia block in their movement towards East, which gave birth to the system of grabens and horsts within the Silvania Mountains. In order to define the formation mode of grabens and depressions from Silvania, we appealed to the Paleogene strike-slip type tectonics of the Pannonian block and in particular the Şimleu basin and its reflexes in the current geomorphology of the Silvania Mountains through the formation of Silvania blocks, bounded by a post-Badenian system of extension grabens.

Fig.8. Overall perspective on the Plopiş horst and the Meseş hemi-anticline

The imleu intramontaneous depression is associated with dextral separations, being bounded by rift shoulders (Plopi Mountains, Pădurea and Codru Moma Mountains). The Pannonian basin as that of imleu, as its integral part, is made of deformed metamorphic and sedimentary rocks, controlled by the westward movement of structures from the Apuseni Mountains structures and the extension of the Paleogen basin Szolnok-Maramure.

Tisia-Dacia block has moved eastward along the shear zone Carei-Preluca-Mid Hungarian Line-Transylvanian Depression - Dragoş Vodă and Bogdan Vodă and North Transylvanian in its collisional dynamics with the Eastern European Plate. Major depressions in the immediate vicinity of the Silvania Mountains are: the Şimleu Depression, Zalău Depression, Borod Depression and Tusa-Cetea Depression). Within the geomorphological landscape of the Silvania Mountains, the grabens are strongly shaped, in general as longitudinal valleys accompanied by river terraces (Zalău, Sălaj, Crasna and Some).

The magmato-volcanic edifices in the Silvania Mountains are specific to Meseş Mountains, the extrusive and hypabissal bodies being developed in areas with disjunctive tectonic elements, those at surface form positive morphological structures in Măgura Moigradului, Măguricea, Citera, Pomăt. The Laramian magmatites are exclusively represented by acidic effusive volcanic products, respectively rhyolites (ignimbritic rhyolite) from Dealul Puguiorul and Dealul Măguricea (grey-green rocks, yellow-white with a massive texture, developed in plates with a cutting break and an orientation similar to the petrotypes from Eastern Vlădeasa) and dacites.

The Neogene magmatites in the Meseş Mountains are highlithed by extrusive and hypabissal bodies of magmatic rocks, which, according to the relations with the surrounding sediments, are attributed to Alpine Neodgene magmatism, being represented by microgabbros and andesites. In terms of the magmatic body from Măgura Moigradului, Iliescu (1965) says that there was a single intrusive body of neck type, made of quartz-diorites, andesites being found towards the periphery of the dioritic body. Traces of volcanic activity are preserved at Chilioara, volcanic elements were largely destroyed by erosion.

Chapter 3. MORPHOSTRUCTURE AND MORPHOSCULPTURE IN THE SILVANIA MOUNTAINS

The morphostructure and morphosculpture in the Silvania Mountains imposed the presentation of geomorphometry, morphostructure and morphotectodynamics elements of the Silvania Mountains, the morphological associations of sedimentary complex structures, the aggradation structogenesis, the denudation relief, the rock's response to the differentiated modeling, the river landscape and the anthropic landscape within the Silvania Mountains.

The elements of geomorphometry allowed highlighting the quantitative parameters of the landscape through the geomorphometric analysis, so we evaluated these parameters through the elaboration of maps (hypsometric levels maps, the depth and density of the fragmentation, the slopes and the versants'exposure) which highlighted the relative discontinuities regarding the map of morphogenetic levels, the depth and density of fragmentation presents relatively high values per sector, the slopes mentain high values on the central crests and predominant versants are those with southern exposure. All these parameters indicate the high degree of landscape's erosion. The hypsometry is one of the most important geomorphometric parameters. In the Mese□ and Plopi□ Mountains, from South to North, the altitudes decrease significantly while

remaining unitary in the central part and with a relative decrease towards North. These variations are due to the vertical game of compartments framed by transversal faults. Măgura imleului has the biggest altitudes in central southern parts. Instead, Măgura, Co eiului is the unit with the lowest altitudes.

The Plopis Mountains occupy a large area and present lower altitudes in central parts, in the form of broad lands while the Mese is abrupt and maintains relatively high altitudes on central crests. Măgura imleului is different from all other subunits through its shape of metamorphic dome which sends numerous structural apophysis in the marginal sedimentary, while that of Co ei has the shape of a capital "S" inclined on NE-SW, fact that is similar to the Meseş.

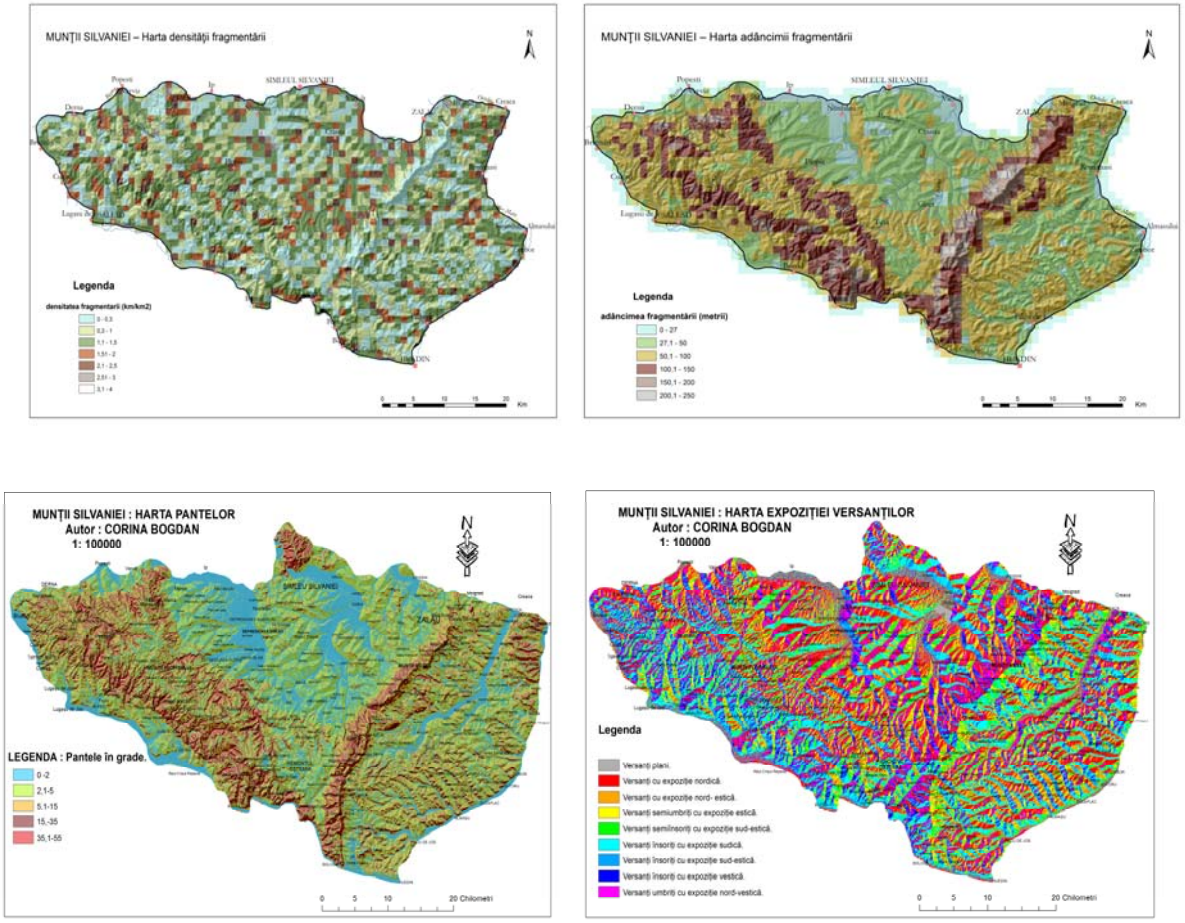


Fig.9. The Silvania Mountains, geomorphometry attributes (the density and fragmentation depths maps, top row, the slopes and the exposure of the versants – bottom row).

The varied density of the hydrographic network related to the Silvania presents low values of the central crests of the Silvania Mountains, average values at the contact between the mountainous crystalline area and the basin sediments, to increase in the areas of convergence of Barcău, Crasna and Zalau. The depth of fragmentation indicates the high degree of landscape's evolution in close connection with the intensity of current morphodynamic processes currently, with high values in the mountain area. The slopes have high values in the mountain area, being specific to strongly inclined versants while in the contact area with the Şimelu basin they decrease significantly. The versants 'exposure determine a favorable or unfavorable topoclimate for agricultural crops and the versants in the southern parts are favorable for the fruit trees and vines.

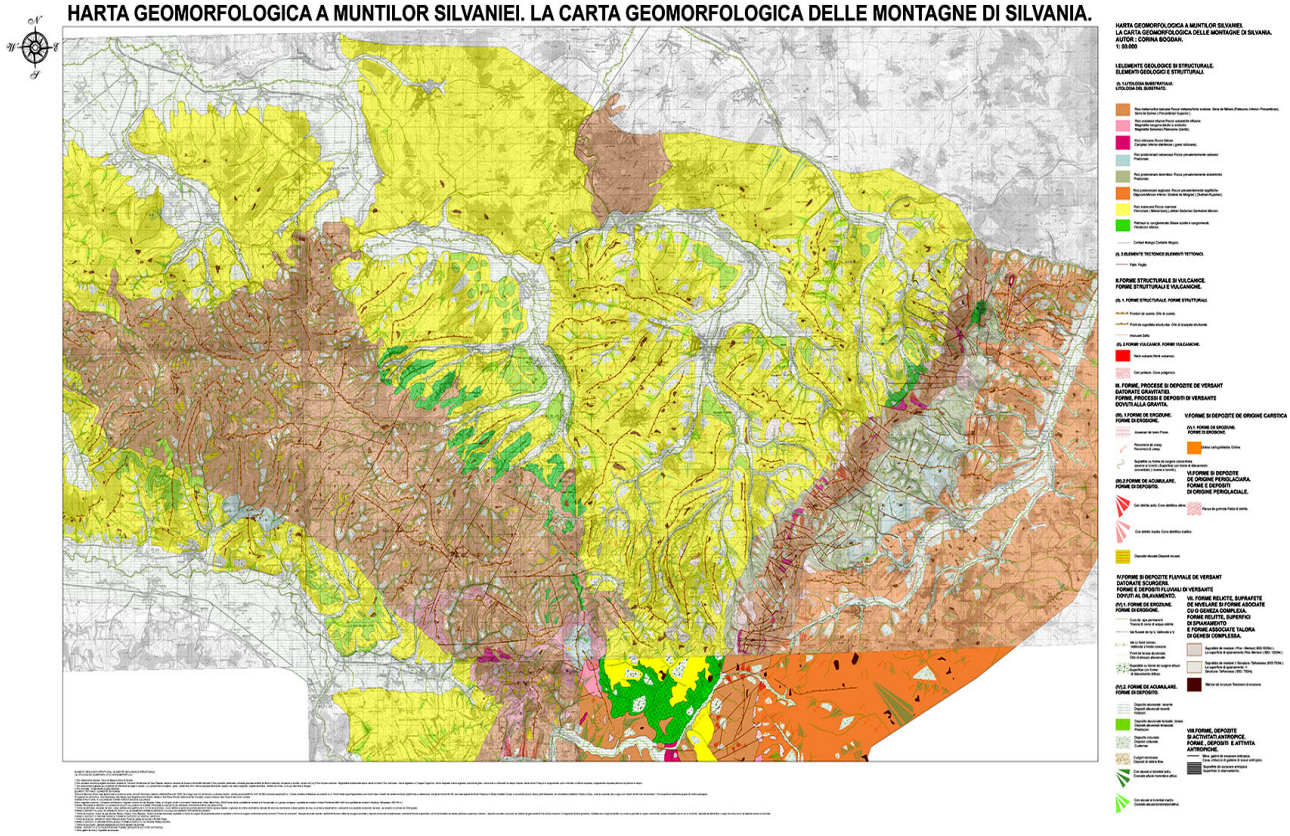


Fig. 10. The geomorphological map of the Silvania Mountains

The morphostructure and morphosculpture of the Silvania Mountains is characterized by the presence of geomorphological associations of structural and lithological discontinuities

present in the magmatic, metamorphic and sedimentary rocks, based on a strike-slip distensive tectonics which imposed a selection in the development erosion processes. The resulting landscape is a consequence of the rock and structure's response to exogenous modeling complex, prevailing the lithostructural forms or specific forms of selective relief, bearing in their form the intimate style of structure.

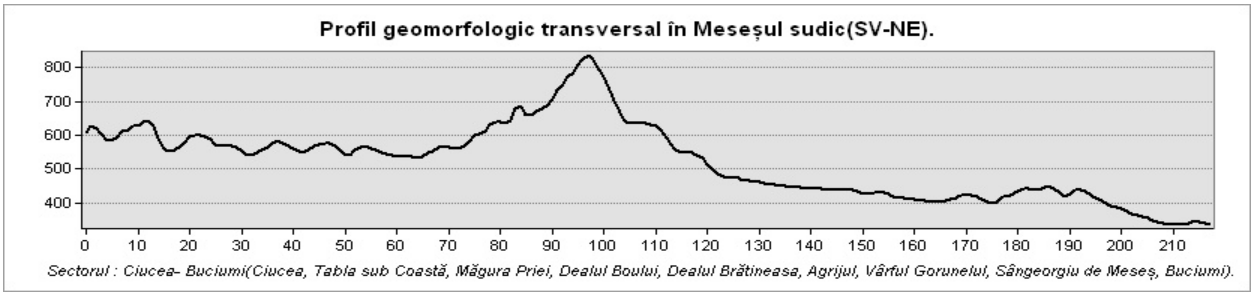


Fig.11. Transversal geomorphological profile over the Southern Mese□.

Highlighting the relationships between landforms and tectonic movements, respectively their geomorphologic consequences within the Silvania Mountains has been achieved through the emphasis of a relief on homoclinal structures. We mention in this case the Alpine nappes structures of the Apusenides in whose structural matrix the Silvania Mountain, as varistic remains, are deposited and their varied mode of existence (folds, flexes, faults, intrusions).

The fault relief in the Silvania Mountains is due to the strike-slip distensive tectonics of the Tisia-Dacia block, supported by complex systems of faults existing in the region that have subsided the faulted blocks and have induced a different morphogenetic potential (see Fig. 11) and a horst-graben system modeling with the resulted related structures. The reflection of these factors in the overall morphology of the Silvania Mountains is given by the large-scale development of structural surfaces, which are one of the most common forms characteristic to the tabular-type regions. They were shaped in harsh crystalline schist strata in the Silvania Mountains, which closed the sedimentary series of the stratigraphic column. In their overall geomorphology, one can notice prominent fronts in the form of "cornices", that move back as a result of regressive erosion processes in sedimentary deposits at their contact with the crystalline.

Fig. 12. The legend of the geomorphologic map of the Silvania Mountains

Fig.13 Tabular morphostructures in Măgura Coşeiului

The layered character of the deposits in the Silvania Mountains, submitted to Alpine deformation, the lithology and rocks'stratification (horizontal, oblique, undulated) had a significant influence on the architecture of the Silvania landscape, conditioned by the strike-slip tectonic, type affected the ancient Tisia Craton, respectively the Tisia-Dacia crustal entity within the post-tectogenetic sedimentary cover of the Apusenides. We distinguished a large-scale tabular relief in Plopişului Mountains and Măgura Coşeiului, a relief on monoclinal structures in the Meseş Mountains and Măgura Coşeiului, a relief on folded structures of anticlinal and synclinal type in the vicinity of the Silvania Mountains.

To these we added a relief of structural contact type between the mountainous massifs-the adjacent depression basin. The morphostructural evolution of the Silvania Mountains is closely linked to that of the Nothern Apuseni Mountains, subject to complex modeling cycles which led to the formation of the three areas of levelling (Pria-Meri□or, Secătura-Tâlhăreasa and Osoaie Cărbunari).

The collaboration between lithology, structure, the sediments'tectonics and the adjacent crystalline imposed the development of very important structural forms, of which the most numerous are the structural surfaces, asymmetric and consequent valleys, structural and erosion witnesses, anticlinal, synclinal and exhumed peneplains. In what concerns the aggradation structogenesis, the Silvania relief has the form of some sequences of polygenic levels to make the transition from the mountain area to the basin sedimentary, or vice versa. These areas of contact with the Silvania mountain area have the shape of piedmont terraces, glacis and erosion basins, sculpted by the rivers which flow from the mountain. The overall morphology of the Silvania Mountains takes the form of a polyphasic relief, where it is noticed this recurrent alternance of the hilly crests with wide valley couloirs, Barcăului and Crasnei, whose landscaping note is relatively discontinuous as a result of the presence of these majestic volcanic and metamorphic hummocks.

The piedmonts in the Silvania Mountains make the transition from the predominantly crystalline mountain frame to the areas between rivers, supported by tertiary sedimentary deposits of the Şimleu Basin, in the form of structural witnesses, which have an opposed placement on the basement. The particularly intense denudation processes provided the detritic material, necessary for the formation of erosive and accumulative piedmonts, generically named the first generation of Parameseş piedmonts of the second category, namely the accumulation piedmonts. The piedmonts in the Silvania Mountains were erected throughout the tectonic, morphological stages and of sub-piedmont modeling, as a result, a collaboration and integration between lithology and systems of faults, which facilitated the fluvial modeling processes. The Silvania rivers, following their interaction with the Silvania substratum, built piedmonts at the point they come out of the mountain. These piedmonts periodically delimited the configuration of the mountain fronts of Plopiş Mountains, Meseş Mountains and Măgura Şimleului. As noticed within the geomorphological map of the eastern part of Plopi□ Mountains, they present a high density of the hydrographic fragmentation, being the subject of a spectacular hydrographic

network of Barcău tributaries, many with the source on the crests' line. They, in their impetuous descent from the mountain area, deposit impressive quantities of materials, eroded in the form of piedmontan gravel.

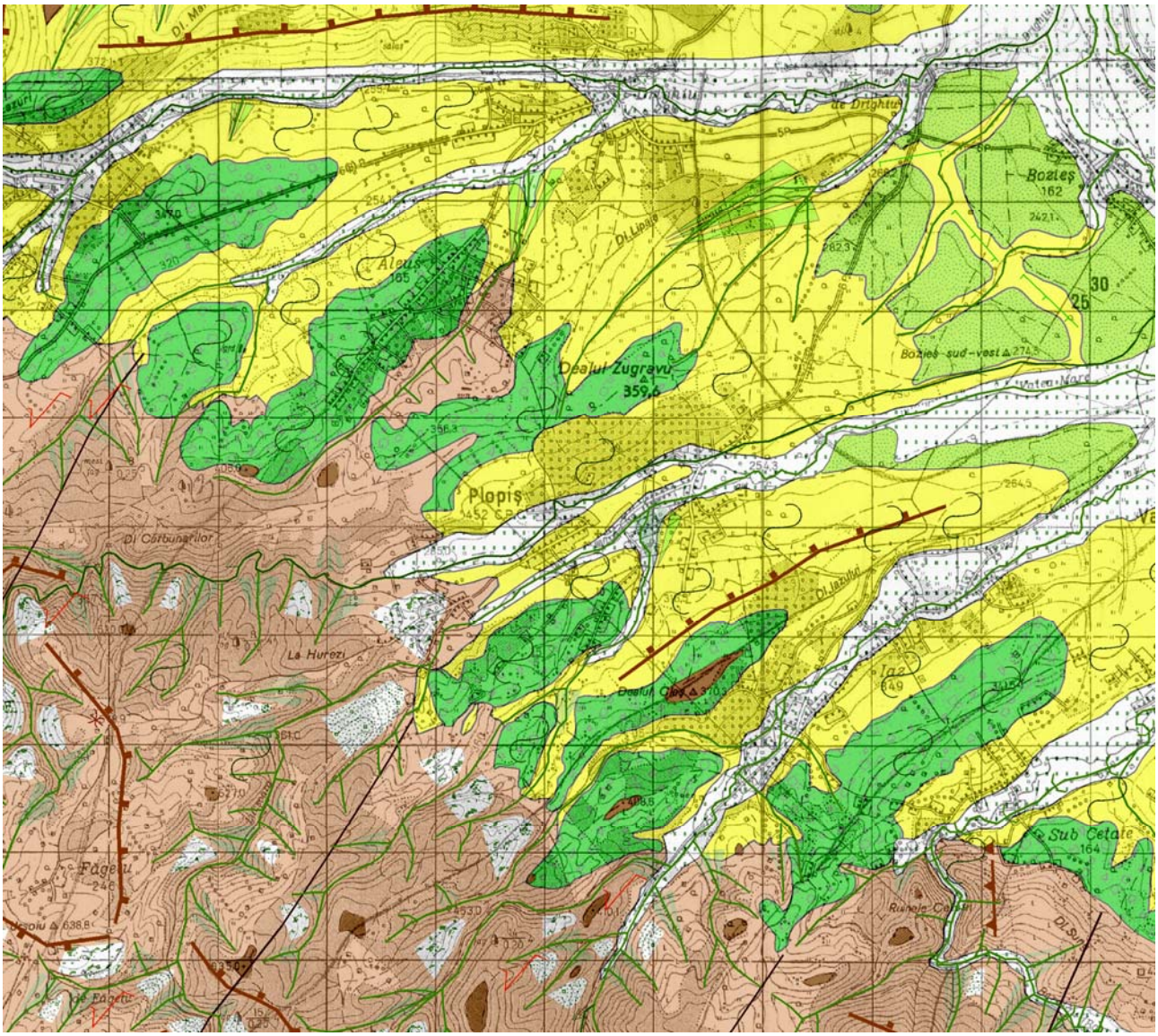


Fig 14. Piedmontan relief in the eastern part of Plopiş Mountains

The glacises in the Silvania Mountains, of polygenetic origin (erosion and accumulation), are represented by valley glacises and versant glacises, formed under structural abrupt areas and developed on monoclinal surfaces. Furthermore, the former Piedmont landscape from Sălaj was turned into association of glacises, that gives a specific character to the Sălaj relief. Alluvial

cones within the Silvania Mountains, as fluvial forms of accumulation, are characterized by the presence of those active and inactive alluvial, respectively detritic, at their turn active and inactive. They have an age that increases towards West, in line with the direction of withdrawal of Pannonian Sea waters.

Fig.15. Valley and structural front glacises in the Plopiş Mountains (top row) and Meseş Mountains (bottom row).

The terraces, as aggradation structogenesis, are former suspended meadows in the form of levels following the deepening process of riverbeds courses: Barcău, Crasna and Zalău within the Silvania Mountains. They accompany on both sides Barcău, Crasna and Zalău and are characterized by monolateral disposal, classic grading and parallelism, their genesis being due to tectonic, climatic and eustatic causes.

The Silvania terraces, due to their overlapping on horizontal or quasi-horizontal surfaces, can be used for anthropic activities, especially the terraces'bridges and rivers'meadow. Within the geomorphological landscape of the Silvania Mountains, the meadows represent the lowest and one of the most recent landforms (Holocene Era) developed along the valleys: Barcău, Crasna, Zalău, Cri□ul Repede, Agij-Alma□ului. The dynamics of these rivers was in close

correlation and interdependence with the tectonic factors (eustatic and neo-tectonic) and Postglacial bio-climatic variations, that imposed their current aspect and expansion. Regarding the denudation relief, the Silvania Mountains were subject to intense denudation processes that have reduced the ancient Hercynian chain to the shape and aspect of some varistic remains, integrated into the Alpine nappes structure of the Apusenides due to meteorization- meteoric degradation and to complex modeling processes of the relief. The morphogenetic processes from Silvania are represented by simple processes, preceding the erosion (meteorisation and related forms) and by complex processes of erosion.

Fig. 16 Alteration processes in the Plopiş Mountains (top row) and crioclastism processes within Măgurii Coşeiului and Măgura Şimleului (bottom row).

The main processes of physical disaggregation of rocks from the Silvania Mountains were held under the auspices of the termoclastism, hydroclastism, crioclastism, exfoliations, granular disaggregation, chemical exfoliations, chemical alterations and oxidation. In what concerns the forms, processes and deposits due to gravity, the versants from the Silvania Mountains are affected by gravitational geomorphological processes such as rocks falling, rocks rolling, debris flows, landslides, collapses, which create a series of particular forms both on the original rock, and on the detritus produced by meteorization.

Regarding the mass movements, we distinguished two categories: slow movements (through solifluction processes) and landslides (according to the geological structure, geological formations, thickness of the geological formations, triggering factor, fragmentation type and their evolution stage). The elementary processes of modeling of the relief in the Silvania Mountains is carried out under the auspices of disintegration through frost-melting, of dissolving and accumulation of dislocated materials in the form of eluvial, colluvial and deluvial deposits, with the majority of colluvial deposits very suggestive in the Mese□ and Plopiş Mountains, Măgurile Şimleului and Coşeiului, but more widely developed within the □imleu Depression. The forms and fluvial processes were characterized by erosion and torrential accumulation, with a high density of torrents.

The rock's response to the differential modeling within the Silvania Mountains was one of the most varied and complex, due to the presence of the following relief types, strongly conditioned by the lithotypes related to Silvania area: the relief on crystalinel and metamorphic rocks, the karstic relief, the relief on sandstones and conglomerates, the relief on marls and clays, the periglacial and anthropic relief. The relief on crystalline rocks in the Silvania Mountains is particularly complex due to the predominance of the crystalline, of numerous islander witnesses in the Plopi□ Mountains, Măgura, Coşeiului, Măgura Şimleului and last but not least the presence of rounded forms with massive aspect more and far better preserved in the Mese□ Mountains. The relief on marls and clays in the Silvania Mountains is similar to that developed on clays, in which the ravination processes, the landslides, the mud flows and the solifluction prevail. The relief on the sandstone and conglomerates in the Silvania Mountains is due to the extremely complex tectonics of the basin sedimentary adjacent to them. Their geology argues the formation of these sandstone and conglomerates through submarine explosions, which destroyed

old basements in the submerge phase of evolution of the Silvania Mountains within the so-called Gilau-Preluca archipelago subject to intense erosion processes.

The karstic relief in the Silvania Mountains is the result of collaboration and integration between the sedimentary cycles and the episodes of regression and transgression from Alpine Tethys, the Pannonian Sea, characteristic to the carbonaceous platform stage of Tisia Craton during the Ladinian, Senonian, Danian, Paleocene and Badenian. The periglacial relief in the Silvania Mountains is well represented both as regards the forms of accumulation and erosion, represented by structured soils; ice tongues; forms produced by termoclastism; nivation forms; block field; crionivation forms (geliflux and river forms).

Fig.17. Karstic relief in the Plopiş Mountains: sinkholes within the Ponor karstic plateau (top row) and strongly chapped limestone (bottom row).

The most obvious traces of the periglacial modeling have been preserved in the Meseş Mountains in comparison with the other Silvania subunits, through the presence of both erosion and accumulation forms, not only those developed on the versant (solifluctions and mud flows), but also those due to gelifraction (detritus nappes). The Meseş Mountains are distinguished from other subunits through the wide representation of periglacial detritic level, represented by the layered detritic nappes on both sides.

The morphodynamics on sector in the Silvania Mountains, under the auspices of fluvial modeling or fluvial landform presented aspects of the most complex as a result of the heterogeneousness of the Silvania substratum and of the predominance of metamorphic and sedimentary deposits intensively processed based on a strike-slip tectonics, which imposed an adaptation of the hydrographical network to these homoclinal structures.

Picture 18. Bistra River in the Plopi□ Mountains, Crasna and Barcău in the source area (the upper row), Crasna River in the sector of Măgura □imleului.

The fluvial modeling led to the creation of predominant forms of fluvial accumulation (piedmonts, terraces, meadows gacis, alluvial cones) compared to those of erosion, specific to the mountain area of Plopişului, Meseşului Mountains, Măgura Şimleului, Măgura, Coşeiului (Silvania valleys with their range of erosion and accumulation forms: islets, low areas, small elongated terrain lifting, marmites).

This fluvial morphodynamics is the result of complex synergy and integration processes between the Silvania substratum and the afferent hydrographic network, in view of the perfection of the balance profile, substantiated at least by the basin sectors of Barcău, Crasna and Zalău.The anthropic landscape of the Silvania Mountains is due to past exploitation activities of mineral resources, especially lignite and building rocks. The extraction of these resources left deep traces on the general geomorphology, mirrored by forms of erosion (mines, pits, gravel pits) and accumulation forms (refuse dumps), which demand an ecological reconversion.

Fig. 19. Exploitation of zeolitic tuffs, rhyolites at Moigrad, crystalline schists, limestone, marls and clays at Şimleul Silvaniei and Coşeiu

As far as the forms of anthropic erosion are concerned, we distinguished forms of landscape due to the exploitation of substratum resources, forms of landscape due to industrial, agricultural and forestry activities, and last but not least, forms of landscape due to the development of communication networks. The anthropic accumulation in the Silvania Mountains distinguished through forms of landscape due to the exploitation of substratum resources, anthropic forms of landscape due to industrial activities and forms of landscape due to the development of inhabited centres.

The Silvania Mountains overlap the heterogeneous geological substratum of the ancient Tisia Craton characterized by a special morpholithological and morphostructural complexity. The formation of useful minerals in the Silvania Mountains has been linked to the basin stage of the Tisia Craton and to the variety of source areas related to this basin.The Silvania Mountains are characterized by the variety of natural resources, plants and animals that provide an integrated support in terms of human activities, due to their exploitation. The interaction between the anthropic factor and the natural substratum can be balanced and harmonious, largely influencing the progress of economic and social development, respectively the environment in Silvania. Considering the typology from the Silvania Mountains we distinguished the following resources categories: non-renewable (minerals and fossil fuels); renewable (water, air, soil, flora, wild fauna); permanent (solar power, wind power, geothermal power).

For our study, the following are important: the subsoil resources, the soil resources (biogeographic and edaphic resources), the climatic resources and the water resources. The succinct exposure of resources within the Silvania Mountains allowed an evaluation of their condition, the subsoil resources are relatively varied (construction rocks: limestone, sandstone, tuffs, mica schists); to which are added the mineral springs. The soil resources highlight a predominance of forest brown acid soils, podzolic argiloiluvial soils, lithomorphic and hydromorphic soils. Climate resources are very important due to the climate as integrator factor, because through temperature and precipitation influence the geomorphological processes, and the formation of local topoclimate. The water resources in Silvania are represented by the water bodies of Barcău, Crasna, Zalău, Agrij and Crişul Repede, relatively modest which imposed the creation of the Vârşolț accumulation in order provide water for the people, agriculture and industrial activities.

The biogeographic resources were the most affected by anthropic activities. Therefore, the lawns and the agricultural terrains are predominant as compared with the forests (beech, durmast, oak, subject to massive deforestation). In terms of the probability of hazards that might lead to an event with serious consequences, in the Silvania Mountains is noticed the presence of some hazards associated with natural processes, in this case geological and geomorphological and human-induced hazards with majority share mainly due to the industrial pollution of air, water and soil.

The geomorphological hazards are associated with the current modeling processes. The economic hazards are represented by industrial pollution with suspension powders and organic pollutants. Agricultural activities have led to an intensification of the processes of linear erosion, spatial erosion, soil compaction and saturation, caused by the widespread use of pesticides. These human-induced hazards require immediate interventions and ecological reconversion programs. The prevention of natural geomorphological hazards instead needs an adequate management being necessary the mapping of areas affected by ongoing landslides and unstable areas, the definition of possible scenarios, the delimitation of these areas, preparing some intervetion plans in case of floods, landslides, mud flows, with significant effects in the physiognomy of the region, an essential point for a harmonious and sustainable development of the areas within the Silvania Mountains. The spatial organization and the landscape types in the Silvania Mountains imposed the delimitation of the space concept and its reverberations, in the context of the complex geospatial reality of the Silvania Mountains.

Therefore we presented the main populating stages of this space and the symbiosis established between the Silvania population and the related area, based on a harmonious integration between it and the capacity of sustaining the Silvania ecosystems. At a micro-scale level, the collaboration between internal factors (rock, structure, tectonics) and external factors based on linear, areal and vertical erosion created complex geospatial architectures of geomorphosites type, included in ecological networks such as the Tusa-Barcău and Plopiş Mountains sites. The territorial unit of planning and development imposed the promotion of a sustainable economic development, in full agreement with the harmonious exploitation and valorization of existing resources. The dynamic combination between biotic, abiotic and anthropic elements and their integration at different levels are reflected in the Silvania Mountains through distinct landscapes where a specific component prevails.

The majority share of the landscapes in Silvania is owned by the natural ones. Instead the interaction between the natural and anthropic factor is reflected in the Silvania Mountains through agrarian, industrial, urban and rural landscapes. The Plopiş Mountains are characterized by a predominance of natural and agricultural landscapes which is a similarity between them and Măgura Coşeiului. The Meseş Mountains and Măgura Coşeiului instead are distinguished through the emergence of industrial landscapes (Zalău, Şimleu Silvaniei) and that also within these sub-units the rural and natural landscapes are an indicator of the deep agricultural character of these areas.

According to a meeting with the authorities within the Environmental Protection Agency Sălaj, it has been agreed that the impact on the local landscape must be thoroughly evaluated at the level of each of the three components, respectively the geomorphological structure (geological features, landscape and hydrological characteristics), biodiversity and social, economic and cultural elements (settlements, infrastructure, construction, human activities). An attempt to indicate the stages of the negative impact of human activities on the landscape, depending on their gravity, reveals the following: destruction, degradation and aggression. We found the broad development of mountain level as spatial extension (in this case the Plopiş Mountains and the Meseş Mountains), the limited relative spatial extension of the hummocks but with a relief as complex as that of the mountain level which fully justifies their integration into a single family of mountains.

The level of depressions and of depression basins is well developed both in the Meseş Mountains and Plopiş Mountains as a reflex of the complex interaction and integration between rock, structure and external modeling agents based on the following relationships mountainous massif-depression basin. After this brief geological and geomorphological presentation of the Silvania Mountains, we cannot draw conclusions without specifying the suitability of the relief through their resources which can be used to meet the human needs. Thus tertiary deposits in the Silvania Mountains include limestone, sandstone, dacitic tuffs, clays, sands, marls and coal. From the perspective of the possibilities of economic development in these areas, it still the agricultural economy based on the pastoral activity, farming and breeding prevail with of the predominance of the rural in the detriment of the urban. However, there is a probability of promoting the cultural and recreational tourism, taking into account the fact that the Silvania Mountains represent among other things a symbol of the Roman civilization.

Many traditions and popular customs are preserved here and from the point of view of the landscape, the Silvania Mountains are suitable for their arrangement as leisure resorts.

BIBLIOGRAFIE

1. **Airinei,Şt.,1957**,*Asupra anomaliei magnetice regionale din centrul Bazinului Transilvaniei.* p. 209-235,Bul.Ştiinţ.Acad.R.P.R., Secţ.geol.,geogr.,2.
2. **Airinei,Şt.,1979**, *Teritoriul României şi tectonica plăcilor* .Ed.Ştinţifică, Bucureşti.
3. **Arghiu□, C., 2010**, *Culmea □i Piemontul Codrului* , Teză de Doctorat, Cluj Napoca.
4. **Aroldi C., 2000,**: *The Pienides in Maramures. Sedimentation*, Tectonics and Paleogeography, Cluj, 1—156.
5. **Bada,G.,Horváth, F**.,**1998**.A *Pannon-medence jelenlegi tektonikája*,Term□szet Vilaga,II különszám,Budapest pp.119-142.
6. **Badea L., Gâ□tescu ,P.,Velcea,V., (1983)** *Geografia României* I, Geografia Fizică , Editura Academiei, România.
7. **Bâlc, D., (2012)**, *Relieful antropic din bazinul superior al râului Cri□ul Repede*, Teză de Doctorat, Cluj Napoca.
8. **Balintoni I & Balica C. 2013**: *Carpathian peri-Gondwanan terranes in the East Carpathians (Romania): A testimony of an Ordovician, North-African orogeny.* Gondwana Res. 23, 3, 1053—1070.
9. **Balintoni I. & Baier U. 2001**.,: *Structural researches in the Eastern Carpathians.* Stud. Univ. Babes-Bolyai, Geol. XLVI (1), 3—13 (in Romanian).
10. **Balintoni I. & Balica C. 2012**,: *Avalonian, Ganderian and East Ca- domian terranes in South Carpathians, Romania, and Pan-Afri- can events recorded in their basement.* Miner. Petrology, Doi 10.1007/s00710-012-0206-x.
11. **Balintoni I., Balica C., Ducea M.N., Zaharia L., Chen F., Cliveti M., Hann H.P., Li L.Q. & Ghergari L. 2010**: *Late Cambrian-Ordovician northeastern Gondwanan terranes in the basement of the Apuseni Mountains, Romania*. J. Geol. Soc. 167, 1131—1145.
12. **Balintoni I., Balica C., Zaharia L., Cliveti M., Chen F., Hann H.P. & Li Qiu Li. 2007,** *The age of the Variscan suture in the Apuseni Mountains, Romania, as revealed by LA-ICP-MS Zircon dating.* Eos Trans. AGU, 88, 52, V13A-1139.

13. **Balintoni I., Mosonyi E., & Puste A. 1997:** *Informatii si interpretări litostratigrafice, metamorfice □i structurale privitoare la masivul Rodna (Carpa□ii Orientali).* Stud. Univ. Babes-Bolyai, Geol. XLII, 2, 51- 66.

14. **Balintoni, I., Balica, C. & Hann, H.P. 2011b**., *About a peri-Gondwanan - North African enlarged acceptance of the Caledonian Orogeny.* Studia Universitatis Babes-Bolyai, Geologia 56(1), 29–32.

15. **Balintoni, I., Balica, C., Ducea, M.N. & Stremt□an, C. 2011a***., Peri-Amazonian, Avalonian-type and Ganderian- type terranes in the South Carpathians, Romania: The Danubian domain basement.* Gondwana Research 19(4), 945–957

16. **Balintoni, I., Balica, C., Ducea, M.N., Chen, F., Hann, H.P. & S□abliovschi, V. 2009.,** *Late Cambrian-Early Ordovician Gondwanan terranes in the Romanian Carpathians: a zircon U/Pb provenance study.* Gondwana Research 16, 119–133

17. **Balintoni, I., Balica, C., Ducea, M.N., Hann, H.P. & S□abliovschi, V. 2010a.***, The anatomy of a Gondwanan terrane: the Neoproterozoic – Ordovician basement of the pre-Alpine Sebes□ – Lotru composite terrane (South Carpathians, Romania).* Gondwana Research 17, 561–572

18. **Balintoni, I., Balica, C., Seghedi, A. & Ducea, M.N. 2010b,** *Avalonian and Cadomian terranes in North Dobrogea, Romania.* Precambrian Research 182, 217–229

19. **Balintoni, I., Mosony, E., Pu□te, A., 1997,** *Informat□ii s□i interpreta□ri litostratigrafice, metamorfice s□i structurale, privitoare la Masivul Rodna, Carpat□ii Orientali.* Studia Univ. "Babes-Bolyai", Geologia, XLII, 2, 52-66, Cluj-Napoca.

20. **Balintoni, I., Petrescu, I., 2002,** *A hypotesis on the Transilvanian halite genesis.* Studia Universitatis Babes□-Bolyai, Geologia, Spesial issue, 1, pp 51- 61.

21. **Balintoni,I.,1998,***An Evolutionary Model for the Rift of External Carpathian Flysch Basin.* Studia Univ. "Babes□-Bolyai", Geologia, XLIII, 2, 119-131, Cluj-Napoca

22. **Balintoni,I.,1989,***Geotectonica terenurilor metamorfice din România*,Edit. Carpatica, Cluj Napoca.

23. **Balintoni,I.,1994,**.*Structure of the Apuseni Mountains.Romanian,* Journal of tectonics and Regional Geology 75 (suppl.no.2),p.51-58.

24. **Balintoni,I.,1995,** *Alpine Plate Boundaries on the Territory of Romania,* Studia, Univ."Babe□-Bolyai", Geologia,XL,1,49-51, Cluj-Napoca.

25. **Balintoni,I.,1996,** *Geotectonica terenurilor metamorfice din România*,p.4-208, Imprimeria Universității Babeş Bolyai.

26. **Balintoni,I.,Balica,C.,Cliveti,M.,Hann,H.P.,Ghergari,L.,2007.** *The Apuseni Mountains, Romania, a Variscan Collage of Ordovician Gondwanan Terranes.*Eos Trans. AGU,v.88(52),Abstract V13A-1138

27. **Balintoni,I.,Puşte,A.,Stan,R.,1995,***The Codru Nappe System and the Biharia Nappe System : comparative argumentation ,* Studia Univ.Babeş-Bolyai, Geologia,XLI, 101-113, Cluj Napoca.

28. **Balintoni,I.,Seghedi,I., □i Szakács,A.,1995,***Geotectonic framework of the neogene volcanism in Romania,*Rom.J.Stratigraphy,76,Suppl.7,7-10.

29. **Balintoni,I.Vlad,Ş.,1996,** *Tertiary magmatism in the Apuseni Mountainsand related tectonic setting,* Studia Univ.Babeş-Bolyai, Geologia,XLI, 115-126, Cluj -Napoca.

30. **Balla Z., 1987,***Tertiary paleomagnetic data for the Carpatho-Pannonian region in the light of Miocene rotation kinematics*. Tectonophysics 139, 67—98.

31. **Balla Z. 1987**,: *Tertiary paleomagnetic data for the Carpatho-Pannonian region in the light of Miocene rotation kinematics.* Tec- tonophysics 139, 67—98.

32. **Balla,Z.,1987,***Tertiary paleomagnetic data for the Carpatho-Pannonian region in the lights of Miocene rotation kinematics*.Tectonophysics,139,67-98.

33. **Balla,Z.,1987**, *Neogene Kinematics of the Carpatho-Pannonian Region.*Ann.InstGeol.Publ.Hung.,LXX,193-199.

34. **Băncilă, I.,1948,***Geologia Carpa□ilor Orientali*,Editura □tin□ifică, Bucure□ti.

35. **Bandat H.,Reich L.,1950,** *Bericht uber geologische Untersuchungen im Krasna Becken (Syilagysag),"*A.magz.allamy Foldtani Inteyet evi jelentese",II kotet, Budapest.

36. **Bartko,L., 1949** *Syekelyudvarhely Homorodalmas kornykenek foldtany viszonyai.* Foldt.Int.Evkonyv.XXXIX.

37. **Bedelean,H.,2012,***Geologia zonei Poarta Meseşană-Moigrad*, Ed.Cordial Lex, Cluj Napoca.

38. **Bedelean,I.,Bedelean,H.,1993,** *Metamorfismul de contact termic de la Măgura Moigradului,* Studia Univ."Babeş-Bolyai"XXXVIII/1p.37-41, Cluj Napoca.

39. **Ben□e,F., 1976 -1977,** *Aspecte morfologice □i morfometrice ale reliefului din Depresiunea □imleu,* Lucrări □tin□ifice , seria A , separatum Geografie, Oradea .

40. **Bercia,I.,Bercia,E.,1970,** *Contribu□ii la cunoa□terea geologiei regiunii Vatra Dornei-Iacobeni(Carpa□ii Orientali)*. An.Inst.Geol.XXXVIII,p.7-49,Bucure□ti.

41. **Bercia,I., Kraütner, H., 1976,** *Premesozoics metamorphites of the East-Carpathians.*An.L,Inst.G□ol.Geof.,Bucure□ti.

42. **Berindei I.,1973**, *Evoluția paleogeografică a depresiunilor golf din vestul României*. Editura Ştiințifică. Bucureşti.

43. **Berindei I.O.,Dumitraşcu S.,1969**, *Contribuții la stabilirea genezei Câmpiei Crişurilor şi a luncilor din depresiunile golf. Formarea luncii Crişului Negru.*Lucrări Ştiințifice, Seria A.,Instit-pedag.Oradea.

44. **Berindei, I., Mac, I., 1980**, *The impact of tectonics in defining the peculiar mountain units in west of Romania,* Revue Roumanie de Geologie , Gèophisique et Gèographie, Gèographie,24.

45. **Bernoulli,D.,1981**,*Ancient continental margins of the Tethyan Ocean*.In: Ballz,AW,Wats AB,Grow, JA,Manspeizer, W,Bernoulli D.,Schreiber,C, Hunt JM (eds),*Geology of passive continentals margins,history, structure and sedimentologic record* (with, special emphasis on the Atlantic margin).Am Ass Petrol Geol,Education, Course Note Series 19,5,p.1-36.

46. **Berza,H.,Iancu,V.,Viorica et al.,1994,***Geological Evolution of the Alpine-Carpathian-Pannonian-system,*ALCAPA II,guidebook.Rom.J.Tect.Reg.G□ol.75.

47. **Blaga, L., 2005-2006,**Analiza geomorfo-sistemelor prin modele generale.Aplicații în Munții Plopişului.

48. **Bleahu, M., 1976**,: *Structural position of the Apuseni Mountains in the Alpine system. Rev. Roumanie.* Géol. Géophys. Géogr. Ser. Geol. 20, 1, 7—19.

49. **Bleahu M., Lupu M., Patrulius D., Bordea S., Stefan A. & Panin. 1981**,: *The structure of the Apuseni Mountains.* Guide to Ex- GEOLOGICA CARPATHICA, 2013, 64, 4, 279—290 *Late Triassic to early cretaceous Tisza unit : Continental platform towards rifting* 289 escursion B3, XII Congress of the Carpatho-Balkan Geological

50. **Bleahu M., Mantea G., Bordea S., Panin S., Stefanescu M., Sikić K., Haas J., Kovács S., Péró Cs., Bérczi-Makk A., Konrád Gy., Nagy E., Rálisch-Felgenhauer E. & Török Á.**

1996,: *Triassic facies types, evolution and paleogeogeographic relations of the Tisza Megaunit.* Acta Geol. Hung. 37, 3-4, 187-234.

51. **Bleahu, M.,1983,***Tectonica globală.*Vol.I.Ed.□t.Enc.Bucure□ti.

52. **Bleahu, M.,1989,** *Tectonica globală.*Vol.II.,Ed.□t.Enc.Bucure□ti,

53. **Bleahu, M.,Soroiu, M.,and Catilina R.,1984,***On the Cretaceous tectonomagmatic evolution of the Apuseni Mountains as revealed by K-Ar dating,* Revue Roumaine de Physique, t.29,1.p.123-130.

54. **Bleahu,M.,1980,** *Relieful Carstic*,Editura Albatros, Bucureşti.

55. **Bleahu,M.,Lupu, M.Patrulius, D.,Bordea, S.,□tefan, A., and Panin,S.,1981**,*The structure of the Apuseni Mountains,*Carpatho – Balkan Geological Association,XII Congress,Bucharest,Romania, Guide to Excursion-B3,103-p.,Bucharest.

56. **Bogdan.C.,Mac,I.,2014**,*Risk phenomena in the Silvania Mountains,intuitive and genetic reflexes,* în volumul Riscuri şi Catastrofe,,Nr.XIII, VOL. 14,Nr.1, Editor Sorocovski, V.,Editura Casa Cărții de Ştiință, Cluj Napoca.

57. **Bosellini, A. 1984**, Le *Scienze della Terra è l' Universo intorno a noi*, Italo Bolventa Editore s.r.l Ferrara.

58. **Bosselini A., 1995,** *Tettonica delle placche e geologia*,Italo Bovolenta Editore.Ferrara

59. **Brivio,L.,1995,** *Argomenti di Geologia,* Edizioni Spiegel,Milano.

60. **Buda Gy., Koller F. & Ulrych J. 2004**: *Petrochemistry of Variscan granitoids of Central Europe: Correlation of Variscan grani- toids of the Tisia and Pelsonia Terranes with granitoids of the Moldanubicum, Western Carpathians and Southern Alps*. A re- view: Part I. Acta Geol. Hung. 47, 117—138.

61. **Burchfiel B.C. 1980**: *Eastern European Alpine system and the Car- pathian orocline as an example of collision tectonics.* Tectono- physics 63, 31—61.

62. **Buzilă,L.,2005,** *Procesele de meteorizare şi reflectarea lor în morfologia Masivului Bihor.T*ză de doctorat.Cluj Napoca.

63. **Carlo Bartolini,Angelo Pecerillo, 2002,***I fattori geologici delle forme di rilievo, lezioni di geomorfologia strutturale,* Pitagora Editrice Bologna.

64. **Cavazza,W., Roure,M.F.,Spakman,W.,Stampfli, G.M.,Ziegler,P.A.,2004,** *The Transmed Atlas,The Mediterranean Region From Crust To Mantle,*Springer,Stürz AG.Würzburg.

65. **Ciaccacci,S.,2010,** *Le forme del rilievo.Atlante illustrato di Geomorfologia*,Mondadori Education, S.P.A.Milano.

66. **Ciocârdel,R., Socolescu, M.,1969,** Act.Geol. Hung.,XIII.,p.157-164,Budapest.

67. ***Cioflică,G., Savu, Ştefan, A., Istrate,G.,1973*****,** *Alpine Volcanism and Metallogenesis, in the Apuseni Mountains*, Symposium Volcanism and Metallogenesis, Bucharest, Guide to Excursion 3 AB, Bucharest, p.45.

68. **Ciulavu D., 1999,** *Tertiary tectonics of the Transylvanian Basin.* PhD thesis, Vrije Universiteit, Amsterdam, 152 pp.

69. **Ciulavu D., Bertotti G., 1994**, *The Transylvanian Basin and its Upper Cretaceous substratum*. Rom. J. Tectonics, 75 (2), p. 59-64.

70. **Ciulavu D., Bertotti G., 1994**, *The Transylvanian Basin and its Upper Cretaceous substratum*. Rom. J. Tectonics, 75 (2), p. 59-64.

71. **Ciulavu D., Dinu C., Szakács Al., Dordea D., 2000**, *Neogene kinematics of the Transilvanian Basin (Romania),* AAPG Bulletin, V. 84, No. 10, p. 1589-1615.

72. **Ciulavu, D., 1999,** *Tertiary tectonics of the Transylvanian Basin.*PhD thesis,NSG,981105,p.152

73. **Ciulavu.D.,Bertotti,G.,1994,** *The Transilvanian Basin and Its Upper Cretaceous Substratum*,ALCAPA II Field Guide Book, Rom.Jour, of Tect.and Reg.Geol.,vol. 75, supl.2 p.59-

74. **Ciupagea,D., Păucă,M., Ichim,Tr.,1970,** *Geologia Depresiunii Transilvaniei*,Ed.Acad., Bucure□ti.

75. **Ciupagea,D.,Păucă,M.,Ichim.,1970,** *Geologia Depresiunii Transilvaniei*,p.34-192, Editura Academiei Republicii Socialiste România.Bucureşti.

76. **Ciurean, C., 2008** *, Jugul Intracarpatic func□iile geografico – umane* , Presa Universitară Clujeană.

77. **Clichici O. ,1967** *Asupra prezen□ei orizontului buglovian în cuprinsul Bazinului □imleu* . □edin□a de comunicări a Catedrei de Geologie – Paleontologie .

78. **Clichici, O., 1973,** Stratigrafia neogenului di estul Bazinului □imleu, Editura Academiei România,Bucure□ti

79. **Clichici, O. , 1968**, *Tectonica □i evolu□ia păr□ii de est a Bazinului □imleu. Extras din* Studia Univ. Babe□ Bolyai , Series Geologia –Geographia , Vol.1,p.53-70.

80. **Clichici, O.,1972,** *Studiul sedimentarului neogen di partea estică a Bazinului □imleului*,Ed.Academiei, Bucure□ti.

81. **Clichici,O. 1967,** *Câteva constatări pe baza cercetării sedimentelor permo –triasice din sectorul Mese□,* Jude□ul Sălaj .

82. **Clichici,O.1971,***Studiul zăcământului de calcar de la Leghia(Jud.Cluj)*,Extras din Studia Univ.Babeş-Bolyai,Geologia- Mineralogia, fasc.2,p.41-46.-Rezumat în limba rusă şi engleză.

83. **Clichici,O.,1965,** *Cretacicul în facies de Gossau de pe bordura vestică a Munților Meseş*."Studia Univ.Babeş-Bolyai, Geol.geogr.2.

84. **Clichici,O.,1970,***Studiul tehnico-economic al andezitului cu amfiboli din cariere Rodna Veche(Județul Bistrița Năsăud)*.Extras din Studia Univ.Babeş-Bolyai Cluj Napoca,seria.Geologia-Mineralogia,fasc.2(1970)p.27-32.

85. **Cocean,P.,2005**,*Geografia Europei*,p.9., Presa Universitară Clujeană,Cluj Napoca.

86. **Condie C.K.,1982,** *Plate Tectonics sand Crustal Evolution*,Pergamon,Press,New York.

87. Consiliul Superior al Agriculturii, Direcția Generală a Fondului Funciar şi Organizării Teritoriului (1996), Atlas de semne convenționale pentru planurile topografice, la scările 1:5000 şi 1: 10.000, Bucureşti.

88. **Cormoş,V.,1980,** *Sălaj, Monografie*, p.11-33.,Editura Sport- Turism, Bucureşti.

89. **Corpade, C.,2005,** *Abordări tematice şi integrate în cunoaşterea mediului*.Suport de curs şi seminar, Cluj Napoca.

90. **Coteț P.,1969,** *Suprafețe geomorfologice de tip piemont, pediment, glacis şi studiilor* .Studii şi cercetări de geolog.geof.şi geograf.,seria geografie, tom.XVI, nr.2.

91. **Coteț,P.,1956**,*Piemonturile de acumulare şi importanța studiului* lor, în Probleme de Geografie, vol III,pp.97-109.

92. **Cox, A., Hart, R.B., 1990** ,*La Tettonica delle Placche* , *Meccanismi è Modalitá*, Zanichelli editore S.p.A - Bologna.

93. **Crețan, R.,2006,** *Geografia Europei*, Ed. Artpress,Timişoara.

94. **Csontos L. & Nagymarosy A., 1998**: *The Mid-Hungarian line: a zone of repeated tectonic inversions.* Tectonophysics 297, 51-71.

95. **Csontos L., & Vörös A., 2004**: *Mesozoic plate tectonic reconstruc- tion of the Carpathian region*. Palaeogeogr. Palaeoclimatol. Palaeoecol. 210, 1-56.

96. **Csontos L., 1995,**: *Tertiary tectonic evolution of the Intra-Carpathian area: a review.* Acta Vulcanol. 7, 2, 1-13.

97. **Csontos L., Nagymarosy A., Horváth F. & Kovác M. 1992,**: *Cenozoic evolution of the Intra-Carpathian area: a model.* Tectonophysics 208, 221-241.

98. **Csontos L., Nagymarosy A., Horváth F. & Kovác M. 1992,**: *Tertiary evolution of the Intra-Carpathian area: a model.* Tectonophysics 208, 221-241.

99. **Csontos, L.,1995,***Tertiary tectonic evolution in the Intracarpathian area*:a review.Acta Vulcanologica,7(2),1-15.

100. **Dallmayer R.D., Neubauer F., Pana D. & Fritz H. 1994**,: *Variscan vs. Alpine tectonothermal evolution within the Apuseni Mts., Romania: Evidence from 40Ar/39Ar mineral ages.* Rom. J. Tect. Regional Geol. 75, 2, 65—76.d.

101. **Dallmeyer D.R., Neubauer F., Handler R., Fritz H., Müller W., Pana D. & Putiš M. 1996:** *Tectonothermal evolution of internal Alps and Carpathians: Evidence from 40Ar/39Ar mineral and whole rock data.* Eclogae Geol. Helv. 89, 203-227.

102. **Dallmeyer R.D., Neubauer F., Fritz H. & Mocanu V. 1998**: *Variscan vs. Alpine tectonothermal evolution of the South Car- pathian orogen: constraints from 40Ar/39Ar ages.* Tectonophysics 290, 111-135.

103. **Dallmeyer, R. D., Kräutner, H. G., Neubauer, F., 1997,** *Middle-Late Triassic 40Ar/39Ar hornblende ages for early intrusions within the Ditrau alkaline massif, Romania: implications for Alpine Rifting in the Carpathian orogen.* Geologica Carpathica, 48, 6, p. 347-352.

104. **Dallmeyer,R.D,Pană,D.,Neubauer,F.,and Erdemer, P.,1999,** *Tectonothermal evolution of the Apuseni Mountains,*Romania, Resolution of Variscan vs.Alpine events with 40Ar/39 Ar ages, Journal of Geology, 107,329-352.

105. **Debelmas and Săndulescu, M.,1987,***Transformante Nord-Penninique et Problems de Correlation Palinspastique entre les Alpes et les Carpates*.Bull.,Soc.,Gol.France,8,III,2,p.403-408.

106. **Decker, R. Decker, B., 1981** , Volcanoes, W.H Freeman and Company, San Francisco.

107. **Demetrescu, C., Polonic, G. 1989**, *The evolution of the Pannonian Depression (Romanian sector), as derived from subsidence and heat flow data.* Tectonophysics, 164, 287–29.

108. **Dewey, J.F, Burke, K.C.A 1974,** *Hotspots and continental break –up: implication for collisional orogeny.* Geology 2, p.57- 60.

109. **Dewey,J.F.,Pitman III W.C.,Ryan, W. B.F,Bonin,J.,1973**,*Plate Tectonics and the Evolution of the Alpine System.*Geol.Soc.Amer.Bull.84,10,3137-3180.

110. **Dimitrescu, R.,1995,** *Contribuţii la corelarea unităţilor de fundament, ale Munţilor Apuseni şi Carpaţilor Meridionali cu cele din Depresiunea Panonică şi de peste Dunăre.*Şt. şi Cercet.de Geologie 40 , 133-139, Bucureşti.

111. **Dimitrescu,R.,1959,** *Note asupra geologiei regiunii Ciucea*,D.S.Com.Geol.,XLII(1994-1995).p.43-48,Bucureşti.

112. **Dimitrescu,R.,1963,***Asupra şisturilor cristaline din nord-vestul Transilvaniei,*Soc. De Şt.Nat.şi Geogr.,Com., de Geologie,II,Bucureşti,p.56-72.

113. **Dimitrescu,R.,1985,1986,***La structure du cristallin "Autochtone"-Gilău,* Institutul de Geologie □i Geofizică,Dări de Seamă ale □edin□elor,vol.72-73,Bucure□ti.

114. **DimitrescuR.,1963**,*Asupra şisturilor cristaline dinN.V Transilvaniei*,"Bul.Soc şt.nat."VII, Bucureşti.

115. **Doglioni ,C., 2007,** *Interno della Terra,* articolo pubblicato nella „ Enciclopedia delle Scienze Treccani ".

116. **Donisă, I.,1977**, *Bazele teoretice □i metodologice ale Geografiei*, Editura Didactică □i Pedagogică Bucure□ti.

117. **Drăghiceanu,M.M.,1923**,*Tectonica Transilvaniei.Liniile tectonice directrice ale bazinului Transilvaniei,* D.S.Inst.Geol.XI,Bucure□ti.

118. **Dragoş,I.,1965,** *Caracterele tehnico-economice ale andezitului din cariera Moigrad(raionul Zalău)*, Studia Univ." Babeş- Bolyai", seria Geol-Geograf., fasc. 2,p.67-72,Cluj Napoca.

119. **Dumitrescu,I.,Săndulescu, M.,1968**,*Problems structuraux fondamentaux des Carpathes Roumaines et de leur avant-pays.*Ann.Inst.Geol.XXXVI,p.195-218,Bucure□ti.

120. **Ellouz N. & Roca E. 1994**: *Palinspastic reconstructions of the Carpathians and adjacent areas since the Cretaceous: a quantitative approach.* In: Roure F. (Ed.): Peri-Tethyan platforms. Éditions Technip, Paris, 51—78.

121. **Ellouz N. & Roca E. 1994**: *Palinspastic reconstructions of the Carpathians and adjacent areas since the Cretaceous: a quantitative approach*. In: Roure F. (Ed.): Peri-Tethyan platforms. Éditions Technip, Paris, 51—78.

122. **Ellouz N., Roure F., Sa□ndulescu M. & Ba□descu D. 1996**: *Balanced cross sections in the Eastern Carpathians (Romania): a tool to quantify Neogene dynamics.* In: Roure F., Ellouz N.,

123. **Ellouz N.,Roca E.,1994,***Palinspastic reconstruction of the Carpathians and adjacent areas since the Cretaceous: a quantitative approach.*In : Roure, F.,(ed), Peri-Tethyan platforms.Ed.Technip,Paris,p.51-78.

124. **Faupl and Wagreich, M,1999**,*Late Jurasic to Eocene paleogeography and geodynamic evolution of the Eastern Alps.*Mit Oster Geol. Gessel 92: 79-94.

125. **Faupl P., Császár G. & Mišík M. 1997**: *Cretaceous and Palaeogene sedimentary evolution in the Eastern Alps, Western Car- pathians and the North Pannonian region:* An overview. Acta Geol. Hung. 40, 3, 273—305.

126. **Federici, P.R. Axianas L., 1983,** *Nuovi lineamenti di Geografia Generale* , Editore Bulgarini, Firenze.

127. **Ficheux R.1971,** *L evolution morphologique du Crişul Repede* (II).Revue Roum.de geol.geoph.et geogr.serie geogr. tome 15,nr.2.

128. **Filip,S.,2008,** Depresiunea şi Munceii Băii Mari, studiu de geomorfologie environmentală. Ed.Presa Universitară Clujeană,Cluj Napoca.

129. **Florian,B.,1974**, *Depresiunea □imleului.Studiu de geografie regională.*PhD thesis.FM.13.092/2,p.1-45. Facultatea de Geografie-Geologie. Rezumatul tezei de doctorat.Prof.Dr.doc.Victor Tufescu.

130. **Florian,Bențe,1970,**Observații geomorfologice în Valea Crasnei între Şimleul Silvaniei şi Supuru de Jos.Extras din Lucrări Ştiințifice,Geografie,p.29-36.

131. **Frisch, W.,1979,** *Tectonic progradation and plate tectonic evolutionof the Alps.*Tectonophysics 60-121-139.

132. **Froitzheim,N., Schmid,S.,Frey, M.,(1995)**, *Two neogene cycles(Cretaceous and Tertiary) at the western marginof the Eastern Alps (Groubunden area).*Second workshop alp.Geol.,Basel, 5-7 January 1995,Abstract,30-31.

133. **Gavăt,I.,Airinei,□t.,Botezatu,R.,Socolescu,M.,Stoenescu, S.C.;Vencov, I.,(1964)**, *Structura geologică profundă a teritoriului R.P.R,*Studii □i Cercetări,Geofizică,I/1,Bucure□ti.

134. **Gisotti,G.,2011,** *Le unita di paesaggio.Analisi geomorfologica per la pianificazione territorial e urbanistica,*Dario Flaccovio Editore, s.r.l.

135. **Giu□că D, H., Savu, I., Bercia, Krautner H.,1969***, Succesiunea Ciclurilor Tectonomagmatice Prealpine , pe teritoriul României*.Buletinul Societă□ii de □tiin□e geologice din România.

136. **Goffe,B.,Oberhänsli,R.,1992**,Ferroand magnesiocarpholite in the Bunderschiefer of the eastern Central Alps (Grisson and Engadine window).Eur.J.Mineral,4: 835-838.

137. **Goia I., 1982** ,"*Zona Etnografică Mese□".* Editura Sport- Turism , Bucure□ti.

138. **Gudea, N.,1988,** Porolissum, cheia de boltă a apărării Daciei Porolissensis,în AMP,XII, Muzeul de Istorie şi Artă, Zalău, p.195-214.

139. **Gyo□rfi I., Csontos L. & Nagymarosy A. 1999,***: Early Cenozoic struc-tural evolution of the border zone between the Pannonian and Transylvanian basins.* In: Durand B., Jolivet L.,

140. **Györfi, I., Csontos, L. 1994**: *Structural evolution of SE Hungary and Neogene basins of the Apuseni mountains (Romania).* Rom. J. Tecton. Reg. Geol. 75: 19–20.

141. **Haas J. & Péró Cs. 2004,**: Mesozoic evolution of the Tisza Mega- unit. Int. J. Earth Sci. 93, 2, 297—313.

142. **Haas J., Kovács S., Krystyn L. & Lein R. 1995**,: *Significance of Late Permian—Triassic facies zones in terrane reconstructions in the Alpine—North Pannonian domain.* Tectonophysics 242, 1, 19—40.

143. **Haas J., Mioć P., Pamić J., Tomljenović B., Árkai P., Bérczi-Makk A., Koroknai B., Kovács S. & Rálisch-Felgenhauer E. 2000**,: *Complex structural pattern of the Alpine-Dinaridic-Pannonian triple junction.* Int. J. Earth Sci. 89, 377—389.

144. **Haas J., Tóth-Makk Á., Góczán F., Oraveczné-Scheffer A., Oravecz J. & Szabó I. 1988***: Lower Triassic key sections in the Transdanubi- an Mid-Mountains.* Ann. Inst. Geol. Publ. Hung. 65, 1—356.

145. **Haidu,I.,2002,** *Analiza de frecvenţă şi evaluarea cantitativă a riscurilor*,pp.180-206, în volumul Riscuri şi Catastrofe, Editor Sorocovski, V.,Editura Casa Cărţii de Ştiinţă, Cluj Napoca.

146. **Haidu,I.,Haidu ,C.,2002***,Analiza de frecven□ă □i evaluarea cantitaivă a riscurilor,*în volumul ”Riscuri □i catastrofe”,Editor Sorocovski,V.,Editura Casa Căr□ii de □tiin□ă,p.180-207,Cluj Napoca.

147. **Hauer,Fr.,Stache,** G.,*Geologie Siebenbürgens*,Wien.

148. **Hess, H.,1962,** *History of oceans basins, in petrologic studies*.p.599-620,Volum omagialpentru A.Fbuddington.Geol.Asoc.America.

149. **Hofmann K.,Jelentes 1878, az 1879** nyaran Szilagymegye keleti reszeben tett foldtani reszletes felvetelekrol.” Foldtani Kozlony”.Budapest.

150. **Hofmann,K.,1881**,*Bericht über die in Nordwestsiebebürgischen Grenzebirgeund Umbergung in sahre*1881.Föld.Közl.XI,p. 317-329, Bucarest.

151. **Hofmann,K.,1888,** *Bericht über die im Sommer d.f1886 ineNW lichen Theile des Szolnok-Dobaker Comitates*.Jahresb.d.Kgl.ung.geolog.Austalt.j.1886,p.45-54,Budapest.

152. **Horváth,F.,1993**, *Towards a mechanical model for the formation of the Pannonian Basin.In: S.Cloething,W.Sassi □i F.Horvath.The origin of the sedimentary basins: Inferences from quantitative modeling and basin analysis;*Tectonophysics,226,333-357.

153. **Huismans, R.S., Bertotti, G., Ciulavu, D., Sanders, C.A.E., Cloetingh, S., Dinu, C. 1997:** *Structural evolution of the Transylvanian Basin (Romania); a sedimentary basin in the bend zone of the Carpathians.* Tectonophysics 272: 249-268.

154. **Iacobescu , M. Airinei, Şt. Ciocârdel, R. Popescu, M.,1975 ,** *Fizica şi structura scoarţei terestre din România,* Editura Tehnică Bucureşti.

155. **Iano□ Gh., 2005** *, Paleogeografia Cuaternarului* , Editura Universită□ii de Vest , Timi□oara

156. **Ianovici, V., Borcoş,M., Bleahu,M.,Patralius,D.,Lupu,M.,Dumitrescu,R., Savu,H.,1976,** *Geologia Munţilor Apuseni*,p.20-554, Editura Academiei Republicii Socialiste România.Bucureşti.

157. **Ichim, T.,Soroiu, M.,Stănescu, A.,1984,***Determinări de vârstră a fundamentului cristalin din zona de nord a depresiunii Panonice prin metoda K-Ar.*Mine.Petrol, Gaze,35,7,338-339,Bucure□ti.

158. **Idu,P.D.,1997***,Agricultură, pădure şi toponimie,* în Studia UBB, nr 1-2,Cluj Napoca.

159. **Idu,Petru Dan 2000**,Toponimie geografică,Editura Dimitrie Cantemir, Târgu Mureş.

160. **Ielenicz,M.,Pătru,I.,2006**,*Geografia fizică a României,*Editura Universitară, Bucureşti.

161. **Ignat,V.,1973**, *Geologia şi petrografia părţii de sud a Munţilor Meseş*(regiunea Ciucea-Vânători-Măgura Priei),D.S.Inst.Geol.LIX/1,p.207-230.

162. **Ionesi.L.,1989,***Geologia României*: unităţi de platformă şi orogenul nord-dobrogean,curs Univ.Iaşi.

163. **Iorga, N.,2006**, *Istoria românilor din Ardeal □i Ungaria,*Vol.1-2,Editura SAECULUM I.O.,Bucure□ti.

164. **Irimu□ Ioan Aurel, 2006**, Hazarde şi riscuri associate proceselor geomorfologice în aria cutelor diapire din Depresiunea Transilvaniei,Casa Cărţii de Ştiinţă, Cluj Napoca.

165. **Irimuş Ioan Aurel,2003,** Geografia fizică a României,Ed.casa Cărţii de Ştiinţă, Cluj Napoca.

166. **Irimu□, I. A., Fodoran, F., Petrea, D., Fodoran I.,** *Geositul Porolissum, Morfologie, Arheologie, Topgrafie* , 23 , Studia – Anul LV I – Universitatis Babe□ Bolyai, Gegraphia I.

167. **Irimuş, I.A,Bogdan,C.,(2016),***Submontan Paramese□ depressions in the structural context of the Transylvanian Basins*, Studia UBB, Seria Geografie,n.2.

168. **Irimuş, I.A,Bogdan,C.,(2017)**, Tectonic and structural relationship in Silvania Mountains, Studia UBB, Seria Geografie,n.1.

169. **Irimuş,I.,1997**,*Cartografiere geomorfologică*, Ed.Focul Viu, Cluj Napoca.

170. **Irimuş,I.A.,2005**,*Tehnici de cartografiere, monitoring şi analiză Gis*, Ed.Casa Cărţii de Ştiinţă, Cluj Napoca.

171. **Irimuş,I.A.,2006**,*Hazarde şi riscuri asociate proceselor geomorfologice, în aria cutelor diapire din Depresiunea Transilvaniei,* Editura Casa Cărţii de Ştiinţă, Cluj Napoca.

172. **Irimuş,I.A.,Vescan,I., Man, T.,2006**, *Tehnici de Cartografiere, Monitoring şi Analiză Gis, casa*, Cărţii de Ştiinţă, Cluj Napoca.

173. **Irimuş, Ion Aurel 1998**,Relieful pe domuri şi cute diapire în Depresiunea Transilvaniei,Presa Universitară Clujeană, Cluj Napoca.

174. **Istrate,Gh.,1976**, *Studiul petrografic al Masivului Vlădeasa* (partea vestică)-rezumatul tezei de doctorat, Bucureşti.

175. **Joja,J.,1956**, *Observa□ii de ordin stratigrafic în regiunea din jurul ora□ului Jibou,* An.Com.Geol.XXIX, p.309-323, Bucure□ti.

176. **174.Josan N., 1970**,Dealurile Dernei, aspect geomorfologice.Extras din Lucrări Ştinţifice,Seria A,pag.183-189.

177. **Josan,I.,2009**,*Ţara Silvaniei, studiu de geografie regională*,p.7-96,195-228.Editura Universităţii din Oradea.

178. **Josan,N.,1970**,*Dealurile Dernei, aspecte geomorfologice*, FM.12496,Oradea.

179. **Josan,N.,1983**,*Cum s-a format relieful,* Ed.Stinţifică şi Enciclopedică Bucureşti.

180. **Josan,N.,1996**,*Geomorfologie generală*, Ed.Univ. din Oradea, Oradea.

181. **Josan,N.,2004**,Hazarde şi riscuri natural şi antropice în Bazinul Barcăului,Ed.Universităţii din Oradea,Oradea.

182. **Josan,N.,2014**, *Antropizarea reliefului*, geomorfologie antropică.Ed.Univ. din Oradea, Oradea.

183. **Kearey, P. ,Vine,F.J., 1994** , *Tettonica Globale,* Zanichelli Editore, S.p.A Bologna.

184. **Kober,L.,1931**, *Das Alpine Europa*, Berlin.

185. **Koch,A.,1894**,*Die Tertiärbildungen des Bekens der Siebenbürgischen Landestheile,I.Paleogene Abtheilung.*Mitth.a.a.Jahr.X,6,p.177-399,Budapest.

186. **Koch,A.,1894,1900**,*Die Tertiäalbindungen der Siebenbürgischen Landesteile (I.Paläogen, II Neogen),*Budapest.

187. **Koch,A.,1900**,*Die Tertiärbildungen des Bekens der Siebenbürgischen Landestheile.II.NeogeneAbtheilung,*p.1-370,Budapest.

188. **Kovács S., Császár G., Galácz A., Haas J., Nagy E. & Vörös A. 1989:** *The Tisza Superunit was originally part of the Northern (European) Margin of Tethys. In: Nairn A. (Ed.): Evolution of the Northern Margin of Tethys.* The Results of the IGCP Project 198 2, 81—100.

189. **Kovacs, S.,1980,**:*Paleogeographical Significance of the Triassic Hallstatt Limestone Facies in the North Alpine Facies region*,Foldt.Kozl.,4-4,360-481,Budapest.

190. **Kovacs,S.,1982,** *Problems of the Pannonian Median Massif and the Plate Tectonic Concept.* Contribution Based on the Distributionof Late Paleoyoic-Early Mesozoic Isopic Yones.Geolog.Rund.,Band 71,Heft,2617-640, Stuttgard.

191. **Kozur, H.,1991 b,** *The Evolution of the Meliata- Halstatt Ocean and its significancefor the early evolution of the Easthern Alps and Western Carpathians.In : Channell JET,Winterer EL,Jansa,LF(eds).Paleogeography of Tethys.*Paleogeogr Paleoclim Paleoecol 87 :109-135.

192. **Kräutner H.G. 1997,** *Alpine and Pre-Alpine terranes in the Roma-102 VOZÁROVÁ et al.*

193. **Kraütner, Th. , 1930** , *Cristalinul Mun□ilor Rodnei* , Dări de seamă ale □edin□elor , Institutul Geologic al României, vol .XIII (1924 -1925), Atelierele grafice Socec & Co, Sa.Bucure□ti.

194. **Krautner,Th.,1934,** ***Recherchesgeologique et petrographzques dans les massifs cristalins*** *du NV de la Transylvanie*, Comptes Rendus des Seances,XXIII,Inst.Geol., Bucureşti.

195. **Kraütner,Th., 1938,** *Das cristaline Massiv von Rodna Ostkarpathen*, An.XIX,Inst.G□ol.Rom., Bucure□ti.

196. **Kraütner,Th.,1941,** *Etude Geologique dans la Pădurea Craiului*, C.R.XV,Ins.Geol.Rom.,Bucure□ti.

197. **Le Pichon X.,1968,** *Sea floor spreading and continental drift*.J.geophys.,Res.,73,3661-3697.

198. **Le Pichon, Francheteau, X., Bonnin J. , 1973 ,**Plate Tectonics. Elsevier, Amsterdam.

199. **Lechin□an ,V., 1996** , □*ara Silvaniei*, Editura Carpatica .

200. **Lexa, J., Konecny, V. 1998.** *Geodynamic aspects of the Neogene to Quaternary volcanism*. In: Rakus, M.

201. **Lobonțiu E., 1922,** *Privire generală asupra morfologiei Sălajului, Anuarul Liceului „Simion Bărnuțiu”,* Şimleu Silvaniei.

202. **Mac ,I., 1980,** *Geomorfologie,curs,*volumul II Uz Intern.

203. **Mac ,I., 2003,** □*tiin□a Mediului*, Editura Europontic, Cluj – Napoca.

204. **Mac I., Nuna Gr.1964,** *Studiul apelor arteziene din regiunea oraşului Zalău*. Studii şi cercetări de geolog.geof.şi geograf.,seria geografie, tom.11.

205. **Mac, I. , Hosu ,M., 1992,** *Glacisurile din Depresiunea Zalău* , Studia U.B.B, Geographia,XLIV,2, 204.

206. **Mac, I., 2000,** *Geografie generală*, Editura Europontic, Cluj – Napoca.

207. **Mac, I., 2008** ,*Geografie Normativă*, Editura Presa Universitară Clujeană, Cluj – Napoca.

208. **Mac, I., 1976.,***Geomorfologie*, volumul I , Uz Intern.

209. **Mac, I., 1996**, *Influen□a reliefului în dezvoltarea, sistematizarea □i estetica urbană a municipiului Zalău* , Studia U.B.B , Geographia , Cluj Napoca.

210. **Mac, I., 1996, *Geomorfosfera*** *si Geomorfosistemele*, Editura, Presa Universitara Clujeana.

211. **Mac, I., Grigore, N., (1994),** *Studiul apelor arteziene din regiunea ora□ului Zalău,* extras din Studii □i cercetări de geologie – geografie , Seria Geografie , Bucure□ti .

212. **Mac, I., Hosu, M., (2002) ,** *Interpretări Geomorfologice privitoare la structurile magmato - vulcanice din Depresiunea Transilvaniei*, Studia UBB, Geografie 2, Cluj Napoca.

213. **Mac, I., Petrea, D.,2002,***Polisemia evenimentelor geografice extreme,* în volumul ”Riscuri □i catastrofe”,EditorSorocovski,V.,Editura Casa Căr□ii de □tiin□ă,p.11-23,Cluj Napoca.

214. **Mac, I.,2000,***Geografie Generală*,Editura Europontic,p.524, Cluj Napoca.

215. **Mac, I.,Sorocovski, V.,1978**,*Rela□ii morfodinamice în Depresiunea Transilvaniei*,în Studia Univ.Babe□-Bolyai,seria Geologie-Geografie,nr.1, Cluj Napoca.

216. **Mac,I.,1986,** *Elemente de geomorfologie dinamică,* Editura Academiei Republicii Socialiste România, Bucureşti.

217. **Mac,I.,1996,***Geomorfologie dinamică,* Editura Academiei, Bucureşti.

218. **Mac,I.,2009,***Geometamorfoze tectogeomorfologice în nord-vestul României : Munţii Silvaniei,*Revista de Geomorfologie, Vol.11, Bucureşti.

219. **Mac,I.,Irimuş, 1998,**Geomorphological homologies in the mountainous massifs situated in the north-western part of the eastern Transylvanian Depression, Geomorphology of the Carpatho-Balcan Region p.20-28.

220. **Mac,I.,Tudoran, P.,1975,** *Iniţieri practice în cunoaşterea reliefului*, Uz intern, Cluj Napoca.

221. Macovei,G.,*Limita cristalin –sedimentar în forajele din aria cuprinsă între Masivul Preluca □i eruprivul neogen Gutâi(Baia Mare)*.

222. **Marin,I.,Marin,M.,2006,** *Geografie regională*, Europa,Editura Universitară, Cluj Napoca.

223. **Márton E. & Fodor L. 1995,** *Combination of palaeomagnetic and stress data – a case study from North Hungary.* Tectonophysics 242, 99—114.

224. **Márton E. & Fodor L. 2003,** *Tertiary paleomagnetic results and struc- tural analysis from the Transdanubian Range (Hungary): rota- tional disintegration of the Alcapa unit.* Tectonophysics 363, 201—224.

225. **Márton E. & Márton P. 1989**, *A compilation of paleomagnetic results from Hungary.* Geophys. Trans. 35, 117—133.

226. **Márton E. 1985,**: *Tectonic implications of paleomagnetic results for the Carpatho-Balkan areas.* Geol. Soc. London, Spec. Publ. 17, 645—654.

227. **Márton E., Tischler M., Csontos L., Fügenschuh B. & Schmid S.M. 2007,** *The contact zone between the ALCAPA and Tisza-Dacia mega-tectonic units of Northern Romania in the light of new palaeomagnetic data.* Swiss J. Geosci. 100, 109—124.

228. **Márton, E., Márton, P. 1996,**: *Large scale rotations in North Hungary during the Neogene as indicated by palaeomagnetic data. In: Palaeomagnetism and tectonics of the Mediterranean region* (Morris, A., Tarling, D.H., eds.). Geol. Soc. Spec. Publ. 105: 153-173.

229. **Márton, E., Pogác, P., Túnyi, I. 1992.** *Paleomagnetic investigations on Late Cretaceous-Cenozoic sediments from the NW part of the Pannonian Basin.* Geol. Carpath., 43, 363-369.

230. 317.Marton,E.,1987, *Paleomagnetism and tectonics in the Mediterranean region*.J.Gedyn.7,33-57.

231. **Mason, P.R.D., Seghedi, I., Szakacs, A., Downes, H. 1998,** *Magmatic constraints on geodynamic models of subduction in the Eastern Carpathians, Romania.* Tectonophysics, 297, 157-176.

232. **Mateescu,□t.,1927,***Date noi asupra structurii geologice a Depresiunii Zalăului,*Rev.Muz.Min.II,1,p.30-60,Cluj.

233. **Mateescu,□t.,1938,** *La faille de Moigrad et les variation de facies*.C.R.Acad.Roum.2,p.697-701,Bucure□ti.

234. **Matenco, L.C. 1997:** *Tectonic evolution of the Outer Romanian Carpathians: constraints from kinematic analysis and flexural modelling*. Ph.D. Thesis Vrije Universiteit, Amsterdam, 160 pp.

235. **Medve A. , Daroczi, I., Coste, Gh., 2011,** *Obiective turistice naturale □i antropice în nord estul jude□ului Sălaj,* Editura □coala noastră , Zalău .

236. **Meszaros ,N.,1961,**Observaţii în legătură cu procesul de migrare a gipsurilor Eocene de la vest de Cluj,Extras din Studia Universitatis Babeş-Bolyai, seies II Geologia-Geographia,fasciculus 1 p.95-101.Rezumat în limba franceză şi rusă.

237. **Mészáros, N., 1957,** *Fauna de moluşte a depozitelor paleogene din nord-vestul Transilvaniei,* Editura Academiei R. P. R., 174 p, Bucureşti.

238. **Mészáros, N., 1997,** *Formaţiunile terţiare din judeţul Sălaj. Natura Silvaniae,* 1, 83-96 p, Jibou.

239. **Mészáros, N., Codrea, V., Sa□sa□ran, E., & Sa□sa□ran L., 2001,** *O succesiune reprezentativa□ a depozitelor Paleogene din aria Gila□ului: zona Morlaca.* Studii s□i cerceta□ri (Geologie s□i Geografie), Numa□rul 6, 69-72 p, Bistrit□a.

240. **Meszaros, N., Mac,I., 1994,** Paleogeografia României, Cluj Napoca.

241. **Meszaros, N.,1957,** ,*Fauna de moluşte a depozitelor paleogene din NV Transilvaniei,*Edit.Academiei,R.P.R.,Bucureşti.

242. Meszaros, N.,1971, *Geologie Istorică*,I., Uz Intern, Cluj.

243. **Meszaros, N.,1973**, Geologie istorică III, Neozoicul,pp.16-128, Uz Intern, Cluj Napoca.

244. **Meszaros, N.,1997,**Formaţiunile terţiare din Judeţul Sălaj, Natura Silvaniae,1,p.83-96.

245. **Meszáros,N.,1957**,*Fauna de molu□te a depozitelor paleogene din NV Transilvaniei,*Edit.Acad.R.P.R,Bucure□ti.

246. **Meszáros,N.,Ghiurcă,V.,1965**,*Paleogenul dintre masivele □icău □i Preluca.* Extras din Studia Universitatis Babeş-Bolyai, series II Geologia-Geographia,fasciculus 2 p.29-43.

247. **Mihăilescu V.,1971,** *Porţile Transilvaniei*, Crisia, Oradea.

248. **Mihăilescu , V., 193**5 *, Platforma Someşeană*, B.S.R.R.G, LXIII, Bucureşti.

249. **Mihăilescu, V., 1978**, *Geografie Teoretică*, Editura Academiei Române, R.S.R, Bucure□ti.

250. **Mihăilescu, V.,1938,** *Observaţii morfologice în NV Transilvaniei*, în volumul omagial Grigore Antipa, „Homage á son oeuvre".Bucure□ti.

251. Bucureşti.

252. **Ministerul Agriculturii şi Industriei Alimentare, Direcţia de Fond Funciar şi Cadastru,** Atlas de semne convenţionale pentru planurile topografice, la scările 1:5000,1:2000,1.1000,1: 500, Cluj Napoca.

253. **Moisescu, M., 1969 ,***Consideraţii asupra faciesurilor oligocenului din regiunea Trăznea – Ciumărna,* Studia univ. B.B., seria Geologie, nr.2.

254. **Moisescu, V.,1975,** *Stratigrafia depozitelor paleogene şi miocen-inferioare din regiunea Cluj-Huedin-Românaşi(NV-ul Bazinului Transilvaniei),*An.Ist.Geol.şi Geofiz., vol.XLVII,p.5-213,Bucureşti.

255. **Morariu T.1969,** *Transilvania, aspecte geografice*, Terra, nr.1.

256. **Morariu T., Sorocovski V., 1972,** *Jude□ul Sălaj*, Editura Academiei Republicii România , Bucure□ti.

257. **Morariu, T.,Gârbacea, V.,1960,***Terasele râurilor din Transilvania*.Comunicările Acad.R.P.R.,tom.X,nr.6.

258. **Morariu, T.,Sorocovschi,.V.,1972,***Jude□ul Sălaj*.Edit.Acad.R.S.România.

259. **Mrazec, L.,1932,** *Consideration sur l origine de depressions internes des Crapates Roumaines.*Bul.Soc.Rom de Geol.Vol.I.Bucureşti.

260. **Mutihac, V., 1990,** *Structura geologică a teritoriului României*. Editura Tehnică , Bucure□ti.

261. **Mutihac, V., Ionesi, L.,1974,** *Geologia României*,Ed.Tehnică,Bucure□ti.

262. **Nagymarosy A. & Báldi-Beke M., 1993,** *The Szolnok unit and its probable paleogeographic position.* Tectonophysics 226, 457-470.

263. **Negu□, S., 2011**, *Geografie Umană*, Editura Academiei Române, Bucure□ti.

264. **Nemc□ok, M., Pospisil, L., Lexa, J., Donelik, R.A. ,1998,** *Tertiary subduction and slab breakoff model of the Carpathian Pannonian region.* Tectonophysics, 295, 307– 340.

265. **Neubauer,F.,Dallmeyer,R.D, and Fritz, H.,19**95,*Who was Tethys two rifts and two continent-continent collision explain the Alpine-Carpathians evolution*.Sec.Workshop Dep.Geol.Basel,,5-7,50-51.

266. **Neubauer, J., Greiner, B., Appel, E., 2001**, *Kinematics of the Alpine–West Carpathian orogen and paleogeographic implications:* J. Geol. Soc. London, 158: 97–110.

267. **Nicoară L. , Pu□ca□, A., 1999**, *Rolul municipiului Zalău în zona de contact dintre Depresiunea Transilvaniei □i Dealurile de Vest.* Studia U.B.B, Geographia,XLIV.

268. **Nicoară L., Puşcaş,A., 2004** ,*The Urban Influence in the Hills of Silvania (North – Western part of Romania* , Studia Universitatis Babe□ - Bolyai, Geographia , XlIX.

269. **Nicolae I., Saccani E., 2003,** *Petrology and geochemistry of the late Jurassic calc-alkaline series associated to Middle Jurassic ophiolites in the South Apuseni Mountains,* Romania, Schweiz. Min. Petr. Mitt., 83: 81-96.

270. **Nicolae, I.,1995,** *Tectonic setting of the ophiolites from the South Apuseni Mountains: Magmatic arc and marginal basin*: Rom J. Tectonics and Regional Geology, 76: 27–38.

271. **Nicorici, E.,1972**,*Stratigrafia Neogenului* din sudul Bazinului □imleu,Ed.Academiei, Bucure□ti.

272. **Nicorici,E.,1974,***Paleontologie şi Geologie Istorică*, cu elemente de Geologie Generală, Uz Intern,Cluj Napoca.

273. **Nitu Gh., 2006-2008,** *Riftul transcurent al Apusenilor şi poziţia nodului uranifer al Bihorului* Central,St.cerc.geologie,t.51-53,p.31-51,Bucureşti.

274. **Oancea, D., Velcea,V. ,Caloianu ,N., Dragomirescu , □., Dragu, Gh. ,Mihai E., Niculescu, Gh.,Sencu,V.,Velcea I.,1987,** *Tratatul de Geografia României, Carpa□ii Române□ti □i DepresiuneaTransilvaniei III,* Editura Academiei Republicii Socialiste România.

275. **Orghidan N.1969,** *Văile transversale din România*, Edit.Academiei R.S.România.

276. **Păcurar, Al., 1999**, *Resursele de materii prime din Dealurile Crasnei*, Studia UBB, Geographia , XLIV, 1.

277. **Pamić J. & Tomljenović B. 1998***, Basic geological data from the Croatian part of Zagorje – Midtransdanubian Zone.* Acta Geol. Hung. 40, 1, 37—56.

278. **Pana□, D. & Balintoni, I., 2000,** *Igneous protoliths of the Biharia lithotectonic assemblage: timing of intrusion, geochemical considerations, tectonic setting.* Studia Universitatis Babes-Bolyai, Geologia,XLV,1,3,22, Cluj Napoca.

279. **Pana□, D. 1998,***Petrogenesis and tectonics of the basement rocks of the Apuseni Mountains. Significance for the Alpine tectonics of the Carpathian-Pannonian region.* Ph.D. Thesis, Univ. Alberta, Canada, 1-356.

280. **Pana□ D., Balintoni I. & Heaman L. 2000**, *Precise U-Pb zircon dating of the syenite phase from the Ditrau alkaline igneous complex.* Studia Universitatis Babes-Bolyai, Geologia XLV, 1, 79-89.

281. **Pana□ D., Balintoni I., Heaman L. & Erdmer P. 2002,** *An alternative tectonic model for the Carpathian-Pannonian system.* Studia Univ. Babes-Bolyai, Geologia, Spec. Issue 1, 265-277.

282. **Pana□ D., Heaman L.M., Creaser R.A. & Erdmer P. 2002b**, *Pre-Alpine crust in the Apuseni Mountains, Romania: Insights from Sm-Nd and U-Pb data.* J. Geol. 110, 341-354.

283. **Pană, D.I., Erdmer, P.,1994**, *Alpine crustal shear zones and pre-alpine basement terranes in the Roumanian Carpathians and Apuseni Mountains.* Geology, 22: 807-810.

284. **Pană, D.I., Heaman, L.M., Creaser, R.A., Erdmer, P.,2002,** *Pre-Alpine Crust in the Apuseni Mountains, Romania: Insights from Sm-Nd and U-Pb Data.* J. Geol. 110: 341-354.

285. **Pană,D.,1998,** *Petrogenesis and Tectonics of the Basement Rocks of the Apuseni Mountains: Significance for the Alpine Tectonics of the Carpatian-Pannonian Region*.Ph.D.Thesis, Univ of Alberta, Canada.

286. **Pană,D.,Balintoni,I.,Heaman,L.,Erdmer,P.,2002,***An Alternative Tectonic Model For The Carpathian-Pannonian System.*Studia Universitatis Babe□-Bolyai.Specia Issue,1,p.265-277.

287. **Panaiotu, C.,1998,** *Paleomagnetic constraints on the geodynamic history of Romania. In: Reports on Geodesy. Monograph of Southern Carpathians.* CEI CERGOP Study Group No 8, Geotectonic Analysis of the Region of Central Europe. Warsaw Univ. of Technology / Inst of Geodesy & Geodetic Astronomy No 7 (37): 205-216.

288. **Panaiotu, C.,1999,** *Paleomagnetic studies in Romania: tectonophysic implications.* Ph.D. thesis, University of Bucharest, 150 pp. (in Romanian).

289. **Panaiotu, C. 1998,** *Paleomagnetic constraints on the geodynamic history of Romania.* Reports on Geodesy (Monograph of Southern Carpathians), 7 (37): 49-71.

290. **Panaiotu, C., Pécskay, Z., Panaiotu, C.E.1996.,** *Which is the time of rotation? Review of paleomagnetic and and K-Ar data from Romania.* Mitt. Ges. Geol. Bergbaustud. Osterr., 41, p. 125.

291. **Panizza, M.,2005,** *Manuale di geomorfologia applicata*, Franco Angelli, s.r.l,Milano, Italy.

292. **Pătra□cu, S., Panaiotu, C., □eclăman, M. & Panaiotu, C.E. 1994,** *Timing of the rotational motion of Apuseni Mountains (Romania): paleomagnetic data from Tertiary magmatic rock*s. Tectonophysics, 233: 163–176.

293. **Pătra□cu, St., Panaiotu, C., Seclaman, M., Panaiotu, C.E., 1994,***Timing of rotational motion of Apuseni Mountains (Romania): paleomagnetic data from Tertiary magmatic rocks.* Tectonophysics 233: 163-176.

294. **Păucă, M.,1964,** *Bazinul neogen al Silvaniei*.Anuarul Com.Geol. XXXIV.

295. **Păucă, M.,Clemens, A.,1964,***Vârstra pietri□urilor piemontane din regiunea de sud a Bazinului Silvaniei*.Dări de seamă ale □edin□elor Com.Geol.L./1.

296. **Păucă,M.,1954,***Neogenul din bazinele externe ale Mun□ilor Apuseni*, An.XXVIII,Com.G0□ol.,Bucure□ti.

297. **Pavai-Vajna,F.,1925,** *A foldkereg legfiatalabb, tektonikus mozgasairol* Foldt.Koyl,LV.

298. **Pécskay, Z., Edelstein, O., Seghedi, I., Szakács, A., Kovacs, M., Crihan, M., Bernard, *A. 1995,*** *K-Ar datings of Neogene-Quarternary calc-alkaline volcanic rocks in Romania.* Acta Vulc. 7: 53-61.

299. **Pécskay, Z., Lexa, J., Szakács, A., Seghedi, I., Balogh, K., Konečný, V., Zelenka, T., Kovacs, M., Póka, T., Fülöp, A., Márton, E., Panaiotu, C. & Cvetković, V. 2006,** *Geochronology of Neogene–Quaternary magmatism in the Carpathian arc and Intra-Carpathian area: a review.* Geologica Carpathica, 57,511–530.

300. **Pecskáy,Z.,Lexa,J.,Szakács,A.,Balogh,K.,Seghedi,I.,Konecny,V.,Kovacs,M.,Marton, M., Kaliciak,M.,Szeky-Fux,V.,Poka, T.,Gyaramaty,P.,Edelstein,O.,Rosu, E and Zec,B.,1996,***Space and time distribution of Neogene-Quaternary volcanism in the Carpatho-Pannonian region*.Acta Vulcanologica,7,15-29.

301. **Penea, I., 1793,** *Zalăul pe treptele istoriei* , Sesiunea de comunicări din 13 – 14 octombrie, Editura sec□iei de propagandă a Consiliului Jude□ean Sălaj.

302. **Plasienska,D.,1996,** Mid Cretaceous (120-180,Ma), orogenic processes in the Central Western Carpathians : brief review and interpretations of data. Slovak Geol Mag 3-4 :319-324.

303. **Popescu-Voite□ti,I.,1942**, *Expos□ synthetique sommaire sur la structure des r□gions carpatiques roumaines,*Bull.Soc.Roum.G□ol.V.

304. **Posea A.,1969,** *Terasele Crişului Repede,*Lucr.şt.Seria A, Instit.pedag.Oradea.

305. **Posea G., Popescu N.(1973),** *Piemonturile din România*, în volumul „Piemonturile”, Centrul de multipl.Univ.Bucureşti.

306. **Posea Gr., 1962**, *Ţara Lăpuşului,* Edit.□tinţifică Bucureşti.

307. **Posea Gr.,1974** , *Relieful României*, Editura □tin□ifică, Bucure□ti

308. **Posea Grigore, 2005,** Geomorfologia României: relief-tipuri,geneză,evoluţie,regionare,Editura Fundaţiei România de Mâine,Bucureşti.

309. **Posea, A.,1989,** *Geografia Mărilor şi Oceanelor* , Bucureşti.

310. **Posea, Gr. , Popescu, N., Ielenicz, M., 1982,** *Enciclopedia geografică a Românei.* Editura □tin□ifică □i Enciclopedică , Bucure□ti.

311. **Posea, Gr.,1967,** *Anteceden□ă □i captare la văile transversale carpatice*.Lucr.□t., nr.1,Inst.pedag.Oradea.

312. **Posea, Gr.,Grigore, M.,Ilie,I.,Popescu, N.,1970,** *Geomorfologie Generală*, p.130-434,Ed.Did.şi Ped.,Bucureşti.

313. **Posea,A.1969,** *Terasele Cri□ului Repede*,Lucr.□t., nr.1,Inst.pedag.Oradea.

314. **Posea,Gr,1962,**□*ara Lăpu□ului*, studiu de geomorfologie,Edit.□tin□ifică,Bucure□ti.

315. **Posea,Gr.,Popescu,N.,Ielenicz, M.,1974,** *Relieful României,* Edit.Ştiinţifică, Bucureşti.

316. **Preda,D.M.,1961,***Vorlandul orogenului carpatic □i pozi□ia lui tectonică în cadrul geologic structural al Europei,*rezumatul comunicărilor,Asoc.Geol.Carp.-Balc.,Congr.V,Bucure□ti.

317. **Rădulescu,D.P.,1976,** *Vulcanii astăzi şi în trecutul geologic*,Ed.Tehnică,Bucureşti,269p.

318. **Răileanu, G.,Rusu,A.,Moisescu,V.,1964**, *Relaţiile tectonice ale cristalinului Munţilor Meseş-Ţicău cu formaţiunile sedimentare ale Bazinului Transilvaniei*, Stud.Cercet.Geol.Geof., vol.9/2,p.251-263,Bucureşti.

319. **Răileanu, Gr.,Saulea, E.,1956,***Paleogenul din regiunea Cluj □i Jibou(NV Bazinului Transilvaniei)*.An.Com.Geol.vol.XXIX,Bucure□ti.

320. **Răileanu,Gr.,Saulea, E.,1956,***Paleogenul din regiunea Cluj □i Jibou*,An.Com.geol.,XXIX.

321. **Ratschbacher, L., Frisch, W., Linzer, H. G., and Merle, O,1991b**.: *Lateral extrusion in the Eastern Alps, Part 2, Structural analysis,* Tectonics, 10, 257–271,.

322. **Ratschbacher, L., Linzer, H-G., Moser, F., Strusievicz, R.O., Bedelean, H., Har, N., Mogos, A. 1993,** *Cretaceous to Miocene thrusting and wrenching along the Central South Carpathians due to a corner effect during collision and orocline formation.* Tectonics, 12 (4): 855–873.

323. **Ratschbacher, L., Merle, O., Davy, P. and Cobbols, P.,1991 a,** *Lateral extrusion in the Eastern Alps: Part 1, Boundary conditions and experiments scaled for gravity,* Tectonics, 10, 245–256.

324. **Reich,L.,1943,***Geologiai jegyzetek az Erd□ly Medenc□böl □s a Lápos-hegys□gböl.*Földt.int.□vi.jel.”Beszámolós”.

325. **Ricci,Lucchi,F.,1992,**Sedimentografia,Atlante fotografico di strutture sedimentarie, Zanichelli Editore,Spa,Bologna.

326. **Ritmann, A., 1967** , *Vulcanii şi activitatea lor,* Editura Tehnică Bucureşti.

327. **Roberts,J.,2002,***Guida alle strutture geologiche*,Franco Muzzio Editore,London-Basingstoke.

328. **Roure F., Howell D.G., Guellec S. & Casero P., 1990,** *Shallow struc- tures induced by deep-seated thrusting. In: Petroleum and Tec- tonics in Mobile Belts* Technip, Paris, 15–30.

329. **Roure F., Roca E. & Sassi W. 1993,** *The Neogene evolution of the outer Carpathian Flysch units (Poland, Ukraine and Romania): Kinematics of a foreland/fold-and-thrust belt system*. Sed. Geol. 86, 177–201.

330. **Royden,L.H. and Burchfiel, B.C,1989,** *Are systematic variations in thrust belt style related to boundary processes?(The Western Alps versus the Carpathians).*Tectonics,8,51-61.

331. **Royden,L.H.,1988,***Late Cenzoic tectonics of the Pannonian basin system*,AAPG Memoir,45,27-48.

332. **Royden,L.H.,1993,***The tectonic expression slab pull at continental convergence boundaries.*Tectonics,12,303-325.20.

333. **Royden,l.H.,Horvath,F.,Rumpler,J.,1983,** *Evolution of the Pannonian Basin* System,1.Tectonics,v.2,p.63-90.

334. **Royden,L.M.,1988,** *Late Cenozoic tectonics of the Pannonian Basin System. In :The Pannonian Basin System.* A Study in Basin Evolution. L.Royden and F.Horvath(Eds.)AAPG Memoir, 45, 27-48.

335. **Rusu, A., 1965 – 1966,** *Studiu Geologic al regiunii Moigrad (nord – vestul bazinului Transilvaniei), D*ări de Seamă ale Şedinţelor , Inst.Geol.vol. 53/1, p. 427-455, Bucureşti.

336. **Rusu, A., 1977,** *Stratigrafia depozitelor oligocene din nord-vestul Bazinului Transilvaniei (regiunea Treznea-Hida-Poiana Blenchii),* An.Inst.Geol.Geofiz.,vol.LI,p.69-255,Bucureşti.

337. **Rusu, A., 1967,** *Studiul geologic al regiunii Moigrad (nord-vestul Bazinului Transilvaniei).* Da□ri de seama□, Comitetul de Stat al Geologiei, Volumul LIII, (1965-1966), Partea 1-a, 427-455 p, Bucures□ti.

338. **Rusu, A., 1970,** *Corelarea faciesurilor Oligocenului din regiunea Treznea-Bizus□a (N-W bazinului Transilvaniei).* Studii s□i cerceta□ri geologice-geofizice-geografice, Seria Geologie, Tomul 15, Numa□rul 2, 513-525 p, Bucures□ti.

339. **Rusu, A., 1972,** *Semnalarea unui nivel cu Nucula Comta în Bazinul Transilvaniei s□i implicat□iile lui stratigrafice.* Da□ri de seama□, Institutul Geologic, Volumul LVIII, 4. Stratigrafie, 265-282 p, Bucures□ti.

340. **Rusu, A., 1977,** *Stratigrafia depozitelor oligocene din nord-vestul Transilvaniei (regiunea Treznea- Hida-Poiana Blenchii).* Anuarul Institutului de Geologie s□i Geofizica□, Volumul LI, 223 p, Bucures□ti.

341. **Rusu, A., 1987,** *Ostreina biohorizons in the Eocene of the nort-west Transylvania (Romania). The Eocen from the Transylvanian Basin,* 175-182 p, Cluj-Napoca.

342. **Rusu, A., 1988,** *Oligocene events in Transylvania (Romania)and the first separation of Paratethys.* Da□ri de Seama□ ale s□edint□elor Institutului de Geologie s□i Geofizica□, 72-73: 207-223, Bucures□ti.

343. **Rusu, A., 1989,** *Problems of correlation and nomenclature concerning the Oligocene formationsin NW Transylvania. In: The Oligocene from the Transylvanian Basin* (ed.: I. Petrescu): 67-78, Cluj- Napoca.

344. **Rusu, A., 1995,** *Eocene formation in the Călata region (NW Transylvania)*: a critical review. Romanian Journal of Tectonic & regional Geology, 76: 59-72, Bucures□ti.

345. **Rusu., A.,1977,** *Harta geologică Republica Socialistă România,Nr.29 c,Meseş,*Institutul de Geologie şi Geofizică,Bucureşti.

346. **Rusu., A.,1983,***Harta geologică Republica Socialistă România,Nr.18 c,Prel*uca.,Institutul de Geologie şi Geofizică,Bucureşti.

347. **Rusu., A.,1994,***Harta geologică Republica Socialistă România,Nr.29 A,Zalău*,Institutul de Geologie şi Geofizică,Bucureşti.

348. **Săndulescu, M. , 1984** ,*Geotectonica României,* Editura Tehnică , Bucure□ti.

349. **Săndulescu, M., 1994**,*Overview on Romanian Geology*.Rom J.of Tectonics and Regional Geology,75,Suppl.2.,3-17.

350. **Săndulescu,M.,1984,***Geotectonica României*, p.9-69, Editura Tehnică, Bucureşti.

351. **Săndulescu,M.,1988,***Cenozoic history of the Carpathians,*AAPG Memoir,45,17-25.

352. **Săndulescu,M.,Visarion, M.,Stanica, D., M.and Atanasiu,L.,1993,** *Deep structure of the Inner Carpathians in the Maramure□-Tisa zone (Esat Carpathians)* Rom.J.Geophysics,16,67-76.

353. **Saulea, E.1967,** *Geologia istorică*, Edit.Didactică şi ped.Bucureşti.

354. Savu Al.1965, *Aspecte de relief , în Depresiunea Şimleului,* Comunicări de Geografie, vol *III, Cluj.*

355. **Savu Al., Mac I.,1965,** *Relieful Județului Sălaj, ca factor în distribuția şi dezvoltarea aşezărilor omeneşti.*Studia Univ.Babeş-Bolyai, series geogr. fasc.2, Cluj.

356. **Savu Al.,1965,** *Aspecte de relief în Depresiunea Şimleului*. Comunicări de geografie, vol.3.

357. **Savu Al.Berindei, I.O.,1973**, *Piemonturile vestice-aspecte genetice şi evolutive, în vol."Piemonturile",* centrul de Multiplic.Univ.din Bucureşti.

358. **Savu, Al.,Mac, I., Tudoran,P.,1973,** *Aspecte privind geneza şi vârstra teraselor din Transilvania,* în „Realizări în Geografia României", Edit, Ştiințifică,Bucureşti.

359. **Savu,A.,1957,** *Contribu□ii la raionarea geomorfologicăă a platformei Some□ene."*Bul.Univ."V.Babe□" □i "Bolyai" Cluj", seria □tiin□.naturii,vol.I,nr.1/2.

360. **Savu,Al.,1963,**Podişul Someşan,studiu geomorfologic.Universitatea Babeş-Bolyai,Cluj, Facultatea de Șt.Naturale, Geografie.Teză de doctorat.Conducător Științific :prof.dr.Tiberiu Morariu.

361. **Savu,Al.,Berindei,I.O,1973,***Piemonturile vestice-aspecte genetice □i evolutive,* în volumul "Piemonturile",Centrul de multiplic.Univ.din Bucure□ti.

362. **Schmid S.M., Bernoulli D., Fügenschuh B., Matenco L., Schefer S., Schuster R., Tischler M. & Ustaszewski K., 2008, *The Alpine- Carpathian-Dinaridic orogenic system: correlation and* evolu- tion of tectonic units.** Swiss J. Geosci. Birkhäuser Verlag,Basel,101, 1-48.

363. **Schreiber ,Wilfried,E.,Drăguț L.,Man,T.,2003,** *Analiza peisajelor geografice din partea de vest a Câmpiei Transilvaniei.*Presa Universitară Clujeană.

364. **Seghedi I.H., Downes A., Szakács P.R.D., Mason M.F., Thirlwall E., Roure Z., Pécskay E., Márton C. & Panaiotu C. 2004,** *Neo- gene-Quaternary magmatism and geodynamics in the Car- pathian-Pannonian region: A synthesis.* Lithos 72, 117—146.

365. **Seghedi, I., Balintoni, I., Szakács, A.,1998,** *Interplay of tectonics and Neogene post-collisional magmatism in the intracarpathian region.* Lithos, 45, 483-499.

366. **Seghedi, I., Downes, H., Harangi, S., Mason, P.R.D., Pécskay, Z., 2005.** *Geochemical response of magmas to Neogene-Quaternary continental collision in the Carpathian–Pannonian region: A review.* Tectonophysics, 410, 485-499.

367. **Seghedi, I., Downes, H., Szakács, A., Mason, P.R.D., Thirlwall, M.F., Ros□u, E., Pécskay, Z., Márton, E., Panaiotu, C. 2004,** *Neogene-Quaternary magmatism and geodynamics in the Carpathian–Pannonian region: a synthesis.* Lithos, 72, 117-146.

368. **Seghedi,I., Szakács,A., and Mason,P.R.D,1995**,*Petrogenesis and magmatic evolution in the East Carpathian Neogene volcanic arc(Romania)*.Acta Vulcanologica,7,135-143.

369. **Seghedi,I.,Downes,H.et al.,2004.,***Neogene - Quaternary magmatism and geodynamics in the Capathian-Pannonian region: a synthesis*,Lithos,72.

370. **Simpson, B.,2013,** *Lettura delle carte geologiche*, Drio Flaccove Editore,s.r.l, Palermo.

371. **Şişeşteanu Gh.,Pop, M.,1984,***Timpul şi spaţiul social în comunităţile rurale sălăjene,în AMP,*VIII, Muzeul de Istorie şi Artă Zalău,p.731-753.

372. **Socolescu,M., Airinei, Şt.,Ciocârdel,R., Popescu,M.,1975**, *Fizica şi structura scoarţei terestre din România*,p.160-196., Editura Tehnică, Bucureşti.

373. **Sofronie,C.,Stoica,S.F.,Dulău,B.R.,Cocuț,M.,Selagea,H.I.,Sârb,T.M.,Scuturici,D.Gh. 2013,b**Bazinul hidrografic Someş-Tisa,U.T.Press,Cluj Napoca.

374. **Sorocovschi, V.,2002,** *Riscuri □i Catastrofe*, Casa Căr□ii de □tiintă.

375. **Sorocovschi,V.,2002**, *Riscuri hidrice,*în Riscuri □i Catastrofe,vol.I,Edit.Casa Căr□ii de □tiin□ă, Cluj Napoca.

376. **458.Sorocovski, V.,2002,*Riscurile hidrice***,pp.55-65, în volumul Riscuri şi Catastrofe, Editor Sorocovski, V.,Editura Casa Cărţii de Ştiinţă, Cluj Napoca.

377. **Soroiu, M.,Popescu, G.,Kasper, U.,Dumitrescu, R.,1972**, *Contributions preliminaires á la geocronologie des massifs cristallins des Monts Apuseni.* An.□t.Univ."Al.I.Cuza", Sec□.II,b,Geologie,XV,p. 25-3.

378. **Spakman,W., de Jonge,M.R. and Wortel,M.J.R 1995**, *Imaging litosphere and mantle structure in the Alpine-Mediterranean region*. Sec.Workshop Dep.Geol.Basel,5-7 January 1995,Abstract,59-60.

379. **Sperner, B., Ratschbacher, L., Zweigel, P. et al., 1999**, *Lateral extrusion, slab-break-off and subduction retreat: the Oligocene-Recent collision-subduction transition in the Alps and Carpathians.* In: Penrose Conference: Subduction to Strike-Slip Transitions on Plate Boundaries, 18±24 January 1999, Puerto Plata, Dominican Republic, pp. 103±104. Available on-line at

380. **Stampfli G. & Borel G. 2002,** *A plate tectonic model for the Paleo- zoic and Mesozoic constrained by dynamic plate boundaries and restored synthetic oceanic isochrones.* Earth Planet. Sci. Lett. 196, 17-33.

381. **Stampfli GM, Borel GD, Cavazza W, Mosar J, Ziegler PA (2001b),** *Palaeotectonic Atlas of the PeriTethyan Domain (CD-ROM).* European Geophysical Society.

382. **Stampfli,GM 1993,** *Le Brianconnais, terrain exotique dans les Alpes*.Eclogae geol helv 86:1-45.

383. **Stampfli,GM, 1996,** *The Intra-Alpine Terrain: a Paleotethyan remant in the alpine Variscides.*Eclogae geol Helv, 89:13-42.

384. **Stampfli,GM 2000**, *Tethyan Oceans In* : Bozkurt E, Winchester J.A, Piper JDA.Tectonics and magmatism in Turkey and surrounding area.Geol Soc London Spec Publ 173:1-23.

385. **Stampfli,GM.,1989,***Late Paleozoic evolution of the easthern Mediterranean region*.IGCP 276 Paleozoic geodynamic domains and their alpidic evolution in the Tethys.

386. **Stan R.,Puşte A.,2001,** *Un posibil model de evoluţie al Munţilor Apuseni şi al sistemului Pânzelor de Biharia,* Studia Universitatis Babeş-Bolyai, Geologia, XLVI,1.

387. **Staub,R.1928,** *Der Bewegungsmechanismus* der Erde, Berlin.

388. **□tefan, A.,1986:** *Eocretaceous granitoids from the South Apuseni.* D. S. Inst. Geol. Geofiz. 70-71/1: 229- 241.

389. **□tefan, A., Rusu, A., Bratosin, I., Colios, E.,1986,** *Petrological study of the alpine magmatites in the link zone between the Apuseni Mountains and the Oas-Gutâi-□ibles Volcanic Chain.* D. S. Inst. Geol. Geofiz. 70-71/1: 243-262.

390. **□tefan, A., Rosu, E., Andar, A., Robu, L., Robu, N., Bratosin, I., Grabari, G., Stoian, M., Vâjdea E., Colios E.,1992,** *Petrological and geochemical features of banatitic magmatites in northern Apuseni Mountains.* Rom. J. Petrology 75: 97-115.

391. **□tefan, A.,Ro□u, E.,Andár,A.,Robu, L.,Robu, N.,Bratosin, I.,Grabari,G.,Stoian, E.,Vajdea, E.,Colios, E.,1992,***Petrological and Geochimical features of banatitic magmatites in northern Apuseni Mountains*.Rom.J.Petrol.,75,97-115.

392. **□tefan,A.,1980**,*Petrographic study of the eastern part of the Vlădeasa eruptive massif*.An.Inst.Geol.Geofiz.LV.p.207-325,Bucure□ti.

393. □**tefanescu, M., 1983**, General remarks on the Eastern Carpathian flysch and its depositional environment. Revue Roumaine de Geologie Geophysique et Geographie. Geologie 27, 59–64.

394. **Stegena, L., Geczy, B., and Horvath, F.*1975**: Late Cenozoic evolution of the Pannonian Basin, Tectonophysics, 26, 71–90,*

395. **Strahler,A.N., 1973**, *Geografie Fizică*, Editura Ştiinţifică, Bucureşti.

396. **Strusievicz,R.O., Strusievicz,E.,1985**, *Asupra prezen□ei rutilului □i andaluzitului în pegmatitele metamorfice ale Serie de Some□ din mun□ii Plopi□(Mun□ii Apuseni),* D.S.Inst.Geol.Geofiz.LXIX/1,p.31-36,Bucure□ti.

397. **Strusievicz,R.O., Strusievicz,E.,Urcan.,1986**,*A New Mineral For The Crystalline Schist Of Romania: Gahnite In The Plopi□ Mountains (Apuseni Mountains),*D.S.Inst.Geol.Geofiz.Vol.72-73/1,p.53-59,Bucure□ti.

398. **Suciu, C.,1968**,*Dic□ionar istoric al localită□ilor din Transilvania*,II, Bucure□ti.

399. **Surdeanu, V., 1998**,*Geografia terenurilor degradate*,Editura Presa Universitară Clujeană.

400. **Surdeanu, V.,2002**,*Gestionarea Riscurilor, o nouă necesitate a timpurilor noastre*,pp.37-42, în volumul Riscuri şi Catastrofe, Editor Sorocovski, V.,Editura Casa Cărţii de Ştiinţă, Cluj Napoca.

401. **Surdeanu,V.,Go□iu,D.,2007**,*No□iuni fundamentale în studiul hazardelor naturale*.Editura,Presa Universitară Clujeană.

402. **Szadeczky,J.,1925**,*Mun□ii ascun□i din Nord-Vestul Transilvaniei*.D.S.Inst.Geol.XIII-XIV,Bucure□ti.

403. **Szadeczky,J.,Kardoss,E.1930**,*Contribu□iuni la geologia Ardealului de NV*."D.de s Inst.Geol.Rom.",vol.XIV,Bucure□ti.

404. **Szadeczky-Kardoss,1925-1926**, *Munţii Ascunşi ai seriei cristaline mai vechi* (seria I), din nord-vestul Ardealului,D.S ale Şed.,Inst.Geol.Rom,XIV, Bucureşti.

405. **Szakacs, A. and Seghedi, I.,1995**, *The Calimani-Gurghiu-Hargita volcanic chain, East Carpathians, Romania: volcanological features,* Acta Volcanologica, 7, 145–153.

406. **Szederkény T. 1997**, *Metamorphic formations of the Hungarian part of Tisza Unit (Tiia Composite Terrane) and their correlation.* In: Haas J. (Ed.): Fülöp József emlékkönyv. Akadémiai Kiadó, Budapest, 133—147 (in Hungarian).

407. **Szikszai, L.,2014,***Zilah*.Net(Hozáff□r□s, November, I)(Magyarul).

408. **Tari G. 1994**, *Alpine tectonics of the Pannonian basin.* PhD Thesis, Rice University, Houston, 1501.

409. **Tari G., Báldi T. & Báldi-Beke M. 1993,** *Paleogene retroarc flexural basin beneath the Neogene Pannonian basin: a geodynamic mod- el.* Tectonophysics 226, 433—455.

410. **Tari G., Horváth F. & Rumpler J. 1992**, *Styles of extension in the Pannonian Basin.* Tectonophysics 208, 203—219.

411. **Tari V. & Pamić J. 1998**: *Geodynamic evolution of the northern Di narides and southern part of the Pannonian Basin.* Tectonophysics 297, 269—281.

412. **Tari, G., Horvath, F., 1995,** *Middle Miocene extensional collapse in the Alpine–Pannonian transition zone. In: Horvath, F., Tari, G., Bokor, Cs. (Eds.), Extensional Collapse of the Alpine Orogene and Hydrocarbon Prospects in the Basement and Basement Fill of the Western Pannonian Basin. A*APG International Conference and Exhibition, Nice, France, Guidebook to Fieldtrip No. 6, Hungary, pp. 75–105

413. **Tătăram, N.,1988,***Geologie Stratigrafică □i Paleogeografie*,Editura Tehnică,Bucure□ti.

414. **Tătăram,N.,1938,***Geologie stratigrafică şi paleogeografie*, Precambrian şi Paleozoic,p.7-50,183-209, 316-321,Editura Tehnică, Bucureşti.

415. **Tătărâm,V.N.,1963,***Stratigrafia Eocenului din regiunea de la sud-vest de Cluj*.Ed.Acad.R.S.R.,Bucure□ti.

416. **Tazieff, H., 1972,** *Vulcanii şi deriva continentelor*, Presses Universitaires de France .

417. **Termier,H.,1956**,*L`evolution de la litosph□re*.Tome II,Orogen□se.Masson et Co.,Paris.

418. **Tischler M., Groeger H.R., Fuegenschuh B. & Schmid S.M. 2007**, *Miocene tectonics of the Maramure□ area (Northern Romania): implications for the Mid-Hungarian fault zone.* Int. J. Earth Sci. (Geol. Rundsch.) 96, 473—496.

419. **Tomljenović B. & Csontos L. 2001**, *Neogene-Quaternary structures in the border zone between Alps, Dinarides and Pannonian Basin (Hrvatsko zagorje and Karlovac Basins, Croatia). Int*. J. Earth Sci. (Geol. Rundsch.) 90, 560—578.

420. **Turcotte, D.L., Oxburgh , E.R., 1978,** *Intra – plate volcanism.* Phil.Trans. Roy. Soc. Lond. 288.A, 561.

421. **Ujvari I.,1972 ,** *Geografia apelor României*, Editura □tin□ifică

422. **Vâlsan ,G.,1938**, *Opere Postume ,Sensul Geografiei Moderne* , Buletinul Societă□ii Regale Române de Geografie.

423. **Varga I. M., Ciurte R., 2007,** *Zăcămintele de cărbuni şi impactul exploatării acestora asupra mediului în bazinul Valea Almaşului,* Environment&Progress, Nr. 9, p.585-591, Cluj-Napoca.

424. **Varga I. M., 2008,** *Environmental protection regarding the explotation of coal in Salaj Region, Environmental Protection,* Edit. Le Presses Agronomiques de Gembloux, p. 227-235 Belgia.

425. **Varga I. M., Petrescu I., 2008,** *The actual state of coal mining in Salaj (Romania), volumul de abstracte - Regional Environmental Problems,* p. 7-8, Odessa, Ukraina, Varga I. M., (2010 a), *Environmental aspects of coal mining at Zăghid and Cristolțel areas (Sălaj County),* Studii şi cercetări - geologie, Analele Universității "Al.I.Cuza", Bistrița-Năsăud -in press.

426. **Viehmann, I., Mac, I., 1966,** Lucrările Institutului de Speologie ”Emil Racovi□ă ”t.V,p.67-, *Observa□ii asupra carstului □i ghipsurile Mun□ilor Mese□ □i Cheilor Turzii,* Bucure□ti.

427. **Vin□eler, O.,2010**,*Studii □i cercetări de onomastică □i etimologie,* Casa Căr□ii de □tiin□ă,Cluj Napoca.

428. **Voiteşti, I.P.,1935,** *Evoluția paleogeografică a pământului românesc*,Rev.Muz.Geol-mineral, Univ.Cluj,vol.5 .

429. **Vörös A. 1990,** Villány Mountains, Villány Templom Hill, upper quar- ry. *Geological key-section of Hungary.* Geol. Inst. Hung., 1-5.

430. **Vörös, A., 2010:** The Mesozoic sedimentary sequences at Villány (southern Hungary) in Hungarian. Földt. Közl. 140, 1, 3-29.

431. **Vörös A. 2012,** *Episodic sedimentation on a peri-Tethyan ridge through the Middle—Late Jurassic transition (Villány Moun- tains, southern Hungary).* Facies 58, 3, 415—443.

432. **Wagreich M. & Faupl P. 1994,** *Paleogeography and geodynamic evolution of the Gosau Group of the Northern Calcareous Alps (Late Cretaceous, Eastern Alps, Austria).* Palaeogeogr. Palaeo- climatol. Palaeoecol. 110, 235—254.

433. **Willingshofer E., Neubauer F. & Cloetingh S. 1999**: *Significance of Gosau basins for the Upper Cretaceous geodynamic history of the Alpine-Carpathian Belt.* Phys. Chem. Earth Part A: Solid Earth Geodesy 24, 8, 687—695.

434. **Wortel MJR,Spakman W.,2000,***Subduction and slab detachment in the Mediterranean-Carpathian region.*Science: 290:1910-1917.

435. **Wortel MJR,Spakman, W.,1993**, The dinamic evolution of the dynamic evolution of the Appeninic-Calabrian- Helvetic and Carpathians arcs: an unifying approach. Terra Abstracts 5:97

436. **X ,1983**, *Geografia României,I,Geografia Fizică*, Edit.Academiei,Bucure□ti.

437. **XXX, 1987**, *Geografia României, III, Carpa□ii □i Depresiunea Transilvaniei*, Edit.Academiei, Bucure□ti.