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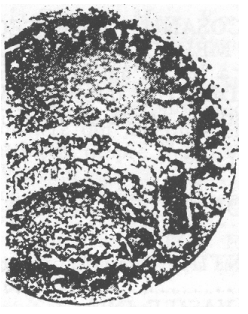

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THE COMPLEX CAPTURE PHENOMEN IN THE GEOLOGICAL, GEOMORPHOLOGICAL AND HYDROLOGICAL CONTEXT OF THE MEHEDINȚI TABLELAND (ROMANIA)

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Abstract: THE COMPLEX CAPTURE PHENOMEN IN THE GEOLOGICAL, GEOMORPHOLOGICAL AND HYDROLOGICAL CONTEXT OF THE MEHEDINȚI TABLELAND (ROMANIA)

The Mehedinți Tableland (Fig. 1) has three longitudinal subdivisions (the East Mehedinți Tableland, the West Mehedinți Tableland and the Cornete Alignment) and three transversal ones (the northern part of the Mehedinți Tableland, drained by the Northern River Group; the Southern Part, drained by the Southern River Group and the Median Part, drained by the Median River Group of the Mehedinți Tableland). The Median River Group includes: 1) the Western River Network (blind valleys, situated only in the East Mehedinți Tableland that are in the mature stage and swallet from a base level on limestone situated in the eastern flank of the Bahna Syncline (Sinform); 2) the Eastern River Network (ordinary valleys) situated only in the West Mehedinți Tableland, are in a young stage and have the base level east of the Mehedinți Tableland, younger that the former ones, but all belonging to the Quaternary; 3) the Common River Network formed as the valleys of the Western River Network were caught by those of the Eastern River Network (Fig. 5, 6).

The evolution pf the Median River Group covers (Fig. 5-7) two periods: 1) the Paleo-fluvial Period with valleys of the Eastern River Network and of the Western River Network; and 2) the Neo-fluvial Period, when the valleys of the Common River Network show abnormal and complex morphological evolutive and functional features, because they have two base levels in the points of swallet (an intermediate one situated on the limestone from the eastern side of the Bahna Syncline, and a terminal one situated east of the Mehedinți Tableland, at lower altitudes).They are the catchment product of the two very different valleys. The complex valleys of the Common River Network function (Fig. 6, 7) as three distinct river entities: 1) the upper (western) river entity; 2) the lower (astern) river entity and 3) the quasi-unitary river entity. During the dry, droughty periods, when swallets from limestone beds absorb the whole discharge of the upper course, the valleys of the Common River Network function as two distinctive river entities, each with its own characteristics and base levels: 1) the upper (western) entity, which behaves like a blind valley; and 2) the lower (eastern) entity, which behaves like a normal valley. It is only in periods of rich precipitation, when swallet from limestone beds cannot absorb the whole discharge of the upper course, that the valleys of the Common River

Network function (temporarily and partially) as a river entity (3-quasi-unitary river entity) with two base levels (one in limestone points of swallet and another east of the Mehedinți Tableland). The Cornete Alignment (fig. 5-7) is mixed erosion outlier (monadnock): 1)positional (overlapping the water divide between the Eastern and the Western River Networks, that is the Buseşti – Balta Paleo-summit); 2) structural (favoured by the cuesta-like aspect of the limestone of the eastern flank of the Bahna Syncline); 3) lithologic (benefiting from the presence of fully permeable limestone). The Mehedinți Tableland levelled surface is different ald lies at higher altitudes, than the Gornovița Plateforme one. The fluvio-karst terraced depressions (climate terraces?) situated in the valleys of the Common River Network (upstream of the catchment area) and in the valleys of the Western River Network (upstream of the blind catchment area) had swallet before the catchments had occured in wet areas (during heavy precipitation) where karst dam lakes would form (Fig. 6).
Keywords: Western Mehedinți Tableland, Eastern Mehedinți Tableland, complex capture, karst capture.

Introduction

From the researchers with contributions in deciphering the Mehedinți Tableland geomorphology we cite De Martone (1906a, 1906b, 1931), Munteanu-Murgoci (1908), Vintilescu (1941, 1946), Bleahu et al. (1978), Ilie (1969, 1970), Goran (1976, 1978, 1981), Preda et al. (1978), Preda (1986), Stănoiu (1999, 2002a) (Badea: in Badea et al., 2010).

Mehedinți Tableland represents a mountainous (Vintilescu, 1946) geomorphologic unit (Mrazec, 1886) with an erosion surface almost perfectly horizontal and leveled, especially eastward. This geomorphologic unit is situated on the south-western margin of the Southern Carpathians, between Vâlcan Mountains to the north, Miroci Tableland (the prolongation of the Mehedinți Tableland) to the south, Mehedinți Mountains to the west and hilly area of the Subcarpathians to the east (Fig. 1).

The majority of the researchers separate (Fig. 1) inside the Mehedinți Tableland three NNE-SSV oriented morphographic sub-units: 1) East Mehedinți Tableland, with about 550m average altitudes and with young stage valleys (Vintilescu, 1946); 2) West Mehedinți Tableland with about 600 m average altitudes and mature stage valleys (Vintilescu, 1946); 3) Cornete Alignment (overlapped mostly over the Upper Jurassic - Lower Cretaceous limestone of the eastern side of the Bahna Syncline) flanking the former two sub-units (Fig. 1). The East Mehedinți Tableland and the West Mehedinți Tableland are well emphasized in the central part of the Mehedinți Tableland, where the Cornete Alignment has a large development. In the northern part, north of the Isverna - Ponoarele Fault, West Mehedinți Tableland has a great development. In the southern part of the Mehedinți Tableland, south of Cireşu and Godeanu localities (where Cornete

Alignment faded), the East and West Mehedinți Tablelands cannot be separated.

The southern part of the Mehedinți Tableland is drained by Southern River Group (Bahna, Vodița, Slănic, Jidostița) oriented mostly N-S, predominantly subsequent, parallel with the stratification of the sedimentary rocks and the foliation of the crystalline shists. The northern part of the Mehedinți Tableland is drained by the Northern River Group (Motru, Motru Sec, Obârşia-Brebina a.o.), transversal to the geological structure and the stratification, with orientation varying between E-W to N-S. The central part of the Mehedinți Tableland is drained by the Median River Group, characterized by a high morphological diversity and a great hydrological complexity.

If we admit that the capture phenomenon represents the classification criteria, the valleys belonging to the West Mehedinți Tableland (Western River Network) highlight (Fig. 2) three different conjunctures, intuited by Preda et al (1978) as been three stages of the Mehedinți Tableland's valleys: Stage 1, Stage 2 and Stage 3. Stage 1 is represented by some blind valleys from West Mehedinți Tableland (a small blind valley situated between Ponorăț and Dreganovăț valleys) with no possible imminent capture by the East Mehedinți Tableland's valleys. Stage 2 is represented by the blind valleys (Ponorel, Ponorăț, Petima) possible to be captured by the East Mehedinți Tableland's valleys. Stage 2 can be also observed south of Ponoarele locality (Munteanu-Murgoci, 1908; Preda et al., 1978; Preda, 1986; Stănoiu, 1999, 2002a) where there is an imminent capture of the Gheorgheşti Valley by Bălușa Valley from East Mehedinți Tableland. Stage 3 refers to the West Mehedinți Tableland's valleys (Coşuştea, Prejna-Balta-Topolnița, Sfodea, Prunei, Dreganovăț) captured by the East Mehedinți Tableland's valleys.

The Median River Group

The valleys belonging to the Median River Group can be classified (Fig. 5) in three main categories: 1) Western River Network represented by matured blind valleys (with karst catchment), with base level in swallets from the limestone of the eastern flank of the Bahna Syncline situated in the West Mehedinți Tableland; 2) Eastern River Network represented by normal young valleys (classical) with the base level at the confluences east of the Mehedinți Tableland, situated in the East Mehedinți Tableland; 3) Common River Network (Coşuştea, Prejna-Balta-Topolnița a.o.) represented by complex valleys with diversified and complicated morphological and hydrological aspects, having two base levels, traveling from the West Mehedinți Tableland to the East Mehedinți Tableland.

Cornete Alignment overlaps the watershead (Buseşti-Balta Paleo-summit) between the Western River Network and the Eastern River Network.

At the entry of the limestone from the eastern flank of the Bahna Sincline, the valleys of the Western River Network (Ponorel, Ponorăț, Petima and a small valley located between Ponorăț and Dreganovăț valleys) loose all their water. On the other hand, the Common River Network's valleys

(Coşuştea, Prejna-Balta-Topolnița) loose only partially their water (Fig. 5-7). This water lost in the Bahna Hydrostructure's limestone (Stănoiu and Povara, 1998, 2000) is guided south-ward and south-west-word by underground routes and reappear at the surface at the emergence from Topleț and into the Danube. This is a hypothesis sustained by Preda (1986) and Stănoiu and Povară (1998, 2000) and is confirmed by Bandrabur et al (2000).

Around the capturing emergences of the Western River Network sinkholes, poljii and pseudopoljis appear accompanied by antithetical steps and small valleys with reverse confluence, as was described by Vintilescu (1941), Ilie (1970), Goran (1978, 1981), Stănoiu (1999, 2000a).

In the evolution of the Median River Group Valleys as well as in the evolution of each complex valley of the Common River Network, two periods of evolution (fig. 4, 5, 6), Quaternary in age, after the Pasaden Getic Moment (about 0.8 M.y.) (Stănoiu, 2011-2012). The first period was the Paleo-fluval Period, when co-existed only the Western River Network's valleys and the Eastern River Network's valleys. The second was the Neo-fluvial Period when appear also the complex valleys of the Common River Network resulted from the catchments of the blind valleys of the Western River Network by the normal (classical) valleys of the Eastern River Network.

The Common River Network

At the entry into the limestone from the eastern flank of the Bahna Syncline, the main complex valleys (Coşuştea and Prejna-Balta-Topolnița) of the Common River Network highlights a zig-zag route (reported by Munteanu - Murgoci, 1908 and the above-mentioned authors) representing bends of some complex fissures (Fig. 2-7).

The upper courses (headwaters) (Upper Coşuştea and Prejna, situated in the western Mehedinți Tableland) of the main valleys belonging to the Common River Network (Coşuştea and Prejna-Balta-Topolnița) enters the limestone through the eastern flank of the Bahna Syncline (Fig. 4) by an obsequent route (A-B is the first obsequent segment) oriented E-W to the Coşuştea Valley (a1-B1) and NW-SE to the Prejna-Balta-Topolnița Valley (A2-B2: Prejna Valley). This was followed by a NE-SW subsequent segment (B-C) orthogonal on the previous segment, 3 km in length for Coşuştea Valley (B1-C1) and 1.5 km in length for Prejna-Balta-Topolnița Valley (B2-C2: Balta Valley). For the Coşuştea Valley, downstream of the subsequent segment, there is a second obsequent segment (C1-D1), with a length of 3 km, oriented NW-SE. The second obsequent segment of the Coşuştea Valley (after passing through Baia de Aramă Graben) continue southward with D1-E1 segment (oriented N-S) from the East Mehedinți Tableland. In case of Prejna-Balta-Topolnița Valley, downstream of the subsequent segment there is an N-S route which begins with the second obsequent segment (C2-D2: Balta Valley) continued until the Baia de Aramă Graben. The second obsequent segment of the Prejna-Balta-Topolnița Valley (about 1 km in length) is prolonged southward (east of the Baia de Aramă Graben,

in the East Mehedinți Tableland) on the Topolnița Valley's route (D2-E2), with an N-S orientation.

The geological and geomorphological context suggests (Fig. 4) that the genesis of the zigzag route of the Coşuştea and Prejna-Balta-Topolnița Valleys is probably a result of the migration (from upstream to downstream) of the catchment's emergence (accompanied by a capturing sinkhole) belonging to the blind valleys (Upper Paleo-Coşuştea Valley, Paleo-Prejna-Balta Valley) of the West Mehedinți Tableland. From this migration resulted an alignment of elongated sinkholes and poljii overlapped by the routes of Coşuştea and Prejna-Balta-Topolnița complex-valleys.

From these reasons, at the beginning, the Upper Coşuştea and Prejna-Balta Paleo-valleys (as all the other valleys from the Western Mehedinți Tableland) lost all the water by a karst capturing (blind capture) in the primary swallet (B) situated in the center of the primary sinkhole. The primary emergence was located in the intersection sector between the first obsequent segment (A-B) and the subsequent segment (B-C). The primary swallet e then moved downstream, in the intersection between the subsequent segment (B-C) and the second obsequent segment (C-D). In this last intersection was born the secondary swallet associated (C) with a secondary sinkhole. The migration path between the primary and the secondary emergence (which generated the subsequent segment) overlap a small valley with a reverse confluence situated on the slope of the primary sinkhole. The parallel to the stratification (of least resistance lithology) position favors a rapid sinking of the above-mentioned reverse confluence small valley. The second obsequent segment overlap probably the path of a small valley (with reverse confluence) situated on the slope of the secondary sinkhole. Finally, the small valley which is overlapped by the second obsecvent segment was captured (together with the primary blind valley: Upper Paleo-Coşuştea Valley and Paleo-Prejna-Balta Valley from the Western Mehedinți Tableland) by a normal (classic) valley from the East Mehedinți Tableland (Lower Paleo-Coşuştea Valley and Paleo-Topolnița Valley) by means of a regressive erosion from a complex capturing phenomenon. In this way the present complex valleys were born (Coşuştea, Prejna-Balta-Topolnița valleys of the Common River Network). Using this complex capturing phenomenon, some classic, normal valleys (Lower Paleo-Coşuştea and Paleo-Topolnița valleys from the Eastern River Network) have captured, by regressive erosion, some blind valleys (Upper Paleo-Coşuştea and Paleo-Prejna-Balta valleys) from the Western River Network. The Lower Coşuştea and Topolnița paleo-valleys were having the base level at altitudes lower (at the confluence with the Danube for the Paleo-Topolnița Valley and at the confluence with Motru for the Lower Paleo-Coşuştea Valley) then Upper Coşuştea and Prejna-Balta paleo-valleys which had the base level in the above-mentioned limestone.

The above-mentioned (Fig. 4) highlights that in the evolution of the Coşuştea and Prejna-Balta-Topolnița complex-valleys's routes (from the catchment region) there is a Paleo-fluvial Period (with two stages: Stage 1

and Stage 2) prior to complex catchment, and a Neo-fluvial Period (Stage 3) after the complex swallet. Stage 1 lasted until the upper paleo-valleys (A-B segments: Upper Paleo-Coşuştea and Paleo-Prejna-Balta valleys) arrived at the primary swallet (B). Stage 2 lasted until the upper paleo-valleys (A-C segments: Upper Paleo-Coşuştea and Paleo-Prejna-Balta valleys) arried at the secondary swallet (C).

The routes of the complex valleys belonging to the Common River Network from the West Mehedinți Tableland (highlight the mature stage) when entering into the East Mehedinți Tableland rejuvenate suddenly and diminish substantially their yield, in some dry periods been dry valleys.

The evolution of the complex capture phenomenon show that when the origin of the valleys belonging to the Eastern River Network (Lower Paleo-Coşuştea and Paleo-Topolnița valleys which highlight the youth stage) crossed the Cornete Alignment, the Western River Network valleys (Upper Paleo-Coşuştea and Paleo-Prejna-Balta valleys which highlight the mature stage) were completed and evolved. This observation suggests that the upper routes (Upper Coşuştea and Prejna-Balta a.o.) of the Common River Network (Coşuştea, Prejna-Balta-Topolnița, Sfodea, Prunei, Dreganovăț) are partially older then the lower routes (Lower Coşuştea, Topolnița a.o.).

At the complex valleys of the Common River Network (especially Coşuştea and Pejna-Balta-Topolnița, which have two base-levels) we can observe a series of abnormalities and curiosities: 1) the upper routes (Upper Coşuştea and Prejna-Balta, situated in the Western Mehedinți Tableland) have a mature stage, a relatively great and constant yield and a base-level (their own and partially) situated in the above-mentioned limestone; 2) the lower routes (Lower Coşuştea, Topolnița) situated downstream of the previous, in the East Mehedinți Tableland had a youth stage, low and very inconsistent yields (in dry seasons they become dry valleys in the upstream segments) and a base-level at altitudes lower than the previous.

The abnormal and complex (morphographic and hydrologic) aspects outlined by the Common River Network valleys were determined by the presence of intermediate base-levels (situated between the spring and the final base-level), clustered in the swallets from the limestone belonging to the eastern flak of the Bahna Syncline (Fig. 5, 6, 7). The intermediate base-levels of the complex valleys imposed the occurrence of some local and temporary (depending on the precipitation quantity) water routes (functional, active) and dry routes (dry, non-functional, inactive). From this facts we can appreciate that the Common River Network has two categories of valleys: 1) morphographic valleys (Coşuştea, Prejna-Balta-Topolnița) with a classic valley morphographic characteristics, well defined cartographically in the region; 2) permanent functional (active, with water) “valleys” (Upper Coşuştea, Prejna-Balta, Lower Coşuştea, Topolnița) and temporary functional “valleys” (Coşuştea, Prejna-Balta-Topolnița complex valleys).

Along the route of a morphographic valley there are some functional “valleys”, temporary and locally, controlled by the amount of precipitations ad by the intermediate base-level from the limestone.

In the dry seasons (Fig. 6, 7), when the swallets situated in limestone absorb the whole yield of the upper routes, the valleys of the Common River Network function (Fig. 6 II a; fig. 7 II a) as two distinct fluvial entities: 1) the upper fluvial entity (western), situated in the West Mehedinţi Tableland which acts as a blind valley in an mature stage, with a relatively great and constant yield and with its own base-level situated in the limestone swallet; 2) the lower fluvial entity (eastern) situated in the East Mehedinţi Tableland, with a classical valley behavior in a youth stage, with a lower and inconstant yield than previous and with a base-level situated east of Mehedinţi Tableland (at lower altitudes than previous). Only in the sufficient and heavy rainfall, when the limestone swallets cannot absorb the whole yield of the upper routes, the Common River Network Valleys function (temporary and partially) as a unitary fluvial entity (3-quasy-unitary fluvial entity: partially and temporary) with two base-levels (a partial and intermediate base-level, situated in the above-mentioned limestone and a total and final base-level situated east of Mehedinţi Tablelalnd: at the confluence with Danube for the Prejna-Balta-Topolniţa valley and the confluence with Motru for Coşuştea valley) (Fig. 6 II b; Fig. 7 II b).

The evolution of each complex valley of the Common River Network has two periods: 1) the Paleo-fluvial Period, previous to the complex capture, when the two segments (upper and lower) functioned as two independent valleys; 2) the Neo-fluvial Period, after the complex capture, when the two independent valleys unite into one functional, semi-unitary valley (Fig. 4, 5, 6, 7).

This morphographic and functional complexity it is a feature of the complex valleys belonging to the Common River Network and it is highlighted (Fig. 4, 5, 6, 7) by the two main valleys, Coşuştea and Prejna-Balta-Topolniţa, both of which are made of two very different routes (segments): one upper route situated in the West Mehedinţi Tableland (Upper Coşuştea and Prehna-Balta) and one lower route situated in the East Mehedinţi Tablelalnd (Lower Coşuştea and Topolniţa).

It is found that the functioning mechanisms of the complex valleys belonging to the Common River Network reflect the evolution of the respective valleys. During the dry periods, the complex valleys function as two independent fluvial entities (the upper fluvial entity = western and the lower fluvial entity = eastern) in the same way as in the Paleo-fluvial Period. During the heavy rainfall periods, the complex valleys function (partially) as a unitary fluvial entity (semi-unitary fluvial entity), as in the Neo-fluvial Period (fig. 6, 7).

The complex valleys belonging to the Common River Network have complex morphological, evolutional and functional characteristics, different from the one for the common, classical valleys.

The presence of the limestone from the eastern flank of the Bahna Syncline (which has imposed the location of some base-levels: permanent, final and total for the valleys belonging to the Western River Network, or partial, intermediate and temporary for the valleys belonging to the Common

River Network) exerted a direct or indirect control over the morphography and the hydrology of the Mehedinți Tableland's median part.

The complex capture phenomenon was inferred by the ingenuity of the peasants who use for the Prejna-Balta-Topolnița valley three different names: 1) Prejna Valley, for the wide route situated upstream the limestone from the eastern flank of the Bahna syncline in the West Mehedinți Tableland; 2) Balta Valley, for the wide swampy route situated over the limestone, especially in the Cornete Alignment; 3) Topolnița Valley, for the narrow path located in the East Mehedinți Tableland.

The catchments from the Mehedinți Tableland have been reported by Munteanu-Murgoci (1908). He consider that Coşuştea Valley, which flow NE, as Motru's tributary (fact unconfirmed by present information) was captured by a valley which flowed NE. Vintilescu (1946) admitted the existence of an initial longitudinal hydrographic network, oriented NE-SW, which later was captured and disorganized by a transverse hydrographic network: a hypothesis also unconfirmed by present information. Goran (1976) presented the evolution up to Paleogene - Quaternary of the Mehedinți Tableland's southern part which is also unconfirmed by present information. The most complex image of the catchments from Mehedinți Tableland (close to the one presented in this paper) was described by Preda et al. (1978) and Preda (1986) who admitted however (as Munteanu-Murgoci, 1908 did) the existence of a paleo-valley (unconfirmed by present information), oriented E-W, been Motru's tributary, which has collected the waters from the upper hydrographic basin of the Coşuştea and Balta valleys. Stănoiu (1999, 2002 a) deepened the study of the complex capture phenomenon by which some classical valleys from East Mehedinți Tableland had captured some blind valleys from the West Mehedinți Tableland, generating complex valleys with very complicated and original characteristics and evolution.

Cornete Alignment

Cornete Alignment overlap (mostly) the eastern margin of the limestone from the eastern flank of Bahna Syncline, is oriented NNE-SSW and highlight a classical development between Buseşti and Balta localities, where it is represented by characteristic (Cernbonia Peak, Cornetul Babelor, Cornetul Bălții) positive, pyramidal-conical landforms (Fig. 3). North of Isverna-Ponoarele Faul, this morphographical unit reveals a eastward shift of about 3 km (in Cornetul Ponoarelor) imposed by the shear of the limestone (Fig. 1) from the northern compartment of the respective fault. Southward of Balta, the amplitude of Cornete Alignment diminishes progressively and rapidly, been controlled by the limestone's lamination on the Baia de Aramă-Balta Alignment (Graben). South of Cireşu - Godeanu localities, Cornete Alignment disappear (Fig. 1) making impossible the discrimination between East Mehedinți Tableland and West Mehedinți Tableland.

Cornete Alignment it is considered to be an erosion witness of some leveled Cretaceous - Miocene surfaces: Râu Şes Platform, Borăscu Platform (De Martone, 1906 a, 1906 b; a.o.).