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Building A New Map Of Tectonic Zoning For Albanides: A Few Issues To Consider

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ABSTRACT
Albanides as regional geological notion, are part of the structural tree Dinarides - Albanides - Hellenides - Taurid. As such, they constitute a major segment of this Balkan structure, their tectonic evolution being part of Balkanide evolution. Thus, Albanides have consistently attracted the attention of researchers, both domestic and foreign, with regard to diversity of major tectonic units, the relationship between their structural features, lithofacial characteristics, as well as their continuity in regionality i.e. their positioning within the Balkanides. This paper addresses a few points, dealing with tectonic zoning of Albanides, the relationship between major structural-facial units, characteristics of longitudinal and cross tectonic contacts etc. An important consideration is given to spatial positioning and structural-facial features of Krasta-Cukal tectonic area as well as specific relationships of this particular area with other bordering tectonic zones. In this regard a careful consideration have received the lithofacial appropriateness of this area, the differeces and similarities it has with neighbouring tectonic zones, the existence of transversal faults and their role in structuring of Albanides, the presence of tectonic windows and their significance in terms of tectonic style and the manner of affecting major structural-facial units etc.
KEYWORDS: Tectonic zoning of Albanides, balkanide, tectonic window, fractured zone

I. INTRODUCTION

Tectonic zoning map is one of the most important studies that can be applied to any geological territory because it accomplishes graphically the spatial delineation of major tectonic units. Tectonic zoning map must constitute the foundation upon which the building of whole series of geological maps should begin. Specifically, the tectonic map of Albanides at the scale 1: 200 000, published in 1999, is a much more extensive map than the tectonic zoning map. It contains an integration of various elements, dealing with tectonics, structure, orogenic cycles, formations, etc. On the other hand, the tectonic zoning map should be relatively simplified, focusing on outlining of major tectonic units and characterization of their main features. The construction of this map, which apparently is the first of its kind, is considered a necessity, not only for its outmost importance, but also for solving a number of controversial issues dealing with the separation of tectonic zones, lithofacial appropriateness, their performance on the extension, etc. Few of these issues, will be treated in the following sections in the form of a discussion.

II. TECTONIC ZONES

Albanides already have a concrete definition, fully represented at the tectonic map of Albania. The rationale behind the problem is closely related to the evolution of scientific thought in the field of global tectonics as well as the new concepts brought by observation in site, along tectonics zones of Albanides. In order to obtain full understanding of this concept, it is deemed appropriate to consider the ranking of tectonic zones, known as Albanides.

Outer Albanides:

1. Tectonic Zone of Sazani; 2. Ionian tectonic Zone; 3. Tectonic Zone of Kruja; 3. Tectonic Zone of Krasta-Cukali; 4.Tectonic Zone of Alps.

Inner Albanides:

1. Tectonic Zone of Mirdita; 2. Tectonic Zone of Korabi; 3.Tectonic Zone of Gashi.

Depressions:

1.PreAdriatic depression; 2. Inter-mountain depression

Obviously, the tectonic structure of Albanides until now had been conceived as consisting of eight tectonic zones and two lowlands, which are organized into three major structural facial units. So there is a question arising naturally: What is problem concerning this tectonic zoning? What are the facts and possibilities standing behind the tectonic structure of Albanides? Let us consider them one by one.

III. SEVERAL SHARP PROBLEMS ABOUT TECTONIC ZONES

If one looks carefully at the geological map of Albania, it will be clear that Krasta-Cukali tectonic zone separates the structural trunk of Albanides into three major parts: a) northern Albanides, known by the name of Albanian Alps, b)

Eastern Albanides, including tectonic zones of Korabi, Mirdita, Gashi and c) Western Albanides, that include tectonic zones of Sazani, Ionian and Kruja (Fig. 1) without considering the lowlands, as the newest unit structurally overlapping these tectonic zones.

On the basis of this map, it is not difficult te get to the notion that the structural trunk of Albanides can also be conceived as rather organized into four major tectonic units: Eastern Albanides, Western Albanides, Northern Albanides and also Central Albanides that include the tectonic zone of Krasta-Cukali.

In the west the Krasta-Cukali tectonic zone is limited to a visible tectonic boundary with Kruja zone, in the east it borders the Mirdita tectonic zone, whereas in the north its boundary with the tectonic zone of Albanian Alps, as thought to date [1], is unclear. There is an important question arising though, regarding the nature of relationship between these tectonic units. This difficult geological situation has been noticed early by Nopça and others, while trying to resolve the attributes of Shkodra-Peja transversal fault. It appears that along the imaginary tectonic segment Shkodra-Peja, there is a clash of major tectonic units, where Krasta-Cukali tectonic zone stands face to face with the tectonic zone of the Alps in a natural manner, although they appear to take each-others place several times along the entire boundary between them; this is unlike other tectonic areas on both sides of this segment, that follow without interruption the Albanide continuity (Fig. 2). This fact poses the inevitable question: Are these tectonic-facial zones part of a larger paleotectonic unit?

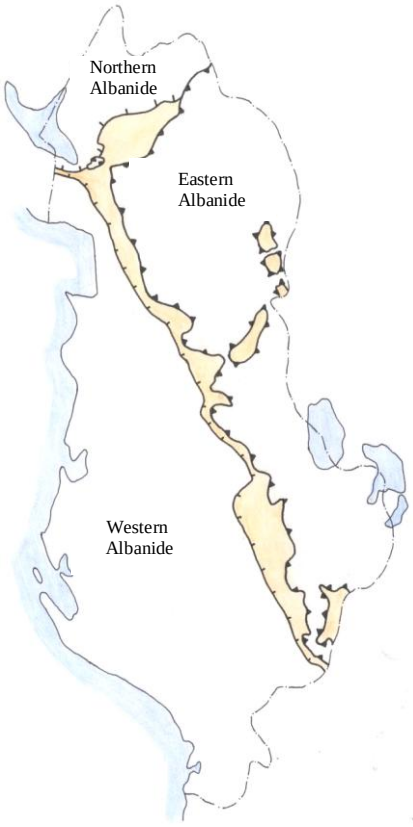

Fig. 1. Scheme of structural trunk of Albanides referred to spatial setting and relationships that offers Krasta-Cukali tectonic zone

This reasoning also supports the existence of a unifying lithofacial boundary between the subzones of Krasta-Cukal tectonic zone, and also between that zone as a whole with the Alps and Mirdita Cretaceous structural unit (Fig. 3).

The unifying lithofacial horizon is considered as the new flysch of Paleocene-Eocene age or Maastrihtian-Eocene age in some cases (Fig. 3), which shows that for the geological time under consideration the units mentioned above have been unified, thus experiencing the same paleotectonic story [2]. The thickness of the limestone with globotruncana of Maastrihtian age is considered another important feature of unifying lithofacial horizon; it is found in almost all tectonic units and serves also as the reference horizon in regard to the thickness of the neritic limestone of Triassic Cretaceous age (Fig. 3), etc. Consequentially, it is probably reasonable to assume that Albanides can be divided into three major tectonic units: Eastern Albanides, including zones of Mirdita, Korabi, Gashi; Western Albanides, including zones of Sazani, Ionian, Kruja and Central Albanides, including zones of Krasta-Cukali, Alps and also the *Cretaceous structural unit of Mirdita.*

In this respect, the sub-districts of Krasta, Sheldi (Spiten), Cukali and Alps are part of the central tectonic zone, while the Cretaceous structural unit of the Mirdita belongs to the eastern "lip" of this

great paleotectonic area. The Mirdita unit in particular, located in central Albanides, is considered a major tectonic zone, consisting of several sub-districts in its composition [3].

Fig. 2. Outline of paleogeographical situation of tectonic zones at the time of their foundation

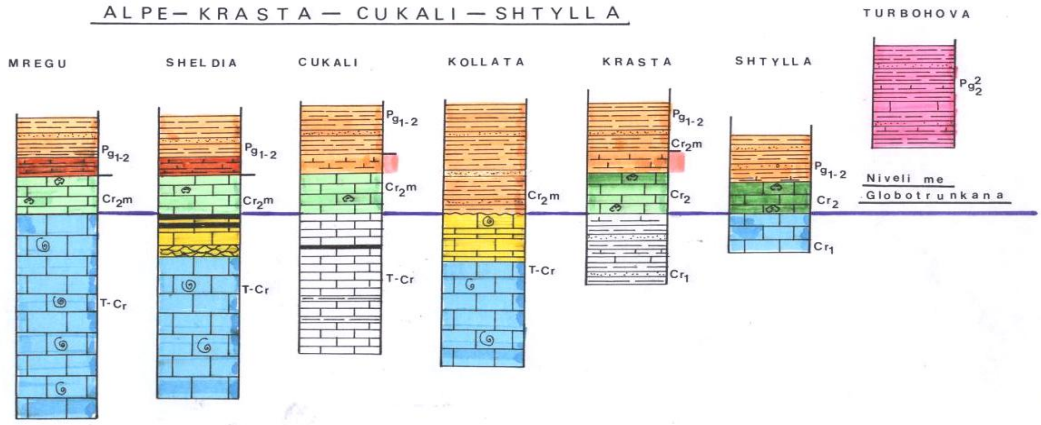

Fig. 3. Correlated scheme between tectonic zones of Alps, Krasta-Cukali and Cretaceous structural unit of Mirdita

On the other hand, the tectonic "windows" of Okshtuni and Peshkopi (Fig. 1), in the geological context considered (Fig. 4), present another controversial problem [4]. The new Eocene Flysch, whenever present, is the first contact with evaporites [5]. In its absence, the Jurassic-Cretaceous flysch formation and then Triassic carbonate formation have been supported over the evaporites, involved so far in the tectonic zone of Korabi. On this basis, there is a particular placement of geological formations in regard to each other.

This situation have been depicted in Figure 5, showing a wider area than Peshkopi region itself. In Zerqan area, the shale formation of Silurian-Devonian involved in the tectonic zone of Korabi, overlays tectonically the flysch formation of Jurassic-Cretaceous age and underlays the carbonate formation of Jurassic-Triassic age [6], involved so far in Mirdita tectonic zone in eastern frame unit [7].

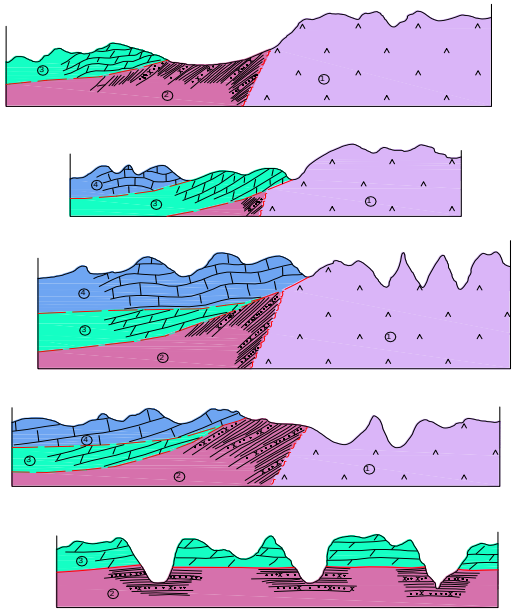

Fig. 4. Schematic geological profiles, which express the relationship between rock complexes in the region of Peshkopi. 1- Evaporite, 2- New Eocene Flysch, 3- Early marly flysch, 4- Triassic-Jurassic limestone

Based on the above considerations, it is reasonable to assume that the Peshkopi evaporites and the Eocene flysch form a tectonic unity and are part of the same tectonic zone, the Krasta sub-zone; also, in the Zerqan sector, the Korab tectonic zone represented by the shale formation of Silurian-Devonian [1], underlays tectonically the Mirdita zone, thus raising serious doubts about the existence of a boundary between them and therefore their existence as separate tectonic zones; rocks involved in eastern Albanides, represent tectonic covers the deepest underlayment of which is flysch formation of Jurassic-Cretaceous age, over which the shale formation of Silurian-Devonin is supported, then the carbonate formation of Triassic-Jurassic age and lastly the unity of ophiolitic rocks in the form of upper cover (Fig. 5).

The Shkodra-Peja transverse constitutes another controversial joint, located between Alps and Krasta-Cukali zones. Tectonic overthrusting of Alps on Krasta-Cukai zone shows very clearly in an area near the city of Shkodra with all the elements (Fig. 6), whereas in the northeast direction this situation becomes unclear as the boundary between Cukali flysch formation of Eocene age and Permian formation of the Alps zone is not at all distinctive.

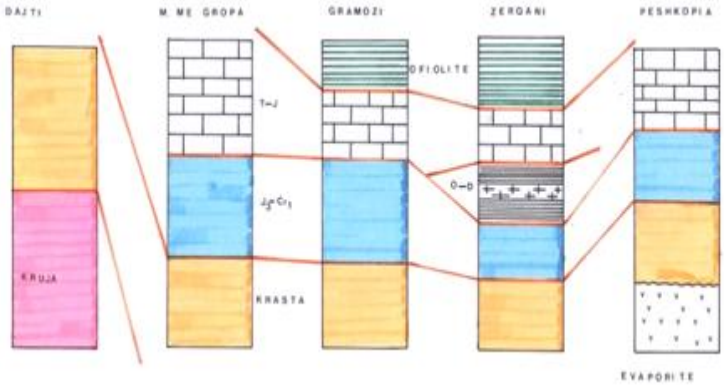

Fig. 5. Tectonic setting of the geological formations in Peshkopi-Dajti region

This ambiguous situation is also noted by a geological survey on a scale of 1: 25 000, carried out in the region. The relationship between these two tectonic units becomes even more problematic, when one considers tha fact that the neritic carbonate layers are intertwined with terrigenous pelagic shale formation layers, two very different sedimentation environments.

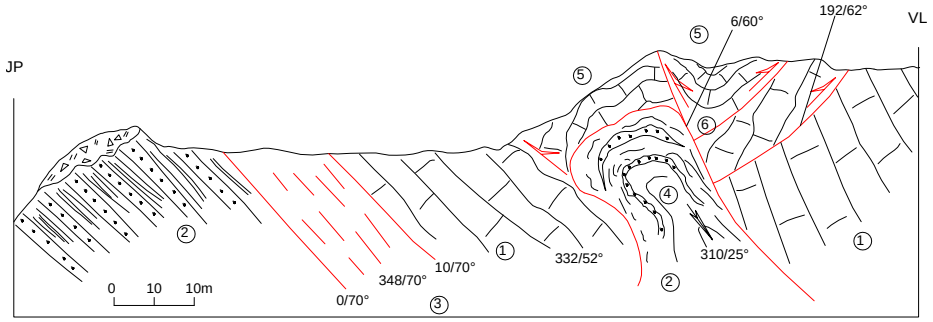

Fig. 6. Outline of the situation of tectonic relationsheep between the Alps and Krasta Cukali zones (former cement factory of Shkodra). 1. Massive limestone, Alps tectonic zone; 2. Silt- sandstone sericitic flysch of Krasta-Cukali tectonic zone; 3. Tectonic boundary between Alpe and Krasta-Cukali zones, broken and brecciated, 20 m thick; 4. Krasta tectonic window, within the Alps zone, effect of flysch diapirism; 5. Carbonates folds for strain effect arising from flysch diapirism; 6. Thrusting and backthrusting tectonic systems

Fusulinid limestones of Permian within the shale matrix, often appear in the shape of chain blocks, in the form of olistolite, giving the rock structure features similar to that of Xhani flysch, located just beneath them. In the sector of Shale Gates the Permian limestones have been

identified as being of Triassic age [8], while in the Plan village, within the terrigenous formation identified as Lower Triassic [1] exist the formation known as Pithonella ovalis, which shows a much younger age [9]. As discussed above it is our opinion that the terrigenous formation that builds the oldest section of the Alps is part of Xhani flysch and as a result takes part in the composition of the Cukali zone. The question remaining concerns the Shkodra-Peja transversal fault, what is its origin and its role in the overall structure of Albanides? This question and many others concerning this problem do leave the Albanides as a regional element wide open to further discussions.

The Lezha transversal fault can also be considered an important tectonic element (Fig. 7). It presents an interesting case in terms of effects that it has had in structural evolution of Albanides. If we consider the lowlands of under-Shkodra, it all comes down gently toward the southeast, until it crashes into the transversal segment of Lezha. This trend is again present in performance of hydrographic network and also structural elements, when considering the anticline of Renci and Kakariqi, gradually decreasing in height toward the south, until it extinguishes near the cross mouth of the Drini river. The anticline ranges of Kruja-Laç and Makareshi follow a similar trend but in the opposite direction, towards the northwest, leaving us with the notion that the same tectonic zone, on both sides of Lezha transversal fault has experienced different

tectonic regimes, experiencing different types of reaction along the main axis of tectonic strains [9]. This is one of the facts, among others, that elucidates the role of this important tectonic element in structuring of Albanides.

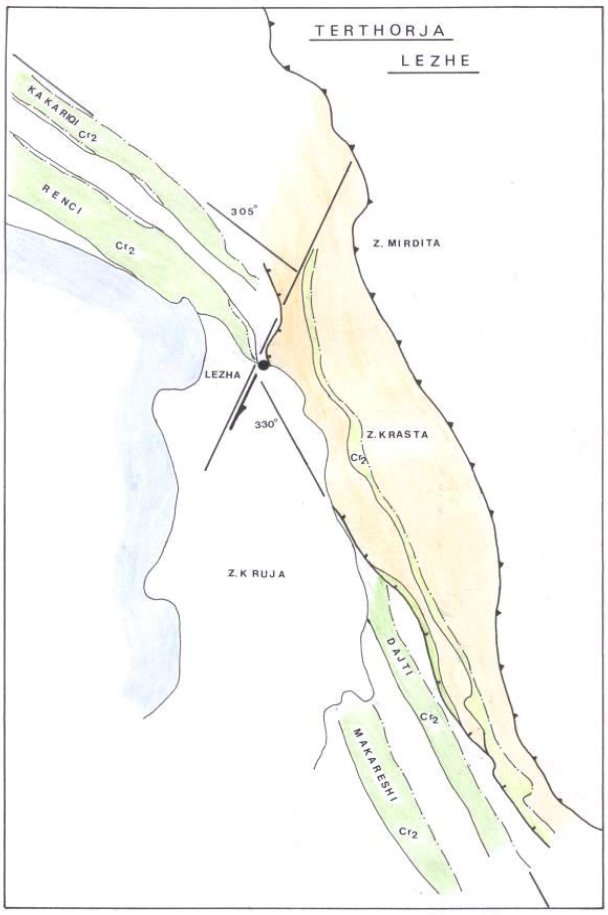

Fig. 7. Lezha transversal fault

IV. CONCLUSIONS

1. Based on the spatial position of Krasta-Cukali tectonic zone, the structural trunk of Albanides can be conceived as organized into four major tectonic units: Eastern Albanides, including tectonic zones of Mirdita, Korabi, Gashi; Western Albanides, including tectonic zones of Sazani, Ionian and Kruja; Northern Albanides, including tectonic zones of the Albanian Alps and Central Albanides, including the tectonic zone of Krasta-Cukali itself.
2. Based on the existence of several unifying lithofacial horizons between the tectonic zones of structural units of Albanides, three major tectonic units can be distinguished: Eastern Albanides, including zones of Mirdita, Korabi Gashi; Western Albanides, including zones of Sazani, Ionian, Kruja and Central Albanides, including zones of Krasta-Cukali, Alps and Mirdita Cretaceous structural unit in the form of a transgresive tongue on eastern Albanides.
3. The Peshkopi evaporates both with Eocene flysch form a tectonic unity and are part of the same tectonic zone, the Krasta sub-zone.
4. In Zerqan, the tectonic area of Korabi represented by the shale formation Silurian-Devonian, tectonically underlays the Mirdita zone, putting in question the boundary between

them and therefore their existence as separate tectonic zones.

5. The rocks involved in eastern Albanides, represent tectonics covers, starting with the flysch formation of Jurassic-Cretaceous age located deeper than others, above which is situated the formation of Silurin-Devonian, then the carbonate formation of Triassic-Jurassic age and the upper one, in the shape of upper covers is the ophiolitic rocks unity.

6. The terrigenous formation that builds the older section of Alps zone, is perceived to be part of Xhani flysch, therefore participating in the formation of a new section of Cukali sub-zone. This raises further questions regarding the Shkodra-Peja transverse, its origin, the rock formations and the role it has played in structuring of Albanides. These questions and other discussions presented in this paper leaves this regional element of Albanides open to debate.

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