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Volcanic and Cultural Geoheritage Potential of Erenlerdağ-Alacadağ Volcanism (SW of Konya-Türkiye)

Erenlerdağ–Alacadağ Volkanizmasının (GB Konya-Türkiye) Volkanik ve Kültürel Jeomiras Potansiyeli

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Abstract: The Erenlerdağ–Alacadağ Volcanic Complex (ErAVC), located in southwest Konya (Central Anatolia), represents a Neogene-aged volcanic unit covering approximately 1500 km². The EAVC is composed of volcanic products that range in composition from mafic to felsic, including lava domes, lava flows, pyroclastic fall and flow deposits, and subvolcanic intrusions such as dikes and plugs. The present study aims to identify and characterize representative volcanic geosites within the ErAVC, assess their geoheritage value, and discuss their potential for geotourism and educational development in the context of Central Anatolian Volcanic Geoheritage.

Volcanic facies analysis reveals a wide range of eruptive behaviors, from the development of lava domes and lava flows and the formation of dacitic spine structures to ignimbrite-forming explosive volcanism and complex volcano-sedimentary processes, expressed across facies ranging from central/proximal to distal settings. In the proximal and medial facies, dacitic–andesitic lava flows, domes, their pyroclastic equivalents, and ignimbrite sequences display features indicative of multi-stage magma mixing, recharge events, and decompression-driven processes. Distal facies are characterized by tuff horizons, widespread ignimbrite, and sedimentary units, which clearly reflect the synchronous development of volcanic and sedimentary processes. These well-preserved successions provide rare and valuable archives for reconstructing eruption dynamics and magma chamber evolution in continental arc settings. The distribution of volcanic facies in the ErAVC documents a pronounced geomorphological contrast between high-relief areas associated with lava domes and lava flows, and lower-relief zones dominated by ignimbrites, tuff layers, and volcano-sedimentary units.

Highly porous ignimbrites and tuff horizons in the medial-distal facies have facilitated settlement and construction activities throughout history, as exemplified by the rock-carved dwellings of the ancient city of Kilistra. The ancient settlement of Kilistra, located within the boundaries of the Erenlerdağ–Alacadağ Volcanic Complex (ErAVC), represents one of the rare geo-cultural heritage sites where volcanological, geomorphological, and archaeological components are integrated. The Late Hittite-period Fasıllar Monument, built upon resistant dacitic–andesitic lava flows, stands as a striking example of the integration of volcanic lithologies into the cultural landscape.

In conclusion, the ErAVC is one of the most significant geosites in Central Anatolia, offering substantial potential for geoconservation, geoeducation, and sustainable geotourism. The region's geological diversity and cultural assets serve as an "open-air laboratory" for multidisciplinary research and community engagement.

Keywords: Erenlerdağ-Alacadağ Volcanic Complex, Fasıllar, ignimbrite, lava flow, Kilistra, volcanic geoheritage.

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Öz: *Erenlerdağ–Alacadağ Volkanik Kompleksi (ErAVK), Konya'nın güneybatısında (Orta Anadolu) yer alan ve yaklaşık 1500 km²'lik bir alanı kaplayan Neojen yaşlı bir volkanik birimi temsil etmektedir. ErAVK, mafikten felsiğe kadar değişen bileşimlerde lav kubbeleri, lav akıntıları, piroklastik düşme ve akma ürünleri ile dayk ve volkanik tıkaç gibi subvolkanik intrüzyonlardan oluşmaktadır. Bu çalışma; ErAVK içerisindeki temsil niteliği yüksek volkanik jeositlerin tanımlanması ve karakterizasyonu, bu jeositlerin jeomiras değerinin belirlenmesi ve Orta Anadolu Volkanik Jeomirası özelinde jeoturizm ve eğitim potansiyellerinin tartışılmasını amaçlamaktadır.*

Volkanik fasiyes analizi, lav kubbeleri(dom) ve lav akıntılarının gelişiminden dasitik çivi yapıların oluşumuna, ignimbirit oluşturan püskürmeli volkanizmadan karmaşık volkano-sedimanter süreçlere kadar geniş bir püskürme davranışı yelpazesini ortaya koymaktadır. Piroksimal ve medial fasiyeslerdeki dasitik–andezitik lav akıntıları, domlar, bunların piroklastik eşlenikleri ve ignimbirit dizileri; çok evreli magma karışımı, yeniden beslenme olayları ve dekompresyon kaynaklı süreçlerin göstergelerini sunmaktadır. Distal fasiyesler ise tüf seviyeleri, yaygın ignimbiritler ve sedimanter birimlerle karakterizedir ve volkanik ile sedimanter süreçlerin eşzamanlı gelişimini açık biçimde yansıtmaktadır. Bu iyi korunmuş istifler, kıtasal yay ortamlarında püskürme dinamikleri ve magma odası evriminin yeniden kurgulanması açısından nadir ve değerli arşivler oluşturmaktadır. Volkanik fasiyeslerin dağılımı, ErAVK'de lav domları ve akıntılarla ilişkili yüksek rölyefli alanlar ile ignimbirit-tüf ve volkano-sedimanter birimlerin hâkim olduğu daha düşük rölyef zonları arasında belirgin bir jeomorfolojik ayrım ortaya koymaktadır.

Medial–distal fasiyeslerde gözlenen yüksek gözenekliliğe sahip ignimbirit ve tüf seviyeleri, tarih boyunca yerleşim ve inşa faaliyetlerini kolaylaştırmıştır. Kilistra antik kenti, ErAVK sınırları içinde yer almakta olup volkanolojik, jeomorfolojik ve arkeolojik bileşenlerin bütünleştiği nadir jeo-kültürel miras alanlarından birini temsil etmektedir. Geç Hitit Dönemi'ne tarihlenen Fasıllar Anıtı ise dayanıklı dasitik–andezitik lav akıntıları üzerine inşa edilmiş olup, volkanik litolojilerin kültürel peyzajla bütünleşmesinin çarpıcı bir örneğini sunmaktadır.

Sonuç olarak, ErAVK Orta Anadolu'nun en önemli jeositlerinden biri olup, jeokoruma, jeoeğitim ve sürdürülebilir jeoturizm açısından büyük bir potansiyele sahiptir. Bölgenin jeolojik çeşitliliği ve kültürel değerleri, disiplinlerarası araştırmalar ve yerel toplumun katılımı için bir "açık hava laboratuvarı" işlevi görmektedir.

Anahtar Kelimeler: *Erenlerdağ–Alacadağ volkanik kompleksi, Fasıllar, ignimbirit, Kilistra, lav akıntısı, volkanik jeomiras.*

INTRODUCTION

Volcanic terrains preserve key records of magma evolution, eruption mechanisms, and depositional processes, and therefore provide important insights into the geological evolution of continental regions. In post-collisional tectonic settings, volcanic systems commonly exhibit complex facies architectures formed by alternating effusive and explosive activity, as well as interactions between volcanic and sedimentary processes. Detailed facies-based studies are thus essential for reconstructing eruptive histories and understanding the spatial organization of volcanic products. Volcanic geoheritage comprises volcanic landforms, eruptive products, and depositional successions that collectively document the dynamics of volcanism and its long-term surface expression (Németh and Palmer, 2019; Németh, 2022). Within this framework, facies analysis represents a fundamental approach for interpreting eruptive sequences, depositional environments, and periods of volcanic quiescence recorded by interbedded sedimentary units (Fisher and Schmincke, 1984; Cas and Wright, 1991; Németh, 2022). The identification of representative geosites based on facies architecture provides a robust framework for evaluating the scientific and educational significance of volcanic terrains.

The Erenlerdağ–Alacadağ Volcanic Complex (ErAVC) represents one of the most extensive Neogene volcanic systems in Central Anatolia. It encompasses a wide spectrum of volcanic facies – from high-viscosity lava domes to pyroclastic flow deposits – and records the interplay of effusive and explosive processes during post-collisional volcanism. In addition to its geoscientific significance, the ErAVC hosts several cultural and archaeological features, including the ancient rock-carved settlement of Kilistra (Gökyurt) and Fasıllar villages, which collectively highlight the strong link between volcanic landscapes and regional cultural evolution. The geological heritage potential of Konya has previously been evaluated by Kazancı and Gençoğlu Korkmaz (2023). In this context, and following the classification of Kazancı et al. (2015), Erenlerdağ Volcanism is included in the Master List inventory under Group B: Volcanic, Metamorphic, and Sedimentary Petrology – Textures, Structures, Events, and Provenance. This study aims to (i) identify and characterize representative volcanic geosites within the ErAVC based on volcanic facies architecture and geomorphological expression, (ii) assess their geoheritage value, and (iii) discuss their potential for geotouristic and educational development in the context of Anatolian volcanic geoheritage.

GEOLOGICAL SETTING

Anatolia, as part of the Cenozoic Alpine–Himalayan orogenic belt, comprises several tectonic blocks that were assembled through the convergence between the Afro–Arabian and Eurasian plates (Şengör and Yilmaz, 1981). The region is divided by the sutures of the Neotethys Ocean into four major tectonic domains: the Pontides to the north, the Kırşehir Block in the center, the Anatolide–Tauride Block to the south, and the Arabian Platform to the southeast (Figure 1A). The closure of different branches of the Neotethys during the Late Cretaceous–Miocene resulted in complex collisional and extensional tectonics (Okay and Tüysüz, 1999; Şengör et al., 2003; Şengör et al., 2019). The Cenozoic volcanism in Anatolia is closely related to this tectonic evolution and is widespread throughout the region, reflecting the transition from compressional to extensional regimes. Miocene volcanic rocks are widely exposed from northwest of Konya to the Central Taurus in the southwest. These volcanic rocks have been described in the literature under several names, including Konya volcanics, Erenlerdağ–Alacadağ volcanics, Sille volcanics, and Sulutas volcanics (Keller et al., 1977; Koçak and Zedef, 2016; Kurt et al., 2003; Temel et al., 1998). Geochemical studies indicate that the volcanic units are predominantly calc-alkaline in composition (Keller et al., 1977; Koçak and Zedef, 2016; Kurt et al., 2003; Kurt et al., 2005; Temel et al., 1998, Uyanık and Koçak, 2016). Previous geochronological studies indicate that Miocene volcanism in the Konya region and its surroundings spans a broad time interval. K/Ar dating yielded ages between 11.95 ± 0.20 and 3.35 ± 0.08 Ma (Besang et al., 1977), whereas $^{40}Ar/^{39}Ar$ ages obtained from calc-alkaline volcanic units range from 16.11 ± 0.18 to 12.07 ± 0.06 Ma (Asan et al., 2021). In addition to calc-alkaline volcanism, sodic alkaline basaltic activity has been dated at 22.37 ± 0.65 and 16.45 ± 0.76 Ma (Gençoğlu Korkmaz et al., 2017), and potassic alkaline lamprophyric sub-volcanic rocks yield ages between 13.72 ± 0.13 and 12.40 ± 0.11 Ma (Asan and Ertürk, 2013). These data collectively indicate prolonged and compositionally diverse magmatic activity in the region during the Early to Late Miocene. Within this regional volcanic framework, the ErAVC in Anatolia is located in the Beyşehir Graben system (Konya), which forms part of the Anatolide–Tauride Block. The graben-like structure and associated volcanic units of the Beyşehir Basin (SW Konya, Turkey) have been the focus of numerous studies addressing their stratigraphic, structural, tectonic and magmatic evolution (Besang et al., 1977; Keller, et al., 1977; Temel, et al., 1998; Tatar et al., 2002; Doğan and Koçyiğit, 2018; Gürbüz et al., 2021; Gündüz, 2023; Asan et al., 2024; Gündüz, 2025; Gündüz et al., 2025). The ErAVC volcanism, ranging in composition from basaltic andesite to rhyolite, represents a well-developed example of Miocene post-collisional extensional magmatism in central Anatolia and provides an important record of magma generation, evolution, and emplacement within an evolving graben system (Asan et al., 2024; Gündüz et al., 2025) (Figure 1B).

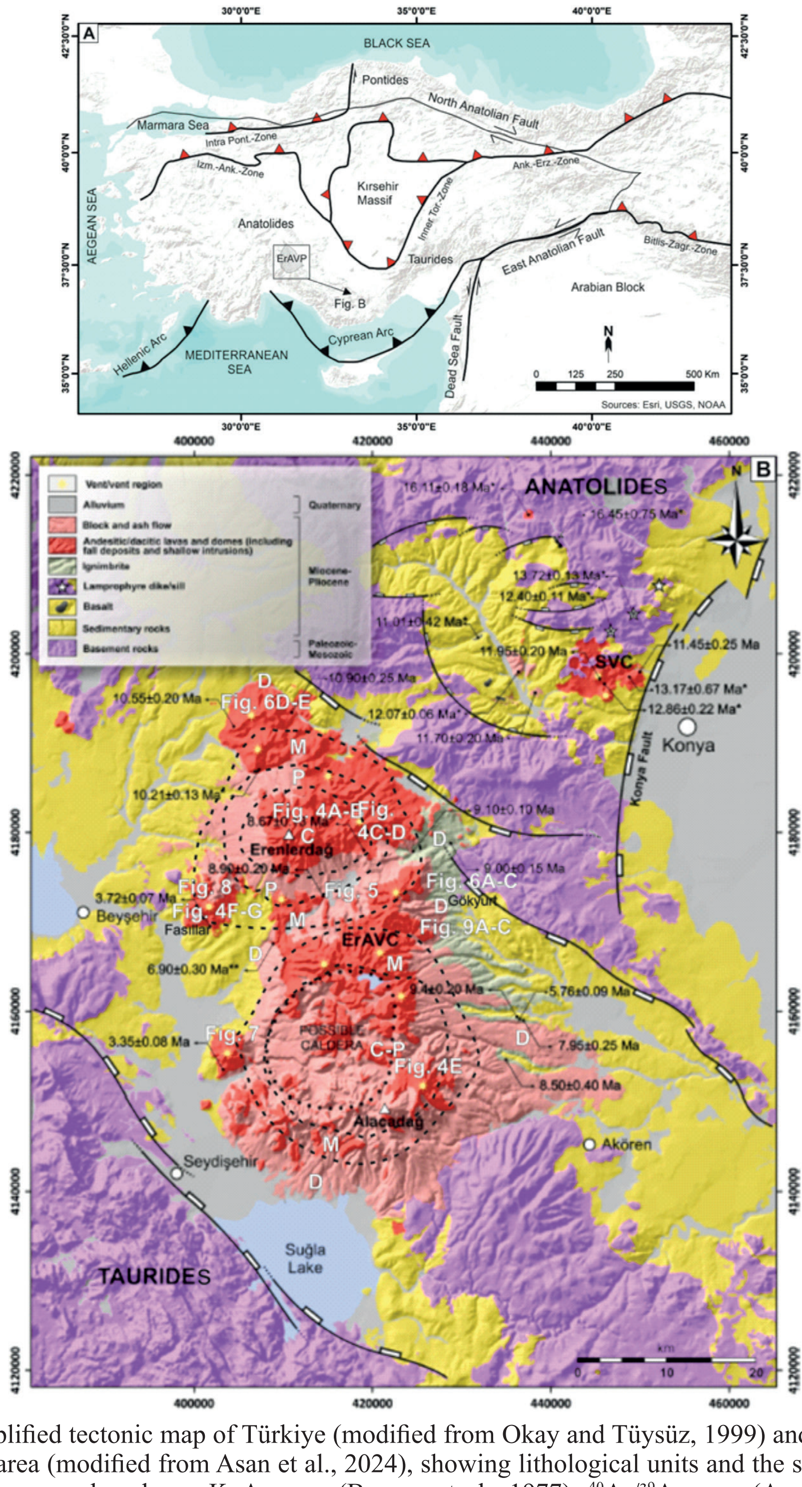

Figure 1. A) A simplified tectonic map of Türkiye (modified from Okay and Tüysüz, 1999) and **B)** Geological map of the investigated area (modified from Asan et al., 2024), showing lithological units and the spatial distribution of volcanic facies. The map also shows K–Ar ages (Besang et al., 1977), $^{40}Ar/^{39}Ar$ ages (Asan and Ertürk, 2013; Gençoğlu Korkmaz et al., 2017; Asan et al., 2021)*, as well as radiometric dating results published by Platzman et al. (1998)** and Rabayrol et al. (2019). Letters and labels on the map indicate the locations of representative field photographs of facies and geosites illustrated in subsequent figures. Facies distribution is classified as C, central facies; P, proximal facies; M, medial facies; and D, distal facies.

Şekil 1*. *A) *Türkiye'nin basitleştirilmiş tektonik haritası (Okay ve Tüysüz, 1999'dan değiştirilmiştir) ve* ***B)*** *İncelenen alanın jeolojik haritası (Asan vd.,2024'ten değiştirilmiştir), litolojik birimleri ve volkanik fasiyeslerin mekânsal dağılımını göstermektedir. Harita ayrıca K–Ar yaşları (Besang vd.,1977), $^{40}Ar/^{39}Ar$ yaşları (Asan ve Ertürk, 2013; Gençoğlu Korkmaz vd.,2017; Asan vd., 2021)*, Platzman vd., (1998)** ve Rabayrol vd., (2019) tarafından yayınlanan radyometrik yaşlandırma sonuçlarını da göstermektedir. Harita üzerindeki harfler ve etiketler, ilerleyen şekillerde sunulan fasiyeslere ve jeositlere ait temsilî arazi fotoğraflarının konumlarını işaret etmektedir. Fasiyes dağılımı C: merkezi fasiyes; P: proksimal fasiyes; M: medial fasiyes ve D: distal fasiyes olarak sınıflandırılmıştır.*

METHOD

Fieldwork was conducted across the ErAVC and involved detailed geological and volcanological observations, as well as systematic sampling for petrographic analysis. Volcanic facies were distinguished on the basis of lithology, texture, structures, and emplacement relationships, following established volcanological concepts (Fisher and Schmincke, 1984; Cas and Wright, 1991; Németh and Palmer, 2019). Facies analysis was applied to interpret eruptive styles, depositional processes, and lateral and vertical variations within the volcanic succession, as well as to assess interactions between volcanic deposits and associated sedimentary environments.

Based on field observations, representative geosites illustrating key volcanic processes and landscape expressions were identified. These sites were qualitatively evaluated using criteria adapted from Brilha (2016) and Navasardyan et al. (2025), with emphasis on scientific relevance, educational value, aesthetic significance, and cultural associations. This qualitative assessment was used to support geological interpretation.

A total of 20 representative rock samples were collected for petrographic investigations. Thin sections were prepared at the Earth Sciences Application and Research Center (YEBİM), Ankara University. Petrographic investigations were conducted at Konya Technical University, where microscopic analyses and microphotographs were obtained.

RESULTS

Mineralogy and Petrography

The investigated rocks are predominantly andesite and dacite, with scarce rhyolite, together with their widespread pyroclastic deposits. The investigated lava flows display hypocrystalline porphyritic texture (Figure 2A-H). The andesites typically contain amphibole, pyroxene, and rare biotite as mafic phases, together with abundant plagioclase microcrysts and phenocrysts (Figure 2A, B, G & H). The dacites are characterized by biotite as the principal mafic phase, with minor quartz and plagioclase occurring as micro- to phenocrysts (Figure 2E & F). The rhyolites generally include biotite, plagioclase, and quartz (Figure 2C & D). All rock types also host opaque minerals, while apatite and zircon occur as common accessory phases. The plagioclase phenocrysts display various zoning patterns and textural features, including dusty cores, fine- and coarse-sieve textures. The amphiboles are commonly altered and exhibit opacitic rims and breakdown structures, reflecting magmatic disequilibrium processes (Figure 2A, B, E & F).

In some andesite and dacite samples, both macro- and micro-scale (micron to decimeters) enclaves are observed (Figures 2G, H & 3). These enclaves are sharply bounded from the host rock and comprise amphibole-rich mafic magmatic enclaves and cognate (magmatic segregation) enclaves. Amphiboles within the enclaves are frequently blade-shaped and quenched, reflecting rapid crystallization (Figure 2G &H).

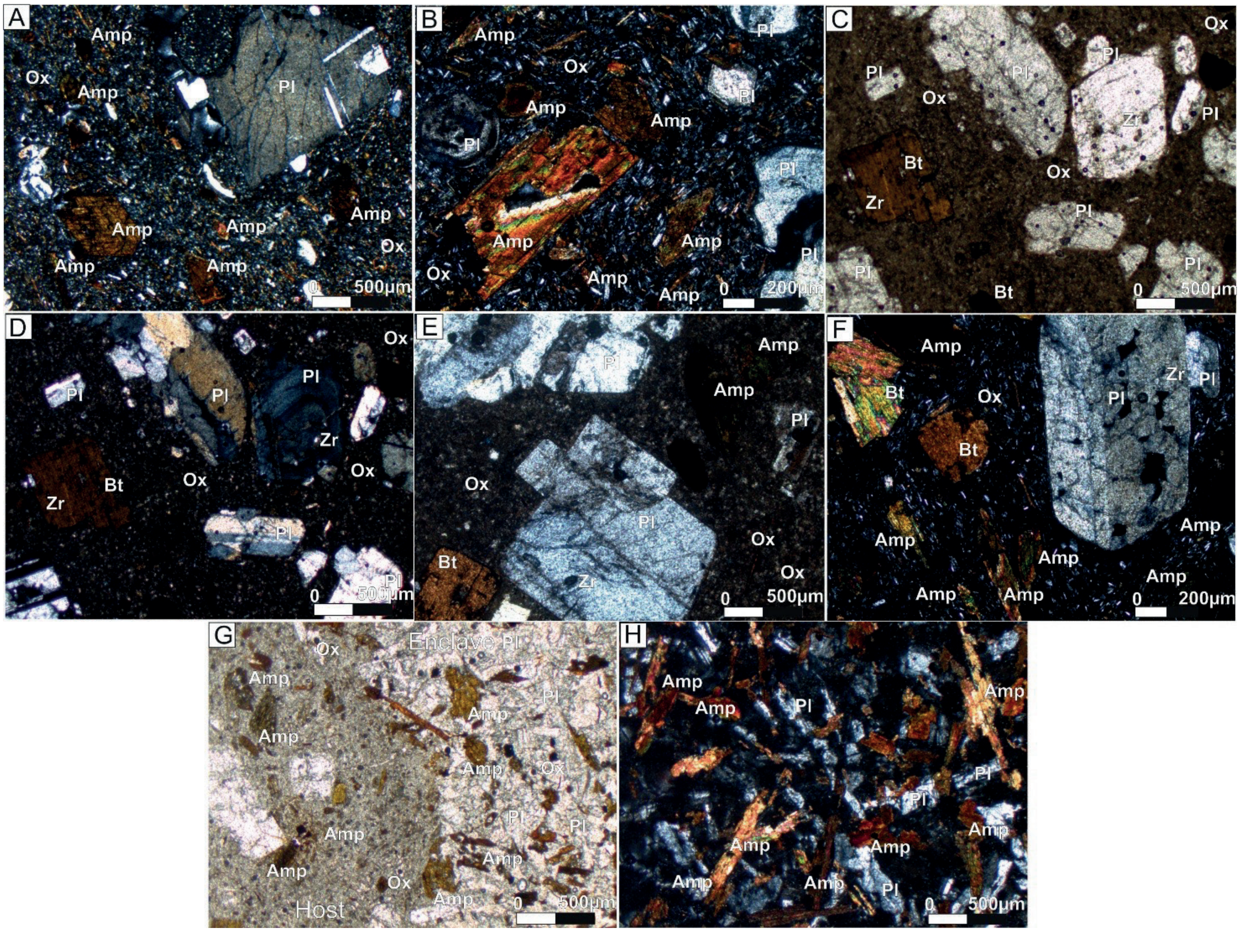

Figure 2. Microphotographs of the investigated rocks. **A & B**) Andesitic, **C & D**) rhyolitic, E & F) dacitic rocks, and **G & H**) mafic magmatic enclaves (magma mixing) in the andesites. Amp: amphibole, Bt: biotite, Cpx: clinopyroxene, Ox: Fe-Ti oxides, Pl: plagioclase, Zr: zircon. Mineral abbreviations are based on Whitney and Evans (2009). C and G were acquired under plane-polarized light (PPL), whereas the remaining images were obtained under crossed polarizers (XPL)

Şekil 2. *İncelenen kayaçların mikrofotoğrafları.* ***A*** *ve* ***B****) Andezitik,* ***C*** *ve* ***D****) riyolitik,* ***E*** *ve* ***F****) dasitik kayaçlar ve* ***G*** *ve* ***H****) andezitler içerisindeki mafik mağmatik anklavlar (mağma karışımı). Amp: amfibol, Bt: biyotit, Cpx: klinopiroksen, Ox: Fe-Ti oksitleri, Pl: plajiyoklaz, Zr: zirkon. Mineral kısaltmaları Whitney ve Evans (2009)'a dayanmaktadır. C ve G düz polarize ışıkta -tek nikolde (PPL), diğer görüntüler ise çapraz polarizörler altında - çift nikolde (XPL) elde edilmiştir*

Geomorphological Properties of the Erenlerdağ–Alacadağ Volcanic Complex

The geomorphology of the Erenlerdağ–Alacadağ Volcanic Complex is strongly controlled by the distribution and physical properties of volcanic facies. Clear differences in relief, slope morphology, and surface expression are observed between central–proximal, medial, and distal facies, reflecting variations in magma rheology, emplacement processes, and post-eruptive erosion resistance.

The ErAVC comprises the products of two major eruptive centers – Erenlerdağ and Alacadağ – and therefore exhibits a facies distribution that varies according to the morphological and lithological characteristics of each center.

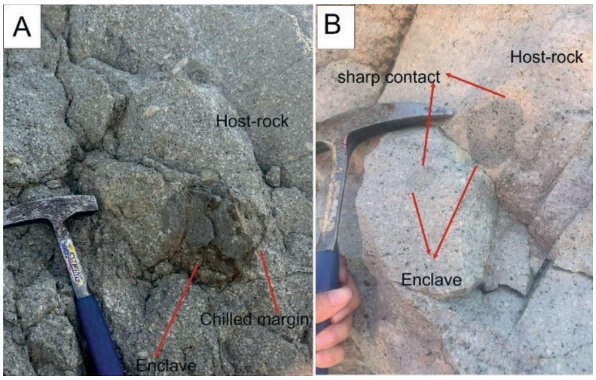

Figure 3. Different textured and colored enclave formations within andesitic–dacitic lava flows. **A)** Black-colored and rounded enclaves with an aphanitic texture (very fine-grained), **B)** Light gray-colored and rounded enclaves with a porphyritic–aphanitic texture. The enclaves are separated from andesitic and dacitic host rocks by sharp contacts and provide evidence for complex magma-mixing processes.

***Şekil 3.** Andezitik–dasitik lav akıntıları içerisinde farklı doku ve renklere sahip anklav oluşumları. **A)** Siyah renkli, yuvarlak şekilli, afanitik dokulu anklavlar (çok ince taneli), **B)** Açık gri renkli, yuvarlak şekilli, porfiro-afanitik dokulu anklav. Anklavlar, andezitik ve dasitik ana kayaçtan keskin dokanakla ayrılmakta olup, karmaşık mağma karışım süreçlerinin varlığına işaret etmektedir.*

In the Erenlerdağ eruption center, the transition from the volcanic center outward is clearly expressed by a well-defined sequence of central, proximal, medial, and distal facies (including transition zones) (Figure 1B). Around the summit area, massive andesitic–dacitic lava domes, steep dome-flank ridges, and viscous lava outcrops delineate a distinct central facies (Figure 4A & B). These structures are surrounded by thick blocky lava flows that form broader slopes, marking a clearly recognizable proximal facies (Figure 4C & D). In Erenlerdağ, contrasts in topography, lithological architecture, and surface textures allow these facies to be distinguished unambiguously in the field.

In contrast, Alacadağ has a different facies model. Here, lava domes and dome-margin lava flows form a gradational and texturally continuous volcanic unit, without a topographic break or a diagnostic lithological–structural boundary that would separate central and proximal facies. As a result, these two facies cannot be discriminated at the field scale, and the inner part of the edifice is treated in this study as a single central–proximal facies domain (Figure 1B). In previous studies (Gündüz, 2023; Asan et al., 2024), it is thought that there may be a possible caldera in the vicinity of Alacadağ (Figure 1B). It is dominated by andesitic-dacitic lava flows and domes (Figure 4E). These high-relief features are controlled by the emplacement of intermediate to felsic lavas and their pyroclastics. Steep topography and minimal hydrological modification highlight the resistance of dome and blocky lava surfaces to erosional processes. Outside the piroximal area, both volcanic centers are bordered by a medial facies characterized by lower-gradient slopes, well-stratified tuff and lapilli beds, perlitic pyroclastic units, and reworked volcaniclastic deposits, collectively reflecting a zone in which the influence of lava diminishes and pyroclastic processes dominate (Figures 4F, G & 5).

The outermost zone of the complex is represented by distal facies, consisting of extensive ignimbrite plateaus, finely stratified tuff sequences, zeolite-bearing alteration zones, epivolcanoclastics, and fluvio-lacustrine sediments (Figures 1B, 6D, E & 7). These deposits record the broad dispersal of pyroclastic material from both eruptive centers and represent the low-energy and far-field products of volcanic activity. Consequently, the complex as a whole is characterized by variably developed central–proximal associations around each volcanic center, radially encircled by medial and distal facies that document the progressive decline of eruptive energy and depositional processes away from the source vents.

Figure 4. A & B) Central facies of the Erenlerdağ stratovolcano with dacitic and andesitic lava flows, **C & D)** Proximal facies of Erenlerdağ showing altered-silica-rich dacitic lava flows with well-developed columnar cooling joints, **E)** Central (proximal) facies of Alacadağ, characterized by dacitic to andesitic lava flows and domes accompanied by block flow-autobreccia, **F & G)** Andesitic lava flows in medial facies of Erenlerdağ

***Şekil 4. A** ve **B)** Erenlerdağ stratovolkanının merkezi fasiyesleri ile dasitik ve andezitik lav akıntıları. **C** ve **D)** Erenlerdağ'ın piroksimal fasiyeslerini gösteren, altere-silisçe zengin ve belirgin sütunsal soğuma çatlaklı dasitik lav akıntıları. **E)** Alacadağ'ın merkezi (piroksimal) fasiyesleri; dasitik–andezitik lav akıntıları ve dom ile bunlara eşlik eden blok akmaları-otobreşler, **F** ve **G)** Erenlerdağ medial fasiyeste andezitik lav akıntıları.*

Moving downslope from the central, the medial facies are represented by a complex assemblage of lava flows, lava domes, lava spin, neck structures, nue ardents, and stratified tuff layers (Figure 5). The lava flows, locally displaying columnar and platy jointing, form linear ridges and subtle scarps across the proximal flanks. The dacitic lavas are more rarely represented and occur mainly as necks and spine structures (Figure 5A & B). In this area, tuff layers and scarce block flows are observed. The tuff and lapilli layers contribute to small-scale ridges, minor channels, and uneven surface microtopography, indicative of low-energy pyroclastic deposition (Figure 5B–E). This zone may represent a transitional landscape, where dome-collapse processes and pyroclastic dispersal have produced a combination of rugged hummocks and smoother ramp-like surfaces.

In the distal facies of the volcanic sequence, the pyroclastic deposits are commonly interbedded with volcaniclastic and alluvial sediments and carbonates, indicating extensive post-eruptive reworking and ongoing landscape evolution. These sequences record both primary eruptive processes and secondary sedimentary modifications, reflecting the dynamic interaction between volcanic activity and surface processes.

Figure 5. Andesitic lava spine and pyroclastics in Erenlerdag medial facies. **A & B)** High-viscosity andesitic magma formed lava spine/dome structures, which are observed in the medial facies in association with tuff units and low-energy pyroclastic density current deposits, **C, D & E)** Perlitic horizons intercalated within the tuff layers reflect post-emplacement hydration and devitrification of glass-rich pyroclastic material, indicating the influence of hydrothermal processes and demonstrating the interaction between lava extrusion and pyroclastic deposition within the medial facies.

Şekil 5. *Erenlerdağ medial fasiyesteki andezitik çivi yapısı (spine) ve piroklastikler,* ***A*** *ve* ***B)*** *Yüksek viskoziteli andezitik magma, lav spine/kubbe yapıları oluşturmuş olup bu yapılar tüf birimleri ve düşük enerjili piroklastik yoğunluk akımı ürünleri ile medial fasiyeste görülmüştür. C, D ve E) Tüf tabakaları içerisinde yer alan perlitik seviyeler, camca zengin piroklastik malzemenin yerleşim sonrası hidratasyon ve devitrifikasyonunu yansıtmakta; bu durum hidrotermal süreçlere işaret etmekte ve medial fasiyeste lav çıkışı ile piroklastik çökelim arasındaki etkileşimi göstermektedir.*

The key geomorphic and sedimentological characteristics of the area include stratified tuffs and pumice layers and high volume of ignimbrite units (Figures 6A-C & 7). The stratified tuffs and pumice layers, which form gently sloping surfaces and low-relief plateaus, providing evidence of episodic ashfall deposition and subsequent pedogenesis. The welded ignimbrite sheets generate locally flattened to gently undulating surfaces characterized by fiamme textures, indicative of high-temperature pyroclastic density currents. These deposits represent the emplacement of voluminous ignimbrites under conditions of sustained flow and thermal welding. Thick ignimbrite sheets, which, being comparatively less resistant to erosion than coherent lava flows, have been extensively sculpted by atmospheric and fluvial processes. This erosional activity has produced distinctive landforms, including fairy chimneys, small valleys, and other microtopographic features. The porous and stratified nature of these ignimbrites has historically provided natural shelters that were utilized as human dwellings, as exemplified by sites such as Kilistra. The carbonate-rich horizons, caliche layers, and clay-rich deposits, which locally enhance susceptibility to chemical weathering, soil formation, and fluvial incision, therefore influence local relief development. The alluvial and lacustrine sediments, which accumulate in valley floors, contribute to the construction of basin-fill sequences and reflect episodic sediment supply from both volcanic and non-volcanic sources.

Additionally, epivolcanoclastics, lahars, and fluviolacustrine deposits have been documented, highlighting the complex interplay between primary volcanic processes, mass-wasting events, and hydrologically-driven sedimentation. In the distal facies, extensive hydrothermal alteration zones have been identified, characterized by advanced silicification and the development of clay mineral assemblages. These alteration processes are particularly pronounced in association with the formation of zeolite-bearing horizons (Figure 6D & E).

Overall, the geomorphology of the ErAVC is a direct expression of its eruptive history: the high-relief central domes reflect effusive and dome-collapse processes; the proximal slopes are molded by pyroclastic density currents and lava flows; and the distal plains represent the combined influence of pyroclastic dispersal, sediment reworking, and geomorphic modification by erosion and hydrological processes. The resulting landscape illustrates a continuum from primary volcanic edifices to reworked sedimentary surfaces, providing a tangible record of the complex volcanic and post-eruptive dynamics of the region.

Cultural Heritage

In the vicinity of Fasıllar village, the andesitic lava surfaces preserve rock-cut features attributed to the Hittite period, including reliefs, sculptural elements, and hieroglyph-like carvings (Figure 8A, B, E). These features occur directly on exposed andesitic lava and include carved niches hosting relief compositions, some of which including the Lukyanus Inscription and the Atlı Kaya (Horse Relief) (Figure 8B). The presence of these rock-cut elements reflects the utilization of volcanic substrates for cultural and symbolic expression during the Hittite period. The Fasıllar Monument, carved into a massive block of andesitic lava originating from ancient volcanic flows in the region, represents a significant example of Hittite monumental sculpture embedded in a volcanic landscape. The monument (Figure 8C, D) depicts the Storm God Tarḫunna, standing dominantly a top mountain god, symbolizing cosmic order and divine sovereignty (Erbil and Ünlü, 2017). Although traditionally classified as a religious or political icon, the monument also constitutes a significant example of geoarchaeological heritage embedded within a volcanic landscape.

The selection of andesite – a durable and erosion-resistant volcanic rock – indicates a deliberate material choice by Hittite artisans, likely due to its long-term preservation potential and sculptural workability. Ceramic findings from Late Bronze Age settlements around the Fasıllar Monument reflect organized production using controlled firing techniques, indicative of large-scale workshop activity (Erbil and Ünlü, 2017).

Figure 6. A-C) Tuff layers, ignimbrites, and **D & E)** hydrothermal alteration with zeolite formation in distal facies-Erenlerdağ. The stratigraphic association of tuff and ignimbrite units reflects the successive development of low-energy pyroclastic fall (tuff) and high-energy pyroclastic density current (PDC) deposits (ignimbrite), which exert a strong control on present-day geomorphological relief due to their contrasting resistance.

Şekil 6. *Distal fasiyeste **A-C)** tüf seviyeleri, ignimbiritler ve **D** ve **E)** zeolit oluşumlu hidrotermal alterasyon-Erenlerdağ. Tüf ve ignimbirit birimlerinin stratigrafik birlikteliği, düşük enerjili piroklastik düşme (tüf) ile yüksek enerjili piroklastik yoğunluk akımı (PDC) ürünlerinin (ignimbirit) ardışık olarak geliştiğini ve bu birimlerin güncel jeomorfolojik rölyefi farklı dayanım özellikleriyle kontrol ettiğini göstermektedir.*

Embedded within a volcanic landscape, these artifacts and the monument itself highlight the interplay between human culture and geological context, demonstrating the site's significance as a case of volcanic geoheritage. In this regard, the Fasıllar Monument demonstrates how volcanic geoheritage influenced material selection, monumentality, and landscape use in ancient societies (Figure 8A-G).

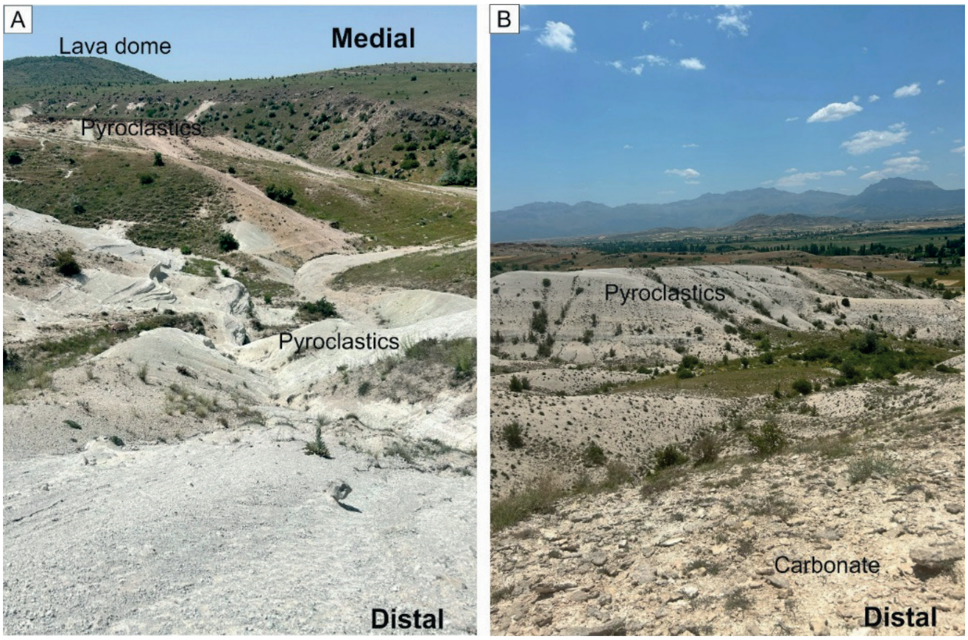

Figure 7. A) Transition zone from medial to distal of Alacadağ, showing lava dome and tuff layers, **B)** Pyroclastic deposits and carbonate formations in the distal zone of Alacadağ.

Şekil 7. A) *Alacadağ'ın medial–distal fasiyesi arasındaki geçiş zonu; lav domu ve tüf tabakalarını göstermektedir.* ***B)*** *Alacadağ'ın distal fasiyesindeki piroklastikleri ve karbonat oluşumları.*

Table 1. Geomorphological expressions of different volcanic facies in the Erenlerdağ–Alacadağ Volcanic Complex.

Çizelge 1. *Erenlerdağ–Alacadağ Volkanik Kompleksi'nde farklı volkanik fasiyeslerin jeomorfolojik yansımaları.*

Volcanic facies	Dominant volcanic products	Relief and slope characteristics	Characteristic geomorphological expression
Central–proximal facies	Andesitic–dacitic lava domes, volcanic necks and spines, thick lava flows, autobreccias	High relief, steep slopes	Lava domes, volcanic necks and spines and dome flanks, rugged and dissected ridges, massive and erosion-resistant bedrock surfaces
Medial facies	Lava flows interlayered with tuffs and pyroclastic density current deposits	Moderate relief, transitional slopes	Undulating topography, mixed morphologies shaped by the coexistence of lava and pyroclastic units, erosion-controlled slopes
Distal facies	Ignimbrites, stratified tuffs, epivolcaniclastic and fluvio-lacustrine deposits	Low to moderate relief, laterally extensive surfaces	Widespread ignimbrite surfaces, paleovalley infill controlled by flow geometry, extensive differential erosion-controlled features developed within ignimbrites, surfaces modified by fluvial and lacustrine processes,

The ancient settlement of Kilistra (in Gökyurt village) represents one of the rare geo-cultural heritage sites where volcanological, geomorphological, and archaeological components are integrated. The Miocene–Pliocene high-K calc-alkaline ignimbrites forming the area preserve stratigraphic and petrographic records of complex magmatic–volcanic processes, including magma mixing, adiabatic expansion, and column collapse. Possessing lithological characteristics such as high porosity and low density, these ignimbrites have historically facilitated the development of subterranean and semi-subterranean architecture, exemplifying the adaptation of volcanic formations to cultural life.

Figure 8. A) Andesitic lava surface showing rock-carved hieroglyphic-like markings (inscription of Lukyanus), **B)** Rock-cut niche carved into andesitic lava containing Hittite reliefs, including the Atlı Kaya (Horse Relief), **C & D)** General view of the Fasıllar Monument within the andesitic lava flow, E) Rock-cut niche elements on the andesitic lava surface and **F & G)** Rock-cut stepped ritual platform with a sarcophagus (*lahit*) carved into andesitic lava.

Şekil 8*. **A)** Hiyeroglif benzeri kaya oyma izleri içeren andezitik lav yüzeyi (Lukyanus Kitâbesi), **B)** Atlı Kaya kabartması da içeren Hitit kabartmalarının bulunduğu, andezitik lava oyulmuş kaya nişi. **C** ve **D)** Andezitik lav akıntısı içerisinde yer alan Fasıllar Anıtı'nın genel görünümü, **E)** Andezitik lav yüzeyinde gelişmiş kaya oyma niş figürleri, **F** ve **G)** Andezitik lava oyulmuş basamaklı ritüel platform ve lahit.*

Kilistra and its surroundings have been influenced by numerous civilizations since ca. 2000 BC, including the Assyrian, Hittite, Lydian, Persian, Hellenistic (e.g., the Kingdom of Pergamon), Roman, Byzantine, Seljuk, Karamanid, and Ottoman periods (Arıtan, 2010). Owing to its proximity to ancient Lystra, the settlement holds significant historical value. Kilistra was designated as a First-Degree Archaeological Site on 25 December 1987, while the multi-layered settlement fabric – shaped by the incorporation of rock-cut spaces into Ottoman-period architecture – was registered as an Urban Archaeological Site on 22 October 2001(Arıtan, 2010).

The archaeological landscape of Gökyurt, encompasses rock-cut architecture, fairy chimneys (similar to those in Cappadocia) concealed refuges, monastic complexes, spaces for ritual practices, funerary features, and large-scale subterranean cisterns (Öztürk, 2017). These constructions, enabled by the geomorphological opportunities provided by volcanic lithology, fulfilled both strategic defensive and symbolic representational functions in human–space relationships. The settlement's location within the transportation and administrative networks of the Roman Empire further underscores its critical role in understanding the geopolitical and cultural dynamics of the region (Öztürk, 2017). The porous and non-welded lithology of these ignimbrites facilitated the anthropogenic excavation of subterranean and semi-subterranean architecture – ranging from monastic complexes and dwellings to necropoleis – spanning the Hellenistic through Byzantine periods. Archaeological features suggest settlement patterns optimized for geomorphological shelter and visual concealment, particularly during periods of religious persecution in Late Antiquity. Strategically positioned along the Roman Via Sebaste, Kilistra served not only as a logistical and administrative node within imperial communication networks but also as a spiritual refuge. Its sacral architecture, such as cross-in-square chapels and crypt churches, was intricately carved into ignimbrite ridges, merging geological form with symbolic function (Baylak et al., 2024). Beyond its archaeological and volcanological significance, Kilistra represents a unique volcanic geoheritage site with high relevance for geoconservation, geoeducation, and geotourism. Its well-preserved pyroclastic stratigraphy and human-modified volcanic landscapes offer an open-air archive for understanding human–landform interactions (Figure 9). At the same time, the site's geological vulnerability, due to natural erosion and anthropogenic pressures, necessitates integrated conservation strategies, including erosion control, digital documentation, and sustainable visitor management. With appropriate interpretation and protection measures, Kilistra holds strong potential as a geotourism destination that bridges geological heritage with cultural memory, offering a valuable case study in long-term human adaptation to pyroclastic terrains (Figure 9).

Representative Volcanic Geosites

1. Erenlerdağ Dome Complex and Pyroclastics: The summit region of Erenlerdağ consists of dacitic–andesitic lava flows exhibiting flow banding, columnar jointing, vertical and horizontal cooling structures (Figure 4A-D). Lava domes and associated autobrecciated facies, including block-and-ash flow deposits, are widespread and reflect repeated episodes of effusive dome emplacement. These features indicate the extrusion of highly viscous magma and recurrent gravitational instability during dome growth, resulting in partial collapse and redistribution of dome-derived material.

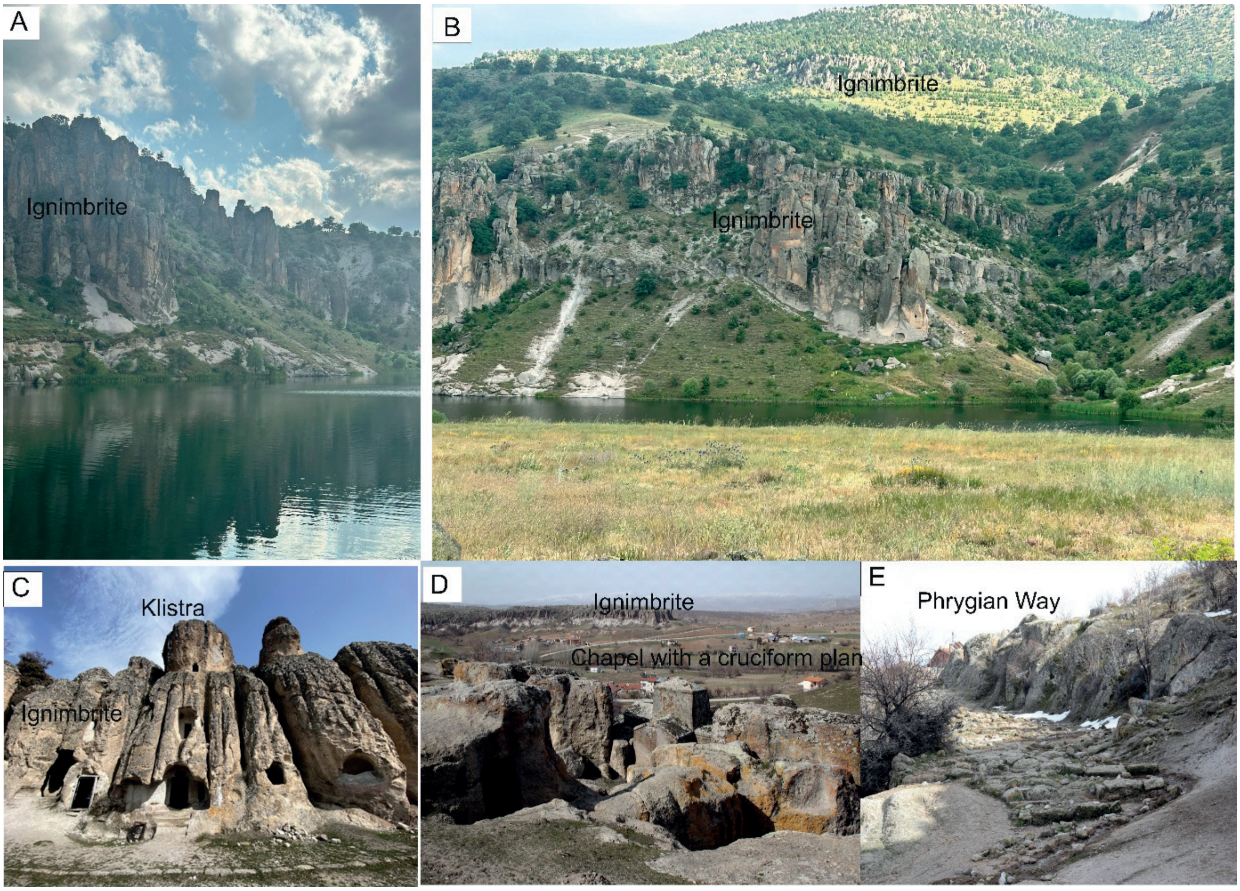

Figure 9. A-D) Rock-cut structures and fairy chimneys-erosional morphologies developed within the Kilistra ignimbrites, displaying the mechanical competence and differential erosion of ignimbrites and their suitability for human excavation, **E)** culturally significant ancient road (Phrygian Way).

***Şekil 9. A-D)** Kilistra ignimbiritleri içerisinde gelişmiş kaya oyma yapılar ve peri bacaları- erozyonal morfolojiler, ignimbiritlerin mekanik dayanımını, diferansiyel erozyon özelliklerini ve insanlar tarafından oyulmaya elverişliliğini göstermektedir, **E)** kültürel jeomiras niteliği taşıyan antik yol (Frig Yolu).*

2. Kilistra ignimbrites: The Kilistra ignimbrites are characterized by a multi-stage pyroclastic succession. The stratigraphic sequence comprises the Erenkaya ignimbrites at the base, overlain by the Evliyateke, Detsa, and Sadıklar ignimbrites, interbedded with paleosol horizons and fluvio-lacustrine deposits (Gündüz, 2023). Lithofacies analysis indicates that these units were predominantly formed by gas-supported pyroclastic density currents and tephra fall processes, represented by massive lapilli-pumice tuff and coarse tuff units (Gündüz, 2023). The Kilistra succession represents a well-preserved example of pyroclastic stratigraphy and post-collisional caldera evolution, making it a significant component of volcanic geoheritage with high educational, scientific, and aesthetic value.

3. Alacadağ Lava flows and Pyroclastics and possible Caldera Structure: The Alacadağ area is dominated by thick andesitic–dacitic lava flows interbedded with block-and-ash flow and pumice-bearing pyroclastic deposits. The morphology exhibits arcuate scarps and

a broad depression on the northern flank, interpreted as a possible caldera collapse zone related to the Kilistra ignimbrite vent. This feature provides critical evidence for coupled effusive–explosive volcanism and shallow magmatic evaluation. Its geomorphological integrity and high scientific relevance make it one of the most valuable geosites in the investigated area.

4. Kilistra (Gökyurt) Ancient city: An ancient settlement is carved into the Kilistra ignimbrites. The site demonstrates the long-term human adaptation to volcanic terrains. Kilistra is a key geocultural heritage combining geomorphological, archaeological, and historical dimensions. Kilistra has been influenced by numerous civilizations since 2000 BC and has historical significance due to its proximity to ancient Lystra. It was designated a First-Degree Archaeological Site in 1987, and its multi-layered settlement was registered as an Urban Archaeological Site in 2001(Arıtan, 2010). With its distinctive geotourism and religious-tourism attributes, Kilistra represents a high-value component of volcanic geoheritage, offering notable educational, scientific, and aesthetic significance

5. Fasıllar Monument Rock-Cut Structures: A Late Hittite relief carved directly onto massive andesite, representing one of the earliest examples of human engagement with volcanic substrates in Central Anatolia. The rock-cut features attributed to the Hittite period include relief panels, sculptural elements, a prominent horse figure, and hieroglyph-like carvings, reflecting the cultural and symbolic use of volcanic rocks. This geosite symbolizes the spiritual and cultural interaction with andesites. This geosite exemplifies the spiritual and cultural relationship between ancient societies and andesitic lithologies. Owing to its outstanding geocultural significance, high aesthetic value, and strong geotourism potential, the Fasıllar Monument constitutes a key element of the region's volcanic geoheritage.

The ErAVC demonstrates a full spectrum of volcanic features ranging from high-relief dome complexes to extensive ignimbrite plateaus and reworked sedimentary plains. Its geosites illustrate distinct evolutionary stages of volcanism – effusive dome emplacement (Erenlerdağ, Alacadağ), explosive pyroclastic deposition (Kilistra ignimbrites), and subsequent erosional landscape evolution. Culturally integrated sites such as Kilistra and Fasıllar further enhance the holistic geoheritage value of the area, creating a strong connection between natural and cultural dimensions. The combination of high scientific importance, educational potential, and aesthetic appeal positions the ErAVC as a significant candidate for regional geopark development under the UNESCO Global Geopark framework.

DISCUSSION and CONCLUSIONS

Volcanic geoheritage encompasses the preserved record of volcanic processes and landforms that collectively document the geological evolution of volcanic systems (Németh, 2022). In polygenetic volcanic systems, geomorphology reflects the cumulative imprint of successive eruptive phases rather than the outcome of individual eruptive events, allowing eruptive architecture, magma properties, and post-eruptive processes to be interpreted from preserved landforms (Nemeth, 2010).

In the ErAVC, facies architecture provides a fundamental framework for interpreting the geomorphological imprint of polygenetic volcanism. This framework demonstrates that the primary volcanic architecture, defined by magma properties and eruptive mechanisms, has been preserved through post-eruptive surface processes, forming a clear record of volcanic geoheritage. The lava domes and thick lava flows of the central–proximal facies represent well-preserved geomorphological expressions of high-viscosity magma emplacement, forming high-relief and erosion-resistant landforms. In contrast, the pyroclastic density current deposits (high volume of ignimbrites) in the medial and distal facies reflect the scale, flow geometry, and dispersal patterns of explosive volcanism. The geomorphology of the ignimbrites in the ErAVC cannot be generalized as flat plateaus. Instead, the laterally extensive ignimbrite sheets commonly fill paleovalleys and have been subsequently modified by fluvial and lacustrine processes, producing widespread differential erosion surfaces. These features preserve both primary emplacement characteristics and secondary geomorphological modification, highlighting the importance of post-eruptive processes in shaping volcanic landscapes. The complex spatial association of the high-relief lava domes and flows with medial to distal ignimbrites, tuff layers, and epivolcanoclastics interbedded with sedimentary units reflects the long-lived eruptive dynamics of a polygenetic volcanic system. Together, these deposits provide an invaluable archive of eruptive mechanisms, eruption magnitudes, and depositional processes, as well as the interaction between volcanic activity and subsequent sedimentary landscape evolution. Comparable facies-controlled geomorphological relationships have been documented in other polygenetic volcanic systems in Central Anatolia, particularly at the Hasandağ stratovolcano, where lava flows, domes, and ignimbrites (pyroclastic density current deposits) collectively reflect successive constructive and destructive eruptive phases, resulting in a geomorphological record that preserves the long-term evolution of the volcanic edifice. (Kuzucuoğlu et al., 2020). Similar to the ErAVC, ignimbrites at Hasandağ display significant geomorphological variability and cannot be simplistically interpreted as uniform plateau surfaces, but instead reflect both emplacement conditions and post-eruptive reworking. These similarities emphasize that polygenetic volcanism in Central Anatolia produces comparable long-term geomorphological signatures that are fundamental to volcanic geoheritage assessment.

The significance of such relationships is further illustrated by comparison with active polygenetic volcanic systems, such as Fogo Island where ongoing volcanic activity continuously reshapes the landscape, resulting in a dynamic volcanic geoheritage characterized by the destruction, reworking, and creation of volcanic landforms through successive eruptions (Alfama et al., 2024). Although the ErAVC represents an inactive system, its geomorphology preserves a stabilized and fossilized record of comparable relationships between effusive and explosive volcanic products. This comparison demonstrates that the geoheritage value of polygenetic volcanic systems emerges from long-term eruptive and geomorphological evolution, rather than from the present activity state of the volcano. Within this conceptual framework, the geomorphological and cultural expressions observed in the ErAVC provide concrete field-based examples of how volcanic facies and post-eruptive processes shape both landscapes and human–environment interactions. In the investigated area, the Kilistra ignimbrites, despite their lower resistance to erosion compared to coherent lava flows, have been naturally sculpted into distinct landforms such as fairy chimneys, small valleys, and low-relief plateaus. These features not only record the geomorphic response of pyroclastic deposits to atmospheric and fluvial processes but also provide natural shelters that were historically used by human settlements. The interaction of physical lithological properties, including ignimbrite porosity and low bulk density, with human activity underscores the synergistic relationship between volcanic geomorphology and cultural adaptation.

Similarly, the monumental cultural features, such as the Fasıllar sculpture, exemplify the influence of volcanic landforms on material culture, symbolic expression, and spiritual practices over millennia. From a geoheritage perspective, Kilistra and Fasıllar represent sites of dual significance, integrating geological, geomorphological, and archaeological values within a coherent landscape framework. They exhibit significant scientific, educational, cultural, and aesthetic value, and have a high geoheritage significance in terms of representativeness, integrity and landscape expression. The preservation of these volcanic terrains provides a natural archive for studying polygenetic volcanism, post-eruptive reworking processes, and sedimentary basin evolution. Simultaneously, the archaeological and cultural components illustrate the long-term adaptation of human societies to geologically dynamic environments. The complementary presence of natural and cultural features at these sites highlights the importance of adopting multidisciplinary methodologies for their identification, documentation, and sustainable management.

Effective conservation of the ErAVC requires a combination of strategies that address both natural and anthropogenic pressures. Erosion control measures, stabilization of fragile ignimbrite structures, digital documentation, and geotourism management are critical to maintaining the integrity of the volcanic landscape while facilitating educational and scientific engagement. Such integrated approaches enable the safeguarding of these landscapes as living archives, providing insights not only into the Earth's volcanic history but also into the interrelationship between humans and volcanic environments. In addition to its geological and cultural significance, parts of the ErAVC are currently affected by active and expanding mining operations, particularly in the İnlice area. These activities have resulted in noticeable landscape degradation. From a cultural heritage, geoheritage and geotourism perspective, such anthropogenic disturbances represent a major threat to the integrity, interpretive value, and long-term conservation of the volcanic facies assemblages documented in this study. Ensuring sustainable geotourism development in the region therefore requires the recognition of mining-induced impacts and the implementation of management strategies aimed at minimizing further degradation, promoting rehabilitation of altered sites, and balancing resource extraction with the protection of geoheritage assets. In conclusion, the ErAVC represents a key volcanic geoheritage site in Central Anatolia, highlighting the need for integrated conservation strategies that balance scientific research, education, and sustainable tourism.

GENİŞLETİLMİŞ ÖZET

Erenlerdağ–Alacadağ Volkanik Kompleksi (ErAVK), Konya ilinin güneybatısında Beyşehir Graben sisteminde yer alan ve yaklaşık 1500 km²'lik bir alanı kaplayan Neojen yaşlı volkanik komplekstir. Mafik–felsik bileşim aralığında gelişen lav akıntıları, domlar, piroklastik akma ve düşme ürünleri ile dayk gibi subvolkanik intrüzyonlar kompleks bir volkanik evrimi temsil eder. Bu çok evreli volkanizma, Anadolu'daki Senozoyik volkanizmanın kıtasal kabuk deformasyonu ve levha etkileşimleriyle ilişkili yaygın karakterini yansıtmaktadır.

Volkanik fasiyes analizi, ErAVK'nin lav kubbelerinin(dom) gelişiminden patlamalı piroklastik süreçlere kadar geniş bir püskürme spektrumunu ortaya koymaktadır. Merkez ve piroksimal fasiyeslerde gözlenen lav domları, dasitik–andezitik lav akıntıları ve piroklastikler çok evreli, uzun süren tekrarlı magma karışımı, yeniden beslenme ve asimilasyon-fraksiyonel kristalleşme süreçlerinin ürünleridir. Medial fasiyeste gözlenen ignimbiritler oldukça geniş alana yayılmakta karmaşık ve tekrarlı-uzun süren

evreleri göstermektedir. Distal fasiyeslerde ise ignimbirit ve tüf düzeyleri, karbonatlı gölsel–akarsu çökelleri, volkanik ve sedimanter süreçlerin eş zamanlı gelişimini açıkça yansıtır. Bu fasiyes mimarisi, ErAVK'de jeomorfolojik rölyefin, yüksek viskoziteli lav ürünleriyle karakterize edilen yüksek topoğrafik alanlardan, ignimbirit akışları ve flüviyolakustrin çökellerle ilişkili daha düşük, dalgalı ve yeniden şekillenmiş rölyef zonlarına doğru sistematik bir değişim gösterdiğini ortaya koymaktadır. Bu iyi korunmuş stratigrafik diziler, karasal yay volkanizmasının püskürme dinamiklerini ve magma odası evrimini, volkanik-sedimanter süreçlerin ilişkisini çözümlemek açısından önemli bir doğal arşiv sunmaktadır.

ErAVK yalnızca jeolojik önemiyle değil, aynı zamanda kültürel mirasla bütünleşmiş volkanik jeomiras alanlarıyla da dikkat çekmektedir. Medial fasiyes ignimbiritlerinin yüksek gözenekliliği, tarih boyunca yerleşim ve inşaat faaliyetlerini kolaylaştırmıştır; bunun en çarpıcı örneği antik Kilistra kentidir. Kilistra ve çevresi, M.Ö. 2000'lerden itibaren Asur, Hitit, Lidya, Pers, Pergamon, Hellenistik dönem, Roma, Bizans, Selçuklu, Karamanoğulları ve Osmanlı egemenliklerini yaşamıştır. Lystra'ya yakınlığı nedeniyle önemli olan yerleşim, 25.12.1987'de I. Derece Arkeolojik Sit, Osmanlı döneminde gelişen çok katmanlı dokusu ise 22.10.2001'de Kentsel Arkeolojik Sit olarak tescil edilmiştir. İgnimbirit ve tüflerin doğal aşınma sonucu oluşturduğu peribacaları ve oyuklu kayalık alanlar, antik dönemde barınma ve ibadet mekânı olarak kullanılmış, böylece volkanik jeomorfolojinin insan yerleşimleriyle doğrudan ilişkisi gözlenmiştir. Bu antik kentte, dini yapılar (kilise, şapel), sosyal amaçlı yapılar (mesken, sarnıç) ve savunma- güvenlik-askeri yapıları (gözetleme kulesi ve sığınaklar), şaraphaneler, kral yolu gibi çeşitli yapılar yer almaktadır. Benzer biçimde, Fasıllar Köyü'nde yer alan Fasıllar Anıtı (Tarhunna Anıtı – Fırtına Tanrısı) ile dini ritüel yapılar ve çeşitli yazıtların ignimbiritlere göre daha dirençli andezitik lav akıntıları üzerine inşa edilmiş olması, volkanik kayaçların kültürel ifadelere malzeme ve anlam kazandırmadaki rolünü ve söz konusu dönemlerdeki taş işçiliğini göstermektedir. Bu yönüyle ErAVK, doğa ve kültür arasındaki karşılıklı etkileşimi belgeleyen özgün bir jeokültürel peyzaj örneğidir.

Bu çalışmada belirlenen ErAVK jeositleri, 1) Erenlerdağ Dom Kompleksi ve Piroklastikleri, 2) Kilistra İgnimbiritleri, 3) Alacadağ Lav Akıntıları, Piroklastikleri ve Olası Kaldera, 4) Kilistra Antik Kenti ve 5) Fasıllar Anıtı ve Kaya Oyma Yapıları olarak belirlenmiştir ve bu jeositler volkanizmanın evrelerini ve bununla yakından ilişkili doğal ve kültürel mirası açık bir şekilde temsil etmektedir. Bu çeşitlilik, bilimsel araştırma, eğitim ve jeoturizm açısından yüksek potansiyel taşır. Bölgedeki doğal ve kültürel bileşenlerin birlikte değerlendirilmesi, UNESCO Küresel Jeopark yaklaşımıyla uyumlu sürdürülebilir bir koruma ve tanıtım stratejisinin geliştirilmesine olanak sağlar.

Sonuç olarak, ErAVK; Orta Anadolu'nun jeodinamik evrimini, volkanik peyzaj gelişimini ve insan–doğa etkileşimini birlikte yansıtan özgün bir volkanik jeokültürel miras alanı niteliğindedir. Volkanik fasiyes mimarisi, jeomorfolojik rölyef ve kültürel unsurların mekânsal birlikteliği, alanın bilimsel, estetik ve eğitimsel değerini belirgin biçimde artırmaktadır. Bu çok bileşenli mirasın sürdürülebilir biçimde korunması, jeolojik ve jeomorfolojik süreçlerin dikkate alındığı; çevresel duyarlılık ile jeolojik, jeomorfolojik, doğal ve kültürel miras unsurlarının bilimsel olarak belgelenmesini esas alan bir yönetim yaklaşımını gerekli kılmaktadır. Böyle bir yaklaşım, yerküre tarihi ile insanlık tarihinin kesiştiği bu özgün peyzajın uzun vadede korunarak gelecek kuşaklara aktarılmasına olanak sağlayacaktır.

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