


Armenian Bole (Deposits, Chemical Composition, Application) and References to It in Medieval Armenian Medical Texts*

▼ **ABSTRACT** This article explores the historical and modern applications of Armenian bole (*bolus armenicus*) in medicine, highlighting its anti-inflammatory, anti-allergic, anti-tumour, and other therapeutic properties. The historical use of this clay is witnessed by prominent Armenian and foreign scholars of the Middle Ages. Its significance extended into both Eastern and Western medicine until the eighteenth century. Today, as confirmed by research at the Matenadaran, Armenian bole is still valued in traditional medicine. The resurgence of interest in Armenian bole aligns with a broader trend towards integrating traditional remedies with modern medical practices. The geological and mineralogical analysis of Armenian bole reveals its rich composition. It has diverse applications in medicine and industry. This study includes citations from medieval medical works and concludes with the potential of Armenian bole's catalytic properties, which will be the focus of future research.

▼ **KEYWORDS** Armenian bole, mineral composition, X-ray diffraction, granularity, catalytic activity, traditional use, medieval Armenian medical works.

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1. Introduction

In ancient and medieval Armenian medicine, inorganic preparations including Armenian bole (*bolus armenicus*, *terra armena*) were widely used. Armenian bole was known for its anti-inflammatory, anti-allergic, anti-tumour properties, as well as its efficacy in treating bleeding and poisoning (see Vardanyan, 2000, 32). This clay is documented in the works of renowned Armenian medical scholars such as Mkhit'ar Herats'i (c. 1120–1200; see Mkhit'ar Herats'i 1832 and 1968) and Amirdovlat' Amasiats'i (c. 1420–1496), who noted that “Armenian bole helps with colds and mammary gland tumours, fevers and contaminated air” (Amirdovlat' Amasiats'i 1990, 464). It was also known to ancient doctors. Galen (129–c. 216 AD) mentions ἡ ἐκ τῆς Ἀρμενίας βῶλος, Ἀρμενικὴ βῶλος (*De simplicium medicamentorum temperamentis ac facultatibus* 12.191–192) and writes that it cured plague. Dioscorides (40–90 AD) calls it Ἀρμένιον and says that it helps the growth of eyelashes ἔστι καὶ τριχῶν τῶν ἐν βλεφάροις αὐξητικόν (*De materia medica* 5–90). Armenian bole was highly esteemed by Ibn Sina (Avicenna, c. 980–1037). He referred to *ṭīn armanī* (“Armenian clay”) and wrote that it stops blood, helps with plague buboes, prevents the spread of putrefaction in organs, is effective on wounds, prevents catarrh, and is helpful for hemoptysis and consumption. He stated that Armenian bole is good for intestinal ulcers, diarrhea, uterine bleeding and is especially effective against pestilential fevers. Ibn Sina also said that many people survived the great pestilence by drinking this clay in weak wine (Ibn Sina 1982, vol. 2, § 313). Pliny the Elder (23–79) called it “Armenium” and mentioned as colouring substance (*Historia Naturalis* 28.47).

During the Middle Ages, Armenian bole was exported to both Eastern and Western countries. It was known in the Muslim East as *gil ermeni* and highly valued (see Avakyan, Avakyan & Vardanyan 2010, 3–22). It remained a staple in European pharmacopoeias until the eighteenth century, when it was supplanted by newer antiseptic agents. Today, Armenian bole continues to be used in traditional Armenian medicine for its anti-inflammatory, antimicrobial, and anti-allergic properties, especially for treating wounds, ulcers, and burns. Research conducted at the Matenadaran, Mesrop Mashtots Institute of Ancient Manuscripts has confirmed its therapeutic benefits. It is used in the form of powders and tablets, both for external and internal applications, with positive results in patients suffering from chronic inflammatory diseases of the gastrointestinal tract, ulcers, hemorrhages, and skin allergies, such as eczema (see Sahakyan and Vardanyan 1995, 67–68):

2. Revival of What was Tried and Tested

There is currently a renewed interest in Armenian bole. This resurgence is part of a broader trend where patients increasingly seek to combine modern medical advances with proven traditional therapies. This trend is not limited to clays but extends to other natural remedies such as medicinal plants and beneficial microorganisms. The formula “The second is not a substitute for the first or in place of the first, but one is a reasonable complement to the other” encapsulates this integrative approach.

Sociological surveys in several Western countries, including Germany (see Federspiel and Ernst 2005), provide statistically reliable evidence of this growing preference.

The motivation behind this trend often stems from dissatisfaction with the health-care system, such as lack of insurance or the inaccessibility of certain diagnostic methods and treatments due to exorbitant prices. Thus, the renewed interest in Armenian bole and other traditional therapies reflects a broader desire to complement modern medical treatments with culturally established, time-tested remedies.

3. Legacy and Compass

Advanced medicine and pharmacy are actively embracing the socio-psychological trends described above. The neglectful and sometimes contemptuous attitude towards ancestral heritage is being overcome. With the growth of knowledge in fields such as genomics, metabolomics, and related analytical sciences, medicine and pharmacy are once again drawing from the treasures of natural substances and inherited therapeutic empiricism. This phenomenon is welcomed by most connoisseurs of the history of medicine, as well as specialists in medicinal plants and minerals.

Beyond purely geological, mineralogical, and medical reasons for the increased interest, other factors are driving interdisciplinary research projects on Armenian bole. *Terra armena* exemplifies the transcontinental spread of medical knowledge and medicines along the “Silk Road”. The diffusion of goods, domesticated livestock, agrarian cultures, and particularly ideas across Eurasia in prehistoric times primarily occurred along lines of northern latitude on land, i.e., east-west direction, as established by the American scientist and publicist Jared Diamond (Diamond 1997). From November 2011 to June 2012, Hamburg hosted the exhibition “Explosive Encounters. Nomads in a Settled World” (see Nippa [ed.] 2011), illustrating the complex relationship between nomads and settled tribes. *Terra armena*, as a vibrant trade object carried mainly by nomadic caravans, was exhibited alongside samples of Central Asian and Far Eastern ethnomedicine (see Fig. 1). These included:

- a. A gift set of preparations from different species of the reindeer.
- b. Capsules containing the Tibetan “caterpillar fungus” (*Cordyceps sinensis*).
- c. Armenian bole, both in pieces and powder (a gift from the Matenadaran).

In the age of the Internet, the “diffusion of ideas” predominantly occurs through electronic channels, making ethnomedicine a global treasure.

4. *Bolus Armenicus* in the Territory of the Republic of Armenia

Clayey rocks are widely present in the Republic of Armenia as part of various geological formations, including the Lower Miocene red-coloured formation of the Near-Araxian zone and the Mid-Carboniferous formation of the ancient laterite bauxite-bearing weathering crust in the southern part of the same zone (see Petrosov 1983, 25–34). According to I. Petrosov, the red-coloured formation (Lower Miocene) is

extensively developed within the Near-Yerevan, Sadarak, and Lower-Akhurian (now Armavir) troughs in the Near-Araxian zone. The Lower-Akhurian trough, situated in the south, southwest, and west of the Near-Araxian zone, extends beyond the Republic of Armenia into Turkey. The full thickness of this formation exceeds 600 meters. Clays constitute more than 60% of the formation, primarily localised in the upper strata. These clays are typically dense, occasionally loose, plastic, and lumpy, with colours ranging from brick-red to pinkish-brown, and pink. The pigmenting substance is iron hydroxide. The clays soak well in water, disintegrating into small aggregates that then turn into a pasty mass. A significant amount of ashy material is present in the primary clay mass. There are three associations of clay minerals in the red-coloured formation:

1. Hydrous mica-chlorite-montmorillonite;
2. Palygorskite-illite-chlorite-montmorillonite;
3. Kaolinite-mixed-layer minerals-swelling chlorite-montmorillonite.

Varieties include ferrimontmorillonite, calcium montmorillonite, magnesium montmorillonite, nickelmontmorillonite, viscoite, Cr Fe-montmorillonite, Cu Fe-montmorillonite, and askan-gel. Montmorillonite clays are formed in sedimentary and metamorphic rocks, soil, through underwater alteration of volcanogenic formations, during weathering of basic volcanogenic rocks, as products of ore-bearing rock alteration, and near hot springs.

The Red-Coloured Formation is characteristic of foothill regions, formed under hot but relatively humid climate conditions. No remains of macro and microfauna, spores, or pollen are found in the sediments of this formation. According to N. Strakhov (Strakhov 1956, No. 5, 3–21; No. 8, 29–61), the colouration is due to the presence of higher iron oxides, with insufficient organic matter in arid zones to reduce the iron and “extinguish” the red colours.

Laterite formations—ancient weathering crust formations—are widespread in the Near-Araxian zone of the southern regions of the republic and in the neighboring territory of Nakhijevan (see Mkrtychyan [ed.] 1966, 416–505). These formations occur as separate pockets, lenses, and interlayers with thicknesses ranging from 0.5 to 70 meters. Fine clastic bauxite-bearing rocks extend from the northeastern wing of the Zovashen to the northeastern wing of the Urts anticline, and another band extends from the northeastern wing of the Armash anticline. Their thickness varies from 10 to 70 meters, and they occur in both dense and friable varieties. The colour of these rocks is consistently brownish-red. All types of laterite rocks have similar mineral compositions, with clay minerals such as kaolinite, hydrous mica, and mixed-layer minerals of the montmorillonite-hydrous mica type. Laterite rocks contain up to 20% iron hydroxides, i.e. considerably more than indicated in the particular sample composition in Fig. 2, making the mineral suitable as a haemostatic agent (Grim 1967, 257–349).

The Armenian bole used by medieval physicians could originate from laterite formations in the Near-Araxian zone of the southern regions of the Republic of Armenia and neighboring territories (Nakhijevan).

Armenian bole is similar to “sealed earth” or Lemnian clay (*terra sagillata*, *terra lemnia*), but the latter contains less iron oxide and is pink in colour. Lemnian clay was mined on the island of Lemnos in the Aegean Sea and was used in ancient and medieval medicine as a detoxifying, antiseptic, and styptic agent (see Vardanyan, 2000, 150–51).

5. Materials and Methods

The material for the study consisted of red clay samples collected in Noravank' (Vayots' Dzor region, Armenia). The elemental composition was studied by the method of X-ray emission measurements in a raster microscope (Humboldt-Universität zu Berlin, Institut für Chemie, Lehrstuhl für Analytische und Umweltchemie). The determination of mineral types and their quantitative ratio was carried out by the method of X-ray diffraction (XRD) analysis (Technische Universität Berlin, Fachbereich Geowissenschaften, Lehrstuhl für Mineralogie und Petrologie).

Here are the instrument/measurement data provided by Prof. G. Franz:

Sample preparation: The pre-dried material was ground for several minutes in an agate mortar and subsequently uniformly applied to a silicon sample holder. Ethanol was then added dropwise, and the resulting suspension was evenly spread into a thin layer and allowed to dry under ambient conditions.

X-ray diffraction (XRD): measurements were conducted in reflection geometry using a “PW 1050” goniometer (PHILIPS) in combination with a NaI-Tl scintillation detector (“PW 1965/50”, PHILIPS) operated with a fixed divergence slit. The X-ray source was driven at an acceleration voltage of 40 kV and a beam current of 30 mA, supplied by an “Iso-Debyflex” high-voltage generator (SEIFERT). A nickel filter was employed as a primary monochromator to isolate the $\text{CuK}\alpha_1$ radiation. Data acquisition was performed over a 2θ range of 5° to 80° , with a step size of 0.02° (2θ), a step resolution of approximately 0.2° (2θ), and a counting time of 10 s per step.

An analysis of weight loss when heated for 1 hour at 1000°C (Technische Universität Berlin, Fachbereich Geowissenschaften) and an X-ray fluorescence analysis of the mixture in tablet form (Technische Universität Berlin, Fachbereich Geowissenschaften) were also conducted.

6. New Scientific Information

The results of the analyses of the mineral content types and their quantitative percentages are presented in Fig. 3b. Over the past decades, significant information has been accumulated on the interactions between aluminum-silicate minerals and various organochemicals, which undergo structural changes upon contact. These catalytic reactions hold potential for numerous applications in medicine and industry. Therefore, it was necessary to subject Armenian bole to X-ray structural analysis to extract characteristic reflections of minerals of volcanic origin and weathering

products sintered in the clay of different composition and structure, and then to assess their catalytic potential.

Fig. 2 shows the XRD spectrum of a ground sample of Armenian bole from Nora-vank' in the Vayots' Dzor region of Armenia. The XRD analysis identified calcium carbonate, iron oxide, and aluminosilicates in the sample, characterised by leaf-like or layered crystallinity. After thorough grinding, the mineral exhibited a single-peaked distribution of grain diameters in the dry mode (see Fig. 3a), contrasting with the double-peaked distribution observed when the same sample was measured in the wet mode (Fig. 3b). The disintegration of mineral mixtures, such as clay, into smaller particles upon contact with low-molecular-weight solvents is explained by the effect of solvent intercalation between the layers of leaf-like (layered) minerals. This is summarised in a simplified representation in Fig. 4.

Certain leaf-like aluminosilicates demonstrate stereoselective effects on the solute permeability of the mineral or even exhibit isomerizing ability. Cell-shaped aluminosilicate impurities, like zeolites within the particles of the right peak in Fig. 5c, show even more heterogeneous catalytic properties. Depending on the heteroatoms embedded within them, these impurities can mimic enzymes such as phosphatases, proteases, isomerases and others. These previously unpublished data will be reported in a future publication. As an example, Fig. 5a presents the pseudo-enzymatic effects of cell-shaped aluminosilicates from different deposits on the chromogenic substrate pNPP (para-nitrophenyl phosphate).

7. Applications in Technology and Food Industry

In engineering, montmorillonite clays serve as adsorbents and are used in the manufacture of ceramics, rubber, paper, paints, and drilling mixtures. Palygorskite-illite-montmorillonite clays are suitable for disposing of radioactive waste, particularly relevant for Armenia due to its nuclear power plant. These clays effectively bind radioactive substances, fixing them in place after firing (see Grim 1967, 431–32).

Historically, red clay, under the name poliment, was used in easel painting, especially for gilding wooden surfaces with gold leaf, when mixed with animal glue or eggwhite; it was also used in bookbinding, as a basis for gilt, providing luster and depth to colours. Before synthetic alternatives became available, it was widely used by painters (Chambers 1753, vol. 1, 347).

Red clay also has practical applications, such as imparting water resistance to sailcloth in a mixture of clay (1 kg), linseed oil (0,75 litre), and water (10 litres). In cooking, it is used to colour dishes and adjust their viscosity, a practice common in Greek, Armenian, Egyptian, and French cuisines. Additionally, it has been used as a colouring agent for rice and sago (a type of groats obtained from the heartwood of the sago palm) (see the corresponding entries in Zdanovich 2001 and Pokhlyobkin 2002).

8. Application of Red Clay in Modern Medicine

Red clay has various applications in modern medicine. It is used both externally and internally to treat and prevent a range of conditions. Externally, it is applied as ointments and masks to correct skin defects and treat certain skin diseases. It is also used as an adjunct therapy for musculoskeletal disorders such as arthritis, arthrosis, osteochondrosis, spinal hernias, various neuralgias, and neuritis. Internally, red clay is consumed in tablet form due to its excellent sorbent properties. It effectively absorbs and neutralises toxic substances and secretory poisons of microorganisms in the stomach and small intestine, facilitating their removal from the body. Armenian red clay, which contains up to 20% iron ions (Fe^{3+}), is particularly beneficial for addressing iron deficiencies and certain endocrine disorders.

In dentistry, Armenian bole was used to produce medicinal tooth powders and pastes, and for colouring dentures (Foulk and Pickering 1935, 975). Both Armenian and bentonite clays possess antifungal properties, making them effective against candidiasis (Parreilleux & Maingan 1971, 853–58 and 1976, 1065–71). They also act on toxic and carcinogenic aflatoxins produced by fungi such as aspergillus (Abdel-Wahhab et al. 1998, 218–228; Haydel, Remeneith, and Williams 2008, 353–61).

While red clay is generally safe and effective, it does have some side effects. It can impair the absorption of antibiotics and hormones in the gastrointestinal tract, potentially increasing their toxic effects. Additionally, it is incompatible with sodium citrate and can cause nausea and decreased nutrient absorption.

9. Red Clay and Medieval Armenian Pharmacology

Medieval Armenian medical works mention the Armenian bole on various occasions. In Mkhit'ar Herats'i's twelfth-century work entitled *Relief of Fevers* («Չեղմաննց մխիթարութիւն»), this clay is an ingredient in compound mixtures against diarrhea and other intestine disorders, for internal use, clyster, and as plaster for tumours (Mkhit'ar Herats'i 1832, 44–45). The fifteenth-century author Amirdovlat' Amasiats'i in his work *The Benefits of Medicine* mentions it as analgetic, as ingredient of various mixtures healing headache, stomach disorders, fracture (Amirdovlat' Amasiats'i 1940, 129, 133, 137, 276, 285, 293, 314, 321, 354, 357, 373, 397, 401, 417, 440, 449). In the *Useless for Ignorant*, he writes:

Bole, which is clay, is of many kinds, and the red kind is the best. It is one degree cold and two degrees dry. It has drying effect. Armenian clay helps with hydrocele and helps with moist yellow bile. Mix saffron and camphor with it and apply to the wound caused by heat; it will help. Armenian clay also helps with coryza and swollen breasts. The sealed earth helps with tuberculosis and spitting the blood that comes from the lungs. And if you apply it to the abdomen of one who has dropsy or [sick] spleen, [it helps]. It also stops bleeding. And all kinds of clay dry soft tumours, while Armenian clay is also helpful against plague. And when drunk or applied [to the body], it is helpful against cholera and fever and contaminated

air. And all these clays can replace one another¹ (Amirdovlat‘ Amasiats‘i 1926, 575–76).

When speaking about Lemnian clay, Amirdovlat‘ adds that it stops bleeding, and in this case, it may be replaced by Armenian clay (126).

Traditional Armenian medicine, as preserved and passed down to us through the works of medieval physicians, significantly developed in the seventeenth and eighteenth centuries. During this period, Armenian medicine continued to thrive in various medical centres across Western and Eastern Armenia, with notable institutions in Lesser Armenia and (Nor Jugha) New Julfa. Although the eighteenth century saw the emergence of prominent Armenian physicians who were aware of the achievements of European and Russian medicine, the spirit of medieval Armenian pharmacology remained present in their works.

One of the most fascinating medical texts was written in the eighteenth century in Evdokia (now Tokat in Turkey). During the late Middle Ages and even earlier, Evdokia had close ties with other medical centres in historical Lesser Armenia, especially the medical schools of Amasia and Sebastia, which are known for a rich literary heritage (see Vardanyan 2000, 189–97). The indigenous Armenian population living in Evdokia played a significant role in the social and economic life of the city, “showing ardent love for the Armenian Church and culture” (Alpöyachean 1952, 1019–1022). Many Armenian manuscripts containing medical texts (some of which are currently kept in the Matenadaran) were produced there.

A pharmacognosy by Poghos from the medical centre in Evdokia has come down to us (MS M2739). Still unpublished, it is considered one of the last works of medieval Armenian pharmacists. Poghos of Kharberd shares details about himself, his teachers, and offers his own manuscript as guidance to his students. In one passage, he writes: “I, Poghos, the son of Khulichan, came to the city of Evdokia (Tokat) and in the year 1747 I began to write my book, spending much of my life on the hard work for its completion” (M2739, 234r). Thus, Poghos was probably born in the early 1700s in Kharberd. He also mentions his teacher Davit, son of Emin. Upon arriving in Evdokia (a notable medical centre at the time), Poghos found a rich library and met experienced scribes, Yakob and Zak‘aria, whom he entrusted with copying his pharmacognosy.

According to the main colophon of this manuscript, the medical work was completed in two years and three months on July 14, 1748 (M2739, 353r). Interestingly, the Matenadaran also houses another manuscript of the *Useless for the Ignorant* by Amirdovlat‘ Amasiats‘i, written in Evdokia in 1748. It contains a colophon from Zak‘aria himself, which, too, witnesses to the activeness of the medical school of

1 Տին, որ է կան, շատ ցեղ է. եւ լան այն է, որ կարմիր լինի. հով է Ա տարաճան եւ չոր Բ տարաճան. չորացնող է. հայկաւն աւգտէ դայլային, եւ աւգտէ գէն սաֆրային, եւ զաֆրան եւ քաֆուր խառնէ յինքն, եւ աւծէ այն խոցին, որ ի տաքութենէ լինի, աւգտէ . եւ հայկաւն աւգտէ նուզլային եւ ծրծին ցաւուն «ուռեցնուն». եւ մատնեհար կաւն աւգտէ սին եւ արուն թքնելուն, որ թոքն գայ. եւ՝ թէ արծուին տիրոջն եւ փայծղան տիրոջն ի փորն աւծես: Եւ զարուն կտրէ, եւ ամենայն կաւեր զթուլ ուռեցնին կու չորացնեն. եւ հայկաւն աւգտէ տայունին. եւ թէ խմեն եւ թէ աւծեն, վապային այլ աւգտէ, եւ ջերմերուն այլ աւգտէ, եւ աւղին պեղծութեանն այլ աւգտէ: Եւ այս ամենայն կաւերս մէկ մէկի փոխան են:

Evdokia (M2739, 343r). Unfortunately, its importance as a centre of traditional Armenian medicine has been overlooked in the studies dedicated to the history of Armenian medicine.

Poghos also provides information about the physician Arzuman eminent among the founders of the medical school in Evdokia. Of him it was previously known only that in 1657 he commissioned Amirdovlat‘ Amasiats‘i’s *Useless for the Ignorant* (Oganesyan 1946, vol. 3, 134). In the chapter entitled “A Word on the Disease Called Hydropsy”, Poghos states that the treatment of this illness is difficult since it requires “a more experienced and masterful physician” to cure the illness (M2739, 152r). It is here that he makes a quotation from Arzuman’s work that has not survived.

Manuscript M2739 presents not only the traditions of medieval Armenian medicine but also the practical application of knowledge in the medical centres of Lesser Armenia. Throughout this work, in addition to detailed descriptions of diseases and treatments, there are recipes including Armenian bole. Below are some examples of such recipes:

Fol. 156v:

And if [the patient] does not recover in this way, and the bowel pain persists, mix the following remedies: take ten drams² each of groundsel, houseleek, and basil seeds, Arabian gum, Armenian red bole from Ashornek³, bamboo ashes, and starch. Also, include twenty drams each of Greek clay and plantain seeds. Collect all, roast the seeds and grind the other ingredients finely (do not grind the seeds). Mix everything together. Administer three drams of this mixture every day on an empty stomach with ten drams of quince juice or cold water. This is helpful.⁴

Fol. 162v:

Take three drams each of the seeds sorrel, that is, *ghuzughulaghi* [in Turkish], knotweed residue, and dodder residue (when the water has gone), Armenian bole of Ashornek‘, Arabian gum, that is *zamkh*, pomegranate flowers, one dram of Egyptian acacia gum, and one dram of ground and sifted *jrzgini*⁵. Grind and sift everything, then mix thoroughly. Douse the mixture with quince juice to form tablets and let them dry. Administer one tablet every morning with two drams of quince juice or water.⁶

² 1 dram = 4,08 grams.

³ Ashornek‘ or Arsharunik‘ was a historical Armenian province north of the Araxes River.

⁴ Եւ թէ այդիւ եւս չի ողջանայ, եւ աղիքն ցաւի, զուզէ զայս դեղս. առ հալեւորկի հունդ եւ զամնադմանկի հունդ եւ ռեհանի հունդ եւ տանիկ կռեզ եւ հայկաւ. կարմիր աշորնեցի եւ տապաշիր եւ նշաստակ Ժ(10)-Ժ(10) տրամ, հոռոմ կաւ. եւ պզրդատուն Ի(20)-Ի(20) տրամ, զամէնն ժողովէ եւ զոր հնդանքն են, աղնձէ եւ զայլ դեղերն մանր աղա եւ զհնդերդ մի՛ աղար, եւ զամէնդ յիրար խառնէ եւ տուր յիրմէտ յամէն օր յամօթուց Գ(3) տրամ եւ ի վերայ Ժ(10) տրամ սերկեւիլի ըմպելի կամ հով ջուր տուր, օգտակար է:

⁵ This word is not found in dictionaries.

⁶ Առ թրթկնի հունդն, որ է դուզուղուլաղին, եւ մատիստեղան քամուքս եւ զօճմորուսի քամուքս, որ ջուրն չորցուցած լինի, եւ հայկաւ աշորնեցի եւ տանիկ կռեզ, որ է զամխ, եւ նոսան ծաղիկ Գ(3)-Գ(3) տրամ, կակիլայ Ա(1) տրամ եւ ջրզգինի ծեծած եւ մաղած Ա(1) տրամ, զամէնն աղա եւ մաղէ եւ յիրար խառնէ եւ սերկեւիլի ջրով շաղղէ եւ քիթնի արա եւ չորացոյ եւ տուր այդից յամէն օր յայգուցն Բ(2) տրամ սերկեւիլի ըմպելիով կամ ջրով:

Fol. 171v:

Remedy that helps when a person urinates blood: it is necessary to cut the basilic vein and draw as much blood as [the patient] can tolerate. Then administer the following powder: take equal portions of tragacanth gum, starch, cucumber seeds, and curative clay or Armenian bole. Add half portions of pomegranate flowers, green gallnut, dragon-tree gum, and parsley seeds. Crush, sift, and mix all this, administer two drams with cold water at the appropriate time. Warn the patient against wine.⁷

For a burning pain, administer the following remedy: combine equal portions of Armenian bole, dragon-tree gum, and frankincense, with half portions of marsh-mallow seeds, parsley seeds, and melon seeds. Grind finely and mix them, and at the appropriate time administer three drams with honey or sugar water, also create a white lotion by mixing the same powder with a girl-child's mother's milk and drip it into the urethra using a dropper. This is very helpful; we have tested it before writing.⁸

10. Conclusions

The research results reveal the mineralogical characteristics of Armenian bole, enabling unambiguous verification and identification of its authenticity. Such measurements also help to exclude the possibility of falsification. Subsequent studies will focus on the catalytic (including pseudo-enzymatic) properties of aluminum-silicate and other inorganic components in Armenian bole from different rocks. This research also aims to clarify the mechanisms underlying the complex therapeutic potential of the *Bolus armenicus*.

The study of the use of Armenian bole throughout history demonstrates its significant contributions to both traditional and modern medicine. Known for its effective properties, this unique clay is documented in the works of distinguished medieval Armenian and foreign scholars, and, in more detail, in the yet unpublished medical work of Poghos (eighteenth century), passages from which are cited in this article. Its applications, which were prominent in Eastern and Western medical practices up until the eighteenth century, continue to hold relevance today, particularly in the treatment of wounds, ulcers, and skin conditions.

In modern times, the resurgence of interest in Armenian bole aligns with the broader movement towards integrating traditional remedies with contemporary

7 Դեղ, որ օգտ է ինչ մարդն արիւն շռէ, պարտ է, որ բասլիկէն երակ առնուս եւ ըստ ուժոյն արիւն հանես, ապա տուր զայս սֆուֆս: Առ քիթթէ եւ նշաստայ եւ խիարի կուտ եւ ուտով կաւ եւ կամ հայկաւ միսսար, եւ նոսան ծաղիկ եւ կանանչ գիսթոր եւ աղբրաց արիւն եւ կարաւսի հունդ. յամեն մէկէ կէս բաժին: Չամենն ծեծէ եւ մաղէ եւ յիրար խառնէ եւ տուր ի ժամուն Բ(2) տրսամ հով ջրով, եւ պատրաստեցոյ զայս ցաւոյս տէրն ի զինոյ:

8 Եւ յորժամ խիստ կսկծէ, զայս դեղս տուր: Առ հայկաւ եւ աղբրաց արիւն եւ խունկ Ա(1)-Ա(1) բաժին, եւ կուտաստիկ հունդ եւ կարաւսի հունդ եւ խարպիզակի կուտ յամեն մէկէ կէս բաժին: Աղա մանտր, յիրար խառնէ եւ ի ժամուն Գ(3) տրսամ մեղրի կամ շաքարի ջրով տուր, եւ ի միգուկն նզարկով սպիտակ շաֆ կաթեցուր՝ տրորած աղջկան մօր կաթով: Շատ օգտակար է: Նախ փորձեցաք եւ ապա գրեցաք:

medical advancements. This integration is driven by growing patient interest in combining natural therapies with conventional treatments. The mineralogical analysis of Armenian bole demonstrates its rich composition and vast potential, not only for medical use but also in industrial applications, such as ceramics and radioactive waste disposal.

Armenian bole represents a vital link between historical medical practices and modern scientific exploration, offering both a continuation of ancient wisdom and the potential for future innovations. Further research into its catalytic capabilities promises to expand its applications and reinforce its value in both fields.



Fig. 1 : Display at the exhibition “Explosive Encounters: Nomads in the Settled World”, featuring medicines that were distributed over several thousand kilometers in the ancient world and the Middle Ages. The red arrow heads point at powdered (left) and broken (right) *Terra armena* (Image © A. Bretan, 2012).

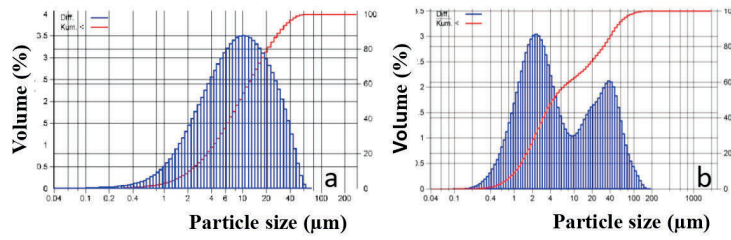


Fig. 3 : Armenian bole powder exhibits a single-peak distribution of grain diameters when dry (a). Upon contact with water, a portion of the material disintegrates into smaller particles, resulting in a double-peaked distribution (b).

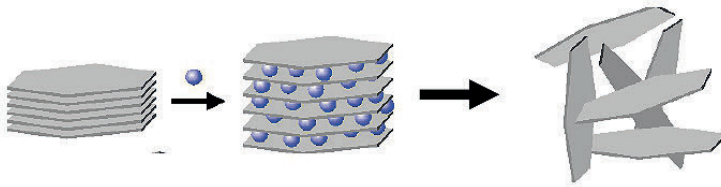


Fig. 4 : Intercalation of liquid solvent molecules results in the disintegration of phyllosilicates. This is an accepted schematic disintegration pattern due to various literature sources.

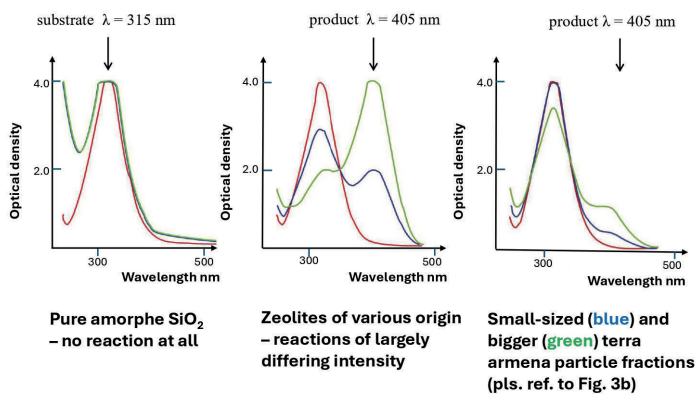
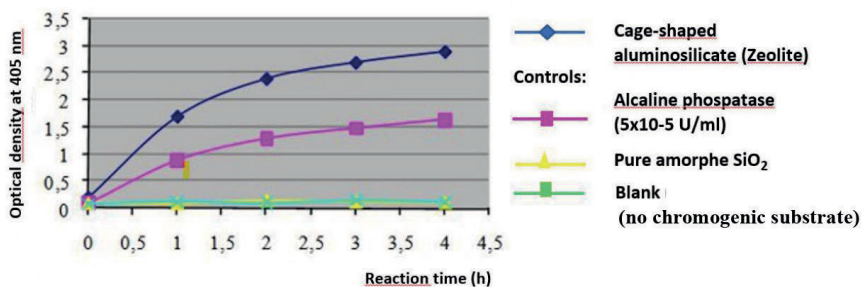
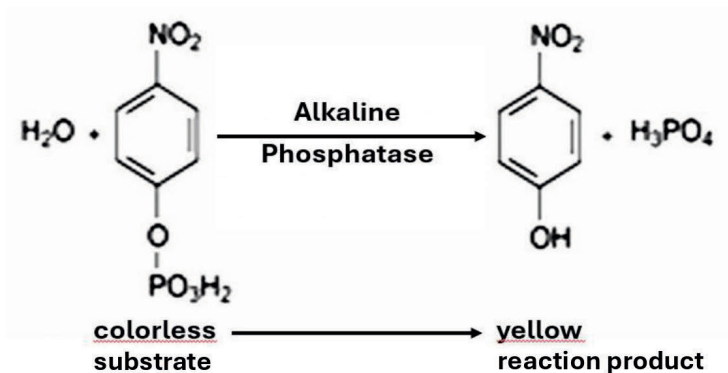


Fig. 5 : a) A scalabe chromogenic reaction (as used for lab-diagnostic measurements of alkaline phosphatase activity in sera); b) b) Reaction kinetics of zeolite as a cage-shaped aluminosilicate with controls; c) Testing of certain silicon-containing substances with respect to pseudo alkaline phosphatase activity.

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