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Testing Dioscorides' medicinal clays for their antibacterial properties: the case of Samian Earth

E. Photos-Jones [a, e, *], C. Keane [b], A.X. Jones [c, 1], M. Stamatakis [d], P. Robertson [b], A.J. Hall [e], A. Leanord [b]

[a] Analytical Services for Art and Archaeology (Ltd), Glasgow G12 8JD, UK
[b] Microbiology, Southern General Hospital, Glasgow G51 4TF, UK
[c] Department of Chemistry, Imperial College London, London SW7 2AZ, UK
[d] Department of Geology & Geoenvironment, National and Kapodistrian University of Athens, Panepistimiopolis, Ano Ilissia 15784, Athens, Greece
[e] Archaeology, Gregory Building, School of Humanities, University of Glasgow, Glasgow G12 8QQ, UK

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ABSTRACT

Earths were medicinal clays reported by authors of classical antiquity. Today, there are no archaeological samples thereof, at least with irrefutable proof that they were used as medicines. Therefore, their mineral identity and potential pharmacological actions have to be investigated on the basis of field work, laboratory testing and analysis as well as scrutiny of the relevant ancient texts. This paper focuses on Samian Earth, from the island of Samos in the East Aegean, used in antiquity as an eye salve and for the cleaning of cloth. Previously, Samian Earth has been equated with kaolin but we suggest its composition was probably more closely associated with the local borates to be found in the proximity of bentonitic clays. Microbiological testing of hydrated layered silicates (kaolin and bentonite) from Samos and Melos in the Aegean in association with different borates (colemanite, tincalconite) was carried out against common pathogens, like *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Experimental results showed that even a few hundred ppms of boron/boric acid in the Samos bentonitic clays can have a significant effect on the reduction of bacterial colonies. This observation corroborates the assumption that the medicinal properties of the *earths* were integrally associated with the mineralogy of specific localities within the volcanic islands of their origin.

1. Introduction

Recently there has been a renewed interest in the study of the anti-bacterial properties of some clays, referred to as medicinal, known to have been used traditionally by many cultures across different regions (Williams et al., 2009, 2011; Haydel et al., 2008; Parolo et al., 2011). The clay minerals associated with these clays are primarily montmorillonite and kaolinite (Carretero, 2002; Droy-Lefait and Tateo, 2006; Gomes, 2013). Smectite clays, of which montmorillonite is one, have two important properties: the capacity to exchange cations like sodium, calcium, ammonia, potassium and magnesium and the ability to adsorb toxic elements like As, Pb or Ag as a result of their cation exchange capacity. The first property is particularly important in the treatment of gastrointestinal problems like diarrhoea because of the ability of the clays to restore electrolyte imbalance caused by the loss of fluids. The empirical understanding of the therapeutic properties of some clays by many cultures across the globe underlies a practice called *geophagia*, or the consumption of earthy substances; such practices still continue today (Hunter, 1973; Wilson, 2003; Woywodt and Kiss, 2002; Young, 2011). Animals like parrots (Burger and Gochfeld, 2003) or elephants (Bowell et al., 1996; Houston et al., 2001) also display similar behaviour in an attempt to neutralise the effect of toxins within edible substances.

Earths, as oxides, sulphates or hydrated layered silicates, have been reported in Greek and Latin texts as having many pharmacological applications but were also used as pigments and washing powders. Their pharmacological actions have been presented by Greek and Latin authors such as Dioscorides (*De Materia Medica* Book V), Galen (*De Simplicium Medicamentorum*) and Pliny (*Natural*

* Corresponding author: Archaeology, School of Humanities, University of Glasgow, Glasgow, UK
E-mail address: effie.photos-jones@glasgow.ac.uk (E. Photos-Jones).
[1] Present address: College of Chemistry and Molecular Engineering, Peking University, Beijing, China

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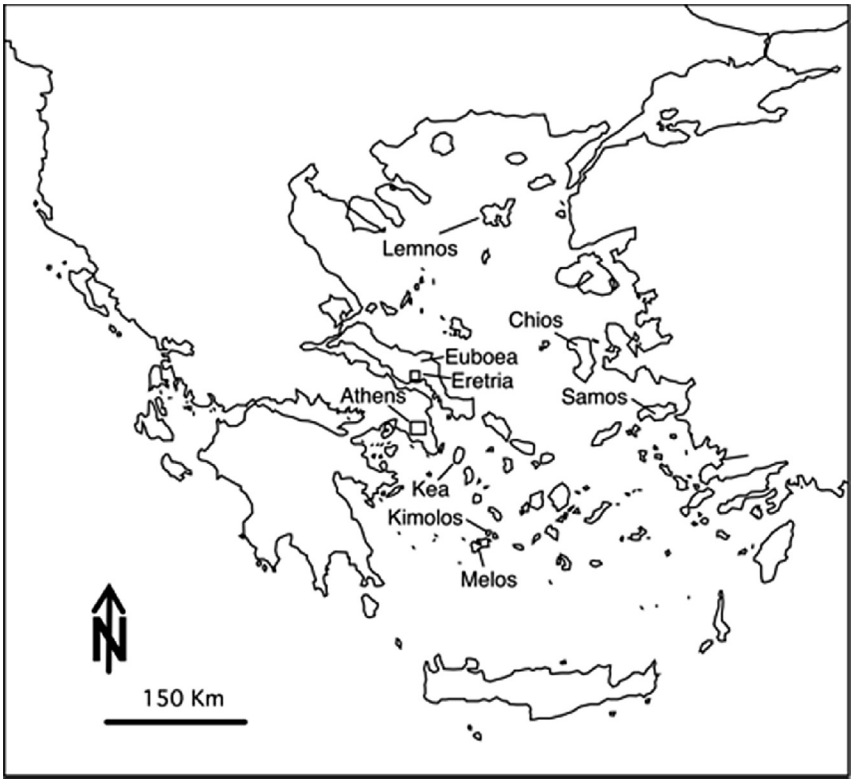

Fig. 1. Map of Greece with islands of origin for some earths, including Samos, Lemnos, Chios, Melos, Kimolos and Euboea.

History Book XXXV). Several Aegean islands with hydrothermally altered volcanic rocks were known as places of origin of *earths*, with Lemnos, Samos, Chios, Melos and Kimolos being the main ones (Fig. 1). *Earths* are almost always described as white, or of a pale colour; they had particular properties like astringency and they were thought to exert an effect (cooling, glueing, dilating, diuretic) when applied externally or taken internally (Riddle, 1985, 34).

This paper focuses on the *earth* of Samos, E. Aegean (Fig. 1). Samian Earth was traded under two different names, *collyrion* and *aster*; *collyrion* is a generic name for eye salve and *aster* was also used for the cleaning of cloth (Pliny *Nat. Hist*. XXXV, 16; Dioscorides *De Mat. Med*. V, 72). It is not possible to know the 'true' mineral identity of the Samian Earth and it is unlikely that there was a single composition/recipe for Samian Earth. Samian Earth has been

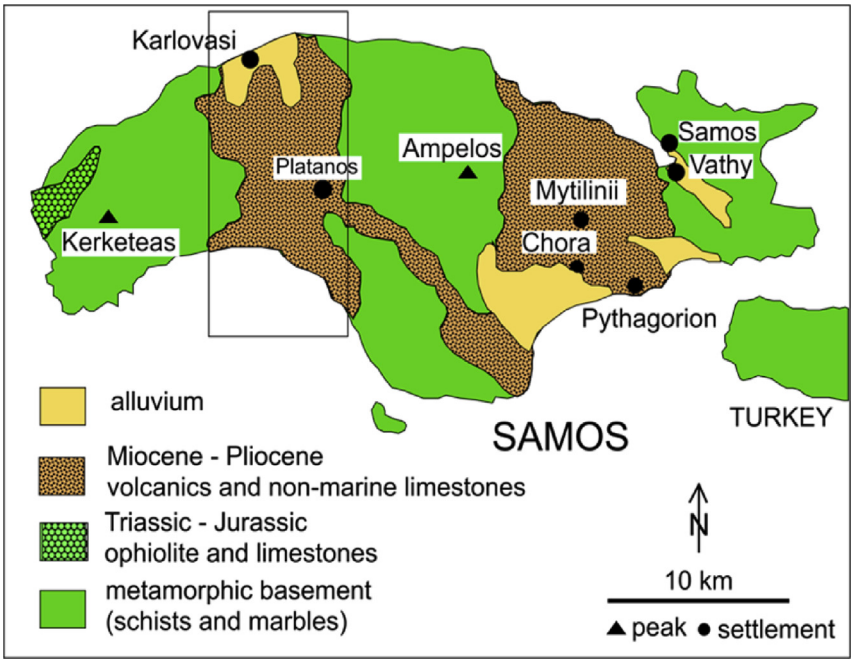

Fig. 2. Geological map of Samos.