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Lithofacies palaeogeography and sedimentology

A review on palaeogeographic implications and temporal variation in glaucony composition

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ABSTRACT

This study presents a review on palaeogeographic implications and temporal variations of glaucony covering both modern and ancient records. Phanerozoic glaucony preferably forms in a shelf depositional setting. Deep marine conditions and low seawater temperature discourage formation of glaucony. Around 75% of glaucony is recorded from the Cretaceous to the Holocene sediments, which are related to the abundance of the most common substrates, faecal pellets and bioclasts. TFe_2O_3 (total), Al_2O_3, K_2O and MgO contents of glaucony vary appreciably through geological time. While TFe_2O_3 content of most Mesozoic and Cenozoic glaucony exceeds 20%, it is always less than 20% in Precambrian varieties. High K_2O, Al_2O_3, MgO and low TFe_2O_3 distinguish the Precambrian glaucony from its Phanerozoic counterpart. Precambrian glaucony, preferably formed within a K-feldspar substrate, is always rich in potassium irrespective of its degree of evolution, while high K-content in Phanerozoic evolved glaucony indicates significant stratigraphic condensation. K_2O *vs.* TFe_2O_3 relationship of glaucony exhibits three different evolutionary trends corresponding to three common modes of origin. Depositional conditions may influence the composition of glaucony as slightly reducing conditions favour Fe enrichment, whereas oxidising conditions cause Fe depletion in glaucony.

1. Introduction

Glaucony is generally considered as a product of marine authigenesis, which is commonly associated with transgressive deposits and condensed sections (Odin and Matter, 1981; Amorosi, 1995, 1997; Amorosi and Centineo, 1997; Kitamura, 1998; Harris and Whiting, 2000; Giresse and Wiewióra, 2001; Hesselbo and Huggett, 2001; Meunier and El Albani, 2007; Banerjee *et al.*, 2008, 2012a, 2012b; Chattoraj *et al.*, 2009). Glaucony occurs typically in forms of 60 μm–1000 μm green clay aggregates in sedimentary rocks ranging in age from the Late Paleoproterozoic to the Holocene (Table 1; Webb *et al.*, 1963; Odin and Matter, 1981; Dasgupta *et al.*, 1990; Amorosi, 1994, 2012; Deb and Fukuoka, 1998; Lee *et al.*, 2002; El Albani *et al.*, 2005; Amorosi *et al.*, 2007; Bandopadhyay, 2007; Banerjee *et al.*, 2008, 2012a, 2012b, 2015; Chattoraj *et al.*, 2009). Glaucony forms in a wide variety of substrates including faecal pellets, bioclasts, feldspar, mica and quartz. Although the stratigraphic implications of glaucony are fairly well understood because of its common association in sedimentary sequences representing simple

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Table 1 – Glaucony occurrences through different ages along with the background lithology, substrate and environmental interpretations.

Strata No.	Author	Age/Stratigraphic unit, location	Background lithology	Substrate	Environment/ Bathymetry
1	Wang (1983)	Holocene/Fuxiangraben Lake, Yunnan	Muds	–	Marine (35 m–150 m)
2	Seed (1965)	Holocene/South Island of New Zealand	Sands	Faecal pellets and alteration of micas	–
3	Vaz (2000)	Holocene/Offshore Cauvery Basin, India	Muds	–	Shelf to slope
4	Giresse *et al.* (2004)	Holocene/Gulf of Lion	–	–	–
5	Rothe (1973)	Holocene/Coast of Morocco, Canary and Cape Verde Islands	Marls	Foraminifera	–
6	Bell and Goodell (1967); Dill (1969)	Holocene/Atlantic continental shelf and slope of USA	Sands and muds	Faecal pellets, foraminifera and other bioclasts	Shelf to slope
7	Furquim *et al.* (2010)	Holocene/Lake of Nhecolândia (Pantanal wetland), Brazil	–	Micas	Lacustrine
8	Wang *et al.* (1985)	Holocene/Sanya Bay, South China Sea	–	Foraminifera and faecal pellets	–
9	Parker (1975); Birch (1979)	Holocene/Continental shelf off South Africa	Sands and muds	Foraminifera and faecal pellets	Shallow marine
10	Chen and Chen (1997)	Holocene/Taiwan Strait, South China Sea	–	–	Shallow marine
11	Giresse *et al.* (1988)	Holocene/Near the Congo river mouth	Sands and muds	Micas and clays	Inner shelf
12	Lee *et al.* (2002)	Holocene/Continental shelf off Yellow Sea	Sands and sandy muds	Faecal pellets	Intertidal to subtidal (10 m–80 m)
13	Basa *et al.* (1997)	Holocene/Sands of Dungeness	Sands and silts	–	Intertidal to subtidal
14	Martins *et al.* (2012)	Holocene/Continental shelf and upper slope of Portugal	Sands	Foraminifera and faecal pellets	Shelf (50 m–150 m)
15	Nelson and Bornhold (1984)	Holocene/Offshore Vancouver Island	Limestones and muds	Foraminifera and other bioclasts	Shelf (<200 m)
16	Mackenzie *et al.* (1988)	Holocene/Chatham Rise and Oamaru	–	–	Shelf
17	Hesse *et al.* (1971)	Holocene/Apulian shelf, Mediterranean	Limestone sands	Foraminifera and faecal pellets	Shelf
18	Ehlmann *et al.* (1963)	Holocene/Southeast coast of USA	Sands	Foraminifera and faecal pellets	Shelf (34 m–826 m)
19	Rongchuan *et al.* (1986); Lim *et al.* (2000)	Holocene/Offshore Yellow Sea, East Sea	Muds and sands	Foraminifera and faecal pellets	Middle shelf (~100 m)
20	Porrenga (1967)	Holocene/Niger delta, the Orinoco shelf and the shelf off Sarawak	Sands	Foraminifera, other bioclasts and faecal pellets	Outer shelf (125 m–250 m)
21	Dias and Nittrouer (1984)	Holocene/Offshore Portugal	Sands and biogenic limestones	Foraminifera	Outer shelf to shelf break (100 m–200 m)
22	Mendes *et al.* (2004)	Holocene/Guadiana shelf	Sandy and silty clays	Foraminifera and molluscs	Outer shelf (100 m–200 m)
23	Demirpolat (1991)	Holocene/Continental shelf off the Russian River	Sands	–	Outer shelf
24	Bornhold and Giresse (1985)	Holocene/Continental shelf off Vancouver Island	Muddy sands to sandy muds	Foraminifera and faecal pellets, mica	Outer shelf to upper slope (100 m–500 m)
25	Wigley and Compton (2007)	Holocene/Oligocene–Miocene/ Cape Canyon of South Africa	Sands or muds	Foraminifera and faecal pellets	Middle shelf to shelf edge (50 m–400 m)
26	Chen *et al.* (1980); Chen and Duan (1987)	Holocene/Continental shelf of East and South China Sea	–	Foraminifera	Outer shelf to upper slope (200 m–400 m)
27	Giresse and Wiewióra (2001); Baldermann *et al.* (2013)	Holocene/Deep sea, Ivory coast Ghana	–	Foraminifera	2100 m
28	Buatier *et al.* (1989)	Holocene/Galapagos spreading centre	Pelagic sediments	–	2500 m
29	Riedinger *et al.* (2005)	Holocene/Western continental margin off Argentina and Uruguay	Mudstones	–	Deep marine