



Micro-characterisation of the colour palette of ceremonial objects from the Papua New Guinea Highlands: Transition from natural to synthetic pigments☆



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ABSTRACT

Fifty ceremonial objects collected between 1961 and 1972 from various parts of the Papua New Guinea (PNG) Highlands and later acquired into the Art Gallery of New South Wales, Australia were analysed using Raman and Fourier-Transform Infrared (FTIR) spectroscopy coupled with microscopy and in some instances, complemented with scanning electron microscopy–Energy dispersive spectroscopy (SEM-EDS) and X-ray diffraction (XRD). Both synthetic and natural pigments were identified and correlated to the source of the objects collected. The distribution of synthetic pigments in Highlands artefacts was found to be widespread, of which PR3, PY1 and ultramarine blues dominated the synthetic palette. Rare blue vivianites were detected on objects collected in the Wiru and Kewa speaking regions of the Southern Highlands, in addition to the more widespread iron oxide-hydroxide pigments, such as limonite, goethite, lepidocrocite and hematite, as well as kaolinite. The results of the study rectified about 30% of the material documentation, which had previously misidentified pigments based on qualitative and anecdotal interpretation.

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1. Introduction

The heritage of Papua New Guinea (PNG) is one of the world's most culturally diverse. With over 300 different languages spoken across the PNG mountain ranges, populations were largely isolated from one another, developing distinct cultures. Since 1930, when vast populations living in the Highlands were revealed by explorers, the region has attracted foreign missionaries, government patrol officials and researchers alike [1–3]. The presence of foreigners created a culture shift which transformed the nature of traditional ceremonial practice [4].

Traditionally, the Highlanders believe in legends, myths and the spiritual forces found in nature. In previous generations, sacred objects were made by ritual experts and used in various cult and ritual ceremonies. Ornaments, masks and other objects were created to adorn the bodies and worn on ceremonial occasions [5]. These objects were seen as a form of art that generated an acquisition interest from foreign art collectors. Stanley Moriarty, an Australian collector of the art and material culture of the Pacific region, dedicated over a decade of travel between 1961 and 1972 to the Highlands in order to acquire these objects. His collection of Highlands art was acquired into the Art Gallery of New South Wales (AGNSW) so that they would be preserved for future generations.

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At the AGNSW, the challenges of preserving and displaying these ceremonial objects have long been apparent. Although most of the works were in very good condition, there have been ongoing conservation issues with these objects, including pigment discolouration, paint flaking, powdering and bio-deterioration [6]. According to Simon Moriarty, his father witnessed works turn into dust within his own lifetime [7], and thereby reinforced the importance of the care and conservation of such fragile objects. Inaccurate or lack of documentation associated with the works made assessments of the works difficult. Large collections of PNG objects found in European, Australian and American museums, have also suffered from erroneous or incomplete documentation, making it problematic to include them in museum displays [6].

Made of ephemeral plant-based materials, the objects in the collection are unique in that they contain blues, in addition to reds, yellows, whites and blacks that are more commonly seen in PNG artworks. Across Highlands societies, paint colours connoted different meanings. In general, strong reds were believed to instil magical power in an object, white was predominantly used for mourning and funerary rituals, while black was associated with masculinity and male solidarity. Bright colours were linked to fertility and attractiveness whereas dark colours were used for disguise and aggression, and dull colours indicated weakness or illness [8]. Paint recipes varied in different parts of New Guinea and could contain up to five ingredients [9]. However, very little information was known about the pigments used in the construction of PNG Highlands ceremonial objects, thereby prompting the current scientific investigation.

Table 1
List of pigments detected in PNG ceremonial objects collected from Western, Southern, Central and Eastern Highlands.

Type	Accession number	Name (generic)	Year collected	Location	Pigment and associated minerals
Weapon	302.1978	Shield	1963	Tambul, Tambul-Nebilyer district, Western highlands, Kakoli people	Red ochre: hematite, Al–OH polymorphs, kaolinite
Weapon	305.1978	Shield	1963	Tambul, Tambul-Nebilyer district, Western highlands, Kakoli people	Red ochre: hematite, kaolinite
Weapon	260.1978	Shield	1966	Gumine district, Simbu province, Central Highlands, Golin people	Grey: Kaolinite, quartz Blue: Ultramarine, BaSO ₄ Red ochre: Hematite, kaolinite quartz Magenta: PR57, BaSO ₄ , CaCO ₃
Weapon	258.1978	Shield (Gilminiyha)	1966	Woenara, Obura-Woenara district, Eastern Highlands, Baruya people	White: Kaolinite, quartz Black: Burnt wood, CaCO ₃ Red: + BaSO ₄ Red Ochre: Hematite, anatase, kaolinite, quartz Pale Red ochre: Hematite, kaolinite
Weapon	475.1979	war shield	1968	Asara, Obura-Woenara district, Eastern Highlands, Tairora people	Pale Red ochre: Hematite, kaolinite
Weapon	265.1977	Kolkol OR watumbiy (shoulder shield)	1969	Det, Poroma district, Southern Highlands, Anganen people	Red: PR3, BaSO ₄ Black: Burnt wood White: Kaolinite, quartz, Al–OH polymorphs
Weapon	266.1977	Shield	1969	Kiburu, Mendi River, Southern Highlands, Mendi people	Red: PR3, BaSO ₄ Red ochre: Hematite, kaolinite Blue: Ultramarine, BaSO ₄
Weapon	264.1977	Shield	1969	Map, Mendi, Southern Highlands, Mendi people	Red Ochre: Hematite, kaolinite, quartz Red: PR3 + BaSO ₄
Weapon	816.1979.1-7	Bows and arrows	1969	Pikosa, Upper Asaro, Dauilo, Eastern Highlands, Dano people	Blue: PB15, gypsum Pink: PR2, gypsum
Weapon	301.1978	Amitung	c.1948, 1968	Oksvip, Telefolmin, Ifitaman valley, Western highlands, Telefolmin people	White: kaolinite, quartz Red: hematite
Weapon	467.1979	Shield	Undated	Lagaip River, Enga province, Western highlands	Red ochre: Hematite, anatase, kaolinite White: Kaolinite
Weapon	490.1979	Shield	Undated	Unknown	Red: PR3, BaSO ₄ Blue: Ultramarine, BaSO ₄
Ritual/performance	268.1978.1	Ocarina (Morimuge)	1968	Kundiawa, Simbu Province, Central Highlands, Sinasina people	Blue: PB15, Prussian Blue, anatase, kaolinite
Ritual/performance	267.1978.2	Ocarina (Morimuge)	1972	Kundiawa, Simbu Province, Central Highlands, Sinasina people	Blue: Ultramarine, kaolinite, quartz
Ritual	613.1979	Ceremonial headdress	1963	Kagua-erave district, Southern Highlands, Kewa people	White: Kaolinite, quartz Blue: Vivianite, kaolinite, quartz Red: PR3, BaSO ₄
Ritual	317.1978	Fertility Stone	1963	Tambul, Western Highlands, Kakoli people	Red: Hematite
Ritual	247.1977	Ceremonial headdress (Rimbu)	1964	Kagua-erave district, Southern Highlands, Kewa people	Blue: Vivianite, kaolinite, quartz Red: PR3, BaSO ₄ White: Kaolinite, quartz
Ritual	283.1978	Yupini	1964	Laigaim, Enga province, western highlands, Enga people	Red: , BaSO ₄ , kaolinite Yellow Ochre: quartz, kaolinite Black: burnt wood white: kaolinite, quartz
Ritual	244.1977	Drummer's wig (bachelor's wig)	1965	Tari, Tari-pori district, Hela province, Western Highlands, Huli people	Red: Hematite Black: Burnt wood
Ritual	272.1978	Sacred stone	1966	Mount-Elimbari, Simbu province, Central Highlands, Chauve people	Red ochre at back: Hematite, siderite, kaolinite, quartz Red ochre at front: Hematite, kaolinite, quartz Yellow ochre: kaolinite, quartz Grey: Kaolinite, quartz Blue: Ultramarine, BaSO ₄
Ritual	245.1977	Ceremonial hat	1967	Pangia, Southern Highlands	Red: PR3, BaSO ₄

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