
A Preliminary Study on the Identification, Coding and Verification Methods of the “Cultural Genes” in the Decoration of Doucai Porcelain of the Chenghua Reign in the Ming Dynasty

Keyong Luo*

Jiangxi Arts & Ceramics Technology Institute, Jingdezhen 333000, Jiangxi, China

**Author to whom correspondence should be addressed.*

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Abstract: Taking “cultural genes” as the core of research, this paper deeply explores the cultural information connotation of the decorative patterns of Doucai porcelain of the Chenghua Reign in the Ming Dynasty, and proposes its cultural identification, coding and verification methods. Through a systematic analysis of the decorative motifs, compositional laws, color collocations and technical characteristics of typical Chenghua Doucai artifacts, the core “cultural gene” units in its decorative system are extracted. On this basis, it is proposed to construct a coding system for pattern connotation, formal combination and technological vocabulary to realize the structured description and storage of its cultural information. Finally, the coding system is cross-verified through various approaches such as stylistic comparison, process archaeology analysis and cross-media cultural context verification, thus putting forward an analytical framework for interpreting the cultural connotation of Doucai porcelain of the Chenghua Reign in the Ming Dynasty.

Keywords: Chenghua Doucai of the Ming Dynasty; cultural genes; decorative patterns; pattern coding; identification method

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1. Introduction

Doucai porcelain of the Chenghua Reign in the Ming Dynasty features moist glaze, elegant color materials and exquisite painting skills, representing the peak of polychrome porcelain craftsmanship in the Ming Dynasty. Its decorative patterns, bearing the aesthetic tastes of the times, the will of court culture and social ideological concepts of that period, have thus become a unique set of “cultural genes”. In recent years, with the digital development of cultural heritage, the introduction of the biological concept of “genes” into the analytical system of cultural inheritance has provided a new paradigm for interpreting the cultural background, stable characteristics, variation laws and transmission paths of artifact decorations. This paper regards the decorative system of Chenghua Doucai as a core cultural gene pool, deeply explores the core cultural information units with stable and heritable characteristics in it, and then puts forward clear identification criteria, a structured coding scheme and a scientific verification path.

2. Identification of the “Cultural Genes” in the Decoration of Chenghua Doucai

The identification of “cultural genes” requires stripping off the decorative appearance and extracting the smallest functional units with stable inheritance, replicability and specific cultural information from it. For Chenghua Doucai, cultural deconstruction and induction need to be carried out from the following three dimensions.

2.1. Core Motif Genes: Connotative Genealogy of Pattern Themes and Expression of Court Will

2.1.1. Natural Flower and Grass Gene Group

Sprig or interlocking flower and fruit patterns are the core representatives of the natural flower and grass gene group, including grapes, chrysanthemums, lotus, gardenias, peonies, ganoderma and other flowers^[1]. Their genetic characteristics are manifested in: highly stylized forms yet showing a vibrant natural state; symmetrical and balanced layout; bright yet elegant colors^[2]. The characteristics of this gene group not only emphasize the natural aesthetic view of “all things have spirits”, but also contain auspicious implications. For example, grapes symbolize “many children”, and lotus implies “integrity”, which are the visual manifestations of the court’s pursuit of auspicious omens in life.

2.1.2. Auspicious Mythical Beast Gene Group

Dragons and phoenixes, unicorns, mythical birds, sea beasts and other creatures constitute the main content of the auspicious mythical beast gene group. Their genetic characteristics are manifested in: soft and stylized shapes; often combined with environmental genes such as cloud patterns and wave patterns^[3]. For instance, dragon patterns on Chenghua Doucai porcelain are usually more tame, no longer emphasizing power and majesty. This gene group is the materialized expression of the thought of “the interaction between heaven and man”, and the softening of its forms can reflect the specific court mentality and aesthetic changes of that time.

2.1.3. Figure Story Gene Group

Children at play, virtuous scholars and beautiful ladies form the main content of the figure story gene group. Their genetic characteristics are manifested in: relatively simple scenes, small and vivid figures with calm and elegant expressions; sparse composition, focusing more on narrative interest rather than grand scenes^[4]. This gene group mainly shows the court’s pursuit and vision of the interest of secular life, and also the presentation of the literati’s elegant thoughts in court art. For example, the pattern of children at play entrusts the royal family’s vision of prosperous offspring, and the portrayal of characters’ expressions tends to the literati’s pursuit of moral integrity and character.

2.1.4. Abstract and Geometric Border Gene Group

Meander patterns, fillet patterns, ruyi cloud head patterns, lotus petal patterns and others are important contents of the abstract and geometric border gene group. Their genetic characteristics are manifested in: usually used as the frame structure of the main patterns, playing the role of separating, assisting, stabilizing vision and strengthening order^[5]. This gene group mainly reflects the stylized characteristics and technological norms of porcelain decoration.

2.2. Visual Grammar Genes: Generative Logic of Composition, Color and Space

2.2.1. Compositional Logic Genes

First, the pattern-adaptive composition. For example, on the chicken cup, the mother hen with chicks and flowers and plants adapt to each other, and the patterns spread and unfold following the shape of the vessel, thus forming a self-contained world scene. Second, the layered banded composition. For example, on jars, bowls and other vessels, the decorative patterns are generally divided into different levels such as neck, shoulder, belly and foot, with a certain sense of order^[6]. Third, the medallion composition, which highlights the visual focus by depicting the theme pattern inside a regular geometric figure.

2.2.2. Color Relationship Genes

The overall “color gene” of Chenghua Doucai is characterized by a dual structure of “underglaze blue and white outlining + overglaze polychrome filling”. Among them, blue and white is used to construct the outline, which can plan the skeleton and space of the pattern; overglaze colors mainly include alum red, deep purple, light yellow, light green and other colors, usually used for flat coating and rendering within a limited range^[7]. Its color relationship rules are mainly reflected in three levels: first, contrast and harmony, such as the collocation of the cool tone of blue and white and the warm tone of alum red; second, clear primary and secondary relationship, with blue and white as the main color and overglaze colors as the supplement; third, fixed color matching, for example, grape patterns are fixed with deep purple, forming the unique symbol of “Chenghua purple”.

2.2.3. Space Processing Genes

The space processing characteristics of Chenghua Doucai can be summarized as planarization, sparseness and imagery, without emphasizing three-dimensionality and spatiality. However, relying on the scattered arrangement of objects and ingenious blank design, it creates a fresh, ethereal and distant picture effect^[8].

2.3. Technological and Material Genes: Cultural Choices in Technical Realization

2.3.1. Body and Glaze Genes

The body of Chenghua Doucai porcelain is distinctly delicate and white, and its glaze is as smooth and rich as fat. The extreme pursuit of materials exactly reflects the court’s advocacy of exquisite taste.

2.3.2. Color Material and Brushstroke Genes

The use of color materials adds important luster to Chenghua Doucai. The dark and lusterless deep purple, and the delicate and transparent light yellow are all key technological effects of Chenghua Doucai. In terms of brushwork, the outlining lines of Chenghua Doucai are delicate, soft and smooth, and the color filling is accurate without overflowing, showing the characteristics of the ultimate pursuit of perfect craftsmanship^[9], which also expresses the extremely high quality standards and rigorous attitude of imperial kiln production.

2.3.3. Firing Technology Genes

The firing process of Chenghua Doucai is complex, which requires high-temperature firing of underglaze blue and white first, and then secondary low-temperature firing of overglaze colors^[10]. This requires stable process links, both precise control of fire temperature and sufficient proficiency, to ensure the perfect presentation of decorative effects.

3. Coding of the “Cultural Genes” in the Decoration of Chenghua Doucai

Constructing a logically clear, describable and operable coding system is the key link to transform the decorative cultural information of Chenghua Doucai from “perceptual cognition” to “structured analysis”^[11]. The coding design can be completed from the following aspects.

3.1. Construction of the Coding System: Layering, Symbolization and Attribute Definition

3.1.1. Coding Principles and Hierarchical Structure

“Progressive hierarchy and attribute correlation” is the basic principle of coding design, on the basis of which a three-level coding structure can be constructed. The first-level code is the gene type code, corresponding to the identification of its dimensional characteristics, namely motif (M), visual grammar (G) and technological material (T). The second-level code is the gene category code, a branch coding structure under the type code. For example, the motif (M) can be divided into N (natural flowers and grass), A (auspicious mythical beasts), H (figure stories) and B (geometric borders); the visual

grammar (G) can be divided into C (composition), S (color) and P (space); the technological material (T) can be divided into B (body and glaze), P (color materials) and F (firing). The third-level code is the specific gene serial number, that is, a unique digital number is set for each specific gene unit to associate detailed attribute descriptions.

3.1.2. Symbolic Coding and Attribute Description Model of Gene Units

Each gene unit can use the combination of the above three-level codes to construct a complete code, and establish a standardized attribute description field. For example, the motif gene “typical Chenghua sprig grape pattern” can be set with the complete code of M-N-VT-01, where M is the first-level code representing motif, N is the second-level code representing natural flowers and grass, VT is a custom feature abbreviation (Vine for grape, Twig for sprig), and 01 is the serial number, the first gene unit in this category.

The attribute description fields include the following aspects:

Morphological characteristics: Slender and graceful vines, palmately divided leaves, clustered fruits, and a well-proportioned layout of density and sparseness.

Color paradigm: Double-outlined blue and white lines (elegant hue), fruits filled with typical “Chenghua purple” (dark and lusterless), leaves filled with light green or light yellow.

Typical carriers: Exquisite small vessels such as chicken cups, stem cups and “Tian” character jars.

Cultural implication: Symbolizing “many children and much happiness” and “abundant fruits”.

Associated genes: Often combined with G-C-FT-01 (pattern-adaptive composition) and T-P-PU-01 (deep purple color material).

Through the coding method of “code + attribute”, the corresponding cultural gene unit can be converted into a data code that can be managed and retrieved by the database.

3.2. Structural Relationship Coding: From Single Genes to “Genetic Map”

The overall decorative style of Chenghua Doucai is not a simple list of genes, but needs to be combined and presented according to certain structural relationships. In this regard, it is also necessary to construct coding for gene combination, sequence and spatial relationship.

3.2.1. Combination Relationship Coding

(+) represents the sequence relationship, used to show the chronological or spatial sequence of patterns. For example, the neck pattern band can be expressed as [M-B-RG-01 (meander pattern)] + [M-B-LP-01 (lotus petal pattern)].

(>) represents the principal-subordinate relationship, used to show the primary and secondary relationship in the visual picture. For example, a certain medallion composition can be coded as [G-C-RF-01 (diamond medallion)] > [M-A-PH-01 (phoenix pattern)].

(&) represents the fusion relationship, used to show a new unit formed by the fusion of different genes. For example, the combination of sea beast pattern and wave pattern can be coded as [M-A-MS-01 (sea horse)] & [M-N-WW-01 (wave pattern)].

3.2.2. “Genetic Expression” of the Overall Decoration

According to the above coding design, the complete decoration of an artifact can be written as an expression composed of codes and connectors. For example, the simplified expression of the decoration of a Chenghua Doucai stem cup with grape pattern is:

Overall vessel style =

Rim: [M-B-SL-01 (fillet pattern)],

Belly: G-C-FT-01 (pattern-adaptive composition) > [M-N-VT-01 (sprig grape pattern)],

Stem: [M-B-LP-01 (transformed lotus petal pattern)],

Color protocol: G-S-PC-01 (Chenghua blue and white outlining + polychrome filling),

Technological protocol: T-B-BP-01 (moist body and glaze) + T-P-PU-01 (containing deep purple color material)

This expression can clearly show the genetic composition and combination logic of the artifact's decoration.

4. Verification Methods of the “Cultural Genes” in the Decoration of Chenghua Doucai

4.1. Stylistic Comparison Verification

First, horizontal synchronic comparison. It is necessary to compare the coding characteristics with typical artifacts such as recognized dated Chenghua porcelain and unearthed specimens from the Jingdezhen imperial kiln of the same period to verify the stability and typicality of gene combinations^[12].

Second, vertical diachronic comparison. It is necessary to compare the coding characteristics with the decorative features of Doucai porcelain of different periods such as Xuande Doucai and Jiajing-Wanli Doucai^[13] to confirm that the gene coding can only correspond to the identification of cultural genes and variation laws of the Chenghua period, ensuring its temporal specificity.

4.2. Process Archaeology Verification

First, microscopic trace analysis. High-power microscopes, spectral analysis and other means should be used to carefully observe the color material composition, brushstroke sequence and firing traces of the porcelain, so as to strictly compare the technological characteristics described by the gene coding^[14] and confirm the accurate correspondence with the physical object.

Second, component detection of body, glaze and color materials. Instruments are used to analyze the components of porcelain body, glaze and colors, and the material genes are verified with data to ensure that they conform to the raw material sources and formula range of the imperial kiln in the Chenghua period.

4.3. Cross-Media Cultural Context Verification

First, documentary mutual verification. A cross-verification method should be adopted to compare the pattern genes with the Veritable Records of the Chenghua Emperor, court paintings of the Chenghua period, and decorative patterns of different crafts such as silk and lacquerware of the Chenghua period to confirm the historical authenticity of its cultural connotation^[15].

Second, inferential verification of social and cultural functions. Combined with relevant evidence such as court records, usage scenario records and tomb unearthed artifacts, it is necessary to analyze whether the specific combination of cultural genes conforms to its ritual system and usage functions, so as to verify the rationality of the cultural logic of the coding.

5. Conclusion

In summary, the systematic construction of the “cultural genes” in the decoration of Chenghua Doucai should consist of three dimensions: specific motifs, formal principles and technological traditions. Based on the cultural characteristics of Chenghua Doucai decoration, this paper puts forward the identification and classification characteristics, and then constructs the corresponding coding structure and verification methods, thus transforming the perceptual and empirical pattern appreciation method into a describable, analyzable and verifiable structured coding system. This not only clearly presents the inherent stable structure and cultural inheritance code of Chenghua Doucai decoration, but also ensures the scientificity and objectivity

of its cultural interpretation. This research not only provides a new tool for the in-depth cognition of Chenghua Doucai, but also explores an interdisciplinary analytical idea for the entire field of material culture research.

Disclosure statement

The author declares no conflict of interest.

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