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THE CONSERVATION OF PAPAL BULLS FROM THE XVth-XVIth CENTURIES

V. Jurado¹, M.P. Pastrana², E. Porca¹ and C. Saiz-Jimenez¹

¹*Instituto de Recursos Naturales y Agrobiología de Sevilla, CSIC, Sevilla, Spain.*

²*Departamento de Documento Gráfico. Centro de Conservación y Restauración de Bienes Culturales. Junta de Castilla y León, Spain.*

The Historical Heritage Foundation of Castile and León, in cooperation with the bishopric of Segovia and the town council of Cuéllar, carried out the restoration of the church of San Esteban and its properties in Cuéllar (Segovia, Spain) (Fundación del Patrimonio Histórico de Castilla y León 2007, 2009). The four sepulchres in the presbytery were restored in 2008. Among them was that of Doña Isabel de Zuazo, the wife of Don Martín López de Córdoba Hinestrosa, an alderman of the corporation of Cuéllar (Figure 1).



Figure 1. Sepulchres of Don Martín López de Córdoba Hinestrosa and Doña Isabel de Zuazo in the presbytery of the church of San Esteban.

Together with the body was found a series of printed documents from the XVth to XVIth centuries, most of which were bulls of indulgence. Many of the printed documents dated from before 1520, some before 1501, and the oldest (and best-conserved, being on parchment) was from 1484; the most-recent dated from 1535. In total, this invaluable find comprises 45 documents on paper, various fragments, two documents on parchment, and a small prayer book. Their value is immense, because they reveal the inception of printing in Castile and the uses and religious ideas of the time — the end of the Middle Ages and beginning of the Renaissance.



Figure 2. Bull of indulgence found in the sepulchre of Doña Isabel de Zuazo.

The find is unusual because of the conditions under which the documents have been conserved — a burial of six centuries ago.

The Centre of Conservation and Restoration of Cultural Properties of the Board of Culture and Tourism of the Junta of Castile and León was in charge of the recovery and conservation of the documents, which presented a high level of microbial colonisation (Figures 2 and 3). A microbiological study of the documents was carried out in the Institute of Natural Resources and Agrobiology, using techniques of molecular microbiology, together with a study by scanning electron microscopy. This report presents some of the results obtained (Tables 1 and 2), indicating the presence of bacteria and fungi on the bulls.

Table 1. Phylogenetic identification of bacterial sequences detected in five bulls

	1	2	3	4	5	6	7
F260209	ND	ND	ND	96%	ND	ND	4%
IZ10.1	ND	ND	ND	ND	100%	ND	ND
IZ5.1	84%	8%	ND	ND	8%	ND	ND
IZ26.1	83%	ND	ND	ND	3%	ND	14%
IZ35.2	ND	ND	18%	ND	ND	74%	8%

1. *Clostridium* sp.; 2. *Moraxella* sp.; 3. *Nocardiopsis* sp.; 4. *Rickettsiella* sp.; 5. *Sporosarcina* sp.; 6. *Saccharopolyspora* sp.; 7. Others <5%; ND, not detected

It is remarkable the presence of species of the genus *Clostridium*, a group of anaerobic bacteria. *Clostridium* forms part of the gastrointestinal tract of humans and animals (Wang et al. 2005). Vass (2001) reported that human decomposition is associated with anaerobic fermentation and saponification from fats is accelerated by the post-mortem invasion of tissues by bacteria, especially putrefactive species such as *Clostridium*.

The genus *Rickettsiella* is a pathogen from a wide variety of arthropods, although our sequences were very similar to those of clones obtained from samples of human skin (Penn et al. 2001).

The fungal genera *Penicillium*, *Cladosporium*, and *Epicoccum* are found in different habitats, including the soil (Michaelsen et al. 2009), although they are closely related with the degradation of cellulose and paper.

Table 2. Phylogenetic identification of fungal sequences detected in five bulls

	<i>Penicillium</i> sp.	<i>Epicoccum nigrum</i>	<i>Cladosporium cladosporioides</i>
F260209	100%	ND	ND
IZ10.1	ND	ND	ND
IZ5.1	ND	ND	ND
IZ26.1	ND	98%	2%
IZ35.2	ND	ND	ND

ND, not detected

Bearing in mind that these documents date from the XVth to XVIth centuries, it has to be recognised that — under the burial conditions — their state of conservation is surprising. The microorganisms detected, most of which are associated to the human body and have cellulolytic activity, grew initially under suitable conditions of nutrients and moisture, in the presence of a decomposing body. Such microbial activity caused the degradation of the paper's cellulose fibres and the formation of stains as reported by other authors (Zotti et al. 2008, Mesquita et al. 2009). Subsequently, the limiting of nutrients, and low temperature and moisture slow the growth of these microorganisms, and thus their metabolic activity, explaining the survival of the documents.



Figure 3. A damaged bull with black, brown and white spots. Fragments of paper were collected using a cotton swab and tweezers.

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The re-exposure of the bulls to higher levels of moisture and temperature following their discovery could favour the growth of further microorganisms, threatening its conservation.

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