

## Shared Watermark Types in the Royal Collection Trust and the Codex Arundel: St. Catherine's Wheel

According to information found on the Royal Collection Trust (RCIN) website, seven drawings by Leonardo da Vinci display variants of the St. Catherine's wheel watermark.<sup>1</sup> Differences

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<sup>1</sup> The author respectfully acknowledges the extensive recording of Leonardo watermarks by Martin Clayton, Head of Prints and Drawings, Royal Collection Trust, which has enriched this study. Descriptions of the RCIN watermarks are taken from <https://www.rct.uk/collection> (accessed December 15, 2022).

### RCIN 912291

Recto: Horses' legs. Verso: The legs and chest of a horse c. 1517-18

Recto: Black chalk and pen and ink. Verso: Black chalk

22.9 x 17.7 cm

Watermark: Six-bladed St. Catherine's wheel, initials IN or IM within, crowned (cut in half in its length)

Image available: <https://www.rct.uk/collection/search#/1/collection/912291/recto-horses-legs-verso-the-legs-and-chest-of-a-horse>

### RCIN 912292

Recto: A horse's foreleg and chest. Verso: A design for a palace c. 1517-18

Recto: Black chalk, pen and ink. Verso: Black chalk

18 x 24.5 cm

Watermark: St. Catherine's wheel, crowned, close to 912291 but dissimilar (more geometrical)

No image available

### RCIN 912293

Horses' forelegs divided by lines c. 1517-18

Pen and ink over traces of black chalk

25.7 x 16.6 cm

Watermark: Six-spoked St. Catherine's wheel with five blades, crowned

Image available: <https://www.rct.uk/collection/search#/1/collection/912293/horses-fore-legs-divided-by-lines>

### RCIN 912303

Studies of a horse c. 1517-18

Black chalk, pen and ink, on paper washed buff

23.3 x 16.5 cm

Watermark: St. Catherine's wheel, crowned (partial), cf. 912309, 912291, 912292

No image available

### RCIN 912309

Recto: Horses' legs. Verso: A study of a horse c. 1517-18

Black chalk and pen and ink. Verso: Black chalk

25.0 x 17.4 cm

Watermark: St. Catherine's wheel, crowned (partial), cf. 912303, 912291, 912292

No image available

### RCIN 912344

Designs for an equestrian monument c.1517-18

Black chalk, pen and ink

20.3 x 14.3 cm

Watermark: St. Catherine's wheel, surmounted by three flowers

Image available: <https://www.rct.uk/collection/search#/2/collection/912344/designs-for-an-equestrian-monument>

### RCIN 912573

Recto: A costume study of a prisoner. Verso: A nude male figure c.1517-18

among them include five- or six- bladed wheels surmounted by either a crown or three branched flowers and the insertion of initials IN or IM within the wheel itself.<sup>2</sup> Among these seven watermarks, no two are exactly alike. The sheets, all anatomical studies of horses with the exception of RCIN 912573, which depicts a prisoner's garb, are dated c. 1517-1518, which is during Leonardo's last years in France.<sup>3</sup> The watermark type and the lack of a *filone supplementare*, a characteristic of Florentine papermaking, suggest a French origin for the papers.<sup>4</sup>

Two sheets found in Leonardo's Codex Arundel (MS 263, British Library) also contain a St. Catherine's wheel watermark type.<sup>5</sup> They are of two variants – one having five blades surmounted by a crown (Arundel ff. 116-119) and the other (Arundel f. 211), just a fragment, has been tentatively identified as a three-leaf branched finial of a St. Catherine's wheel.<sup>6</sup>

Sheets RCIN 912293 and Arundel ff. 116-119 invite extra scrutiny due to their notable lack of a sixth blade despite having six spokes (figures 1 and 2).<sup>7</sup>

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Recto: Black chalk. Verso: Black chalk  
18.4 x 12.7 cm  
Watermark: Six-bladed St. Catherine's wheel  
No image available

<sup>2</sup> Three out of the seven watermarks are available as images; therefore, not all of the differences as described can be discerned.

<sup>3</sup> Dates cited on <https://www.rct.uk/collection>. Accessed December 15, 2022

<sup>4</sup> The presence of a *filone supplementare*, a stabilizing wire closely aligned with each vertical wooden edge bar of the mold, is typical of Fabriano manufacture. I am grateful to paper historian Neil Harris for this information.

<sup>5</sup> Arundel ff. 116-119 and Arundel f. 211 (MS 263, British Library)

<sup>6</sup> Pedretti, Carlo and Carlo Vecce. *Il Codice Arundel 263 nella British Library: edizione in facsimile nel riordinamento cronologico dei suoi fascicoli*. Florence: Giunti, 1998, vol. 4, p. 59.

<sup>7</sup> The similarity, but not exactitude, i.e., moldmate status, of these two unusual watermarks has been noted by Martin Clayton and Claudio Calì. Claudio Calì, "Watermarks from Leonardo da Vinci's Drawings. A Relationship between Codex Atlanticus and American Collections," *35<sup>th</sup> Biennial Congress of the International Association of Paper Historians*, Washington, DC, June 7-10, 2021 (postprints forthcoming).

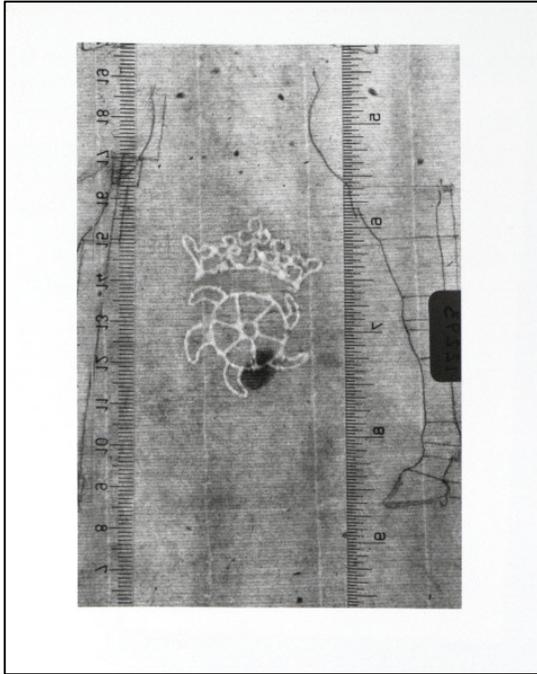


Figure 1. RCIN 912293 (transmitted light image <https://www.rct.uk/collection>)

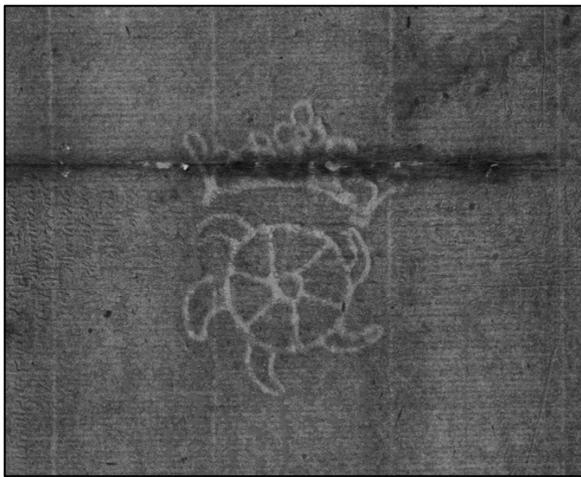


Figure 2. Arundel ff. 116-119, “denoised” to reduce interference from surface marks (image: W.A. Sethares)

The application of image processing software, designed to computationally “code” the manufactured patterns inherent to paper (measurable watermark features, chain line intervals, and laid line density), has revealed that these two sheets are not only similar but appear to be identical moldmates formed from the same papermaking mold. An animated overlay (figure 3) of transmitted light images of the two watermarks demonstrates that their internal characteristics – watermark features, chain line intervals, and laid line densities – match exactly.<sup>8</sup>

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<sup>8</sup> While a compelling case can be made that these two papers were formed from the same mold, absolute confirmation is hindered by the low-resolution image downloaded from the Royal Collection Trust website. Comparison of the chain lines intervals and their distinctive pattern would serve to confirm moldmate status.

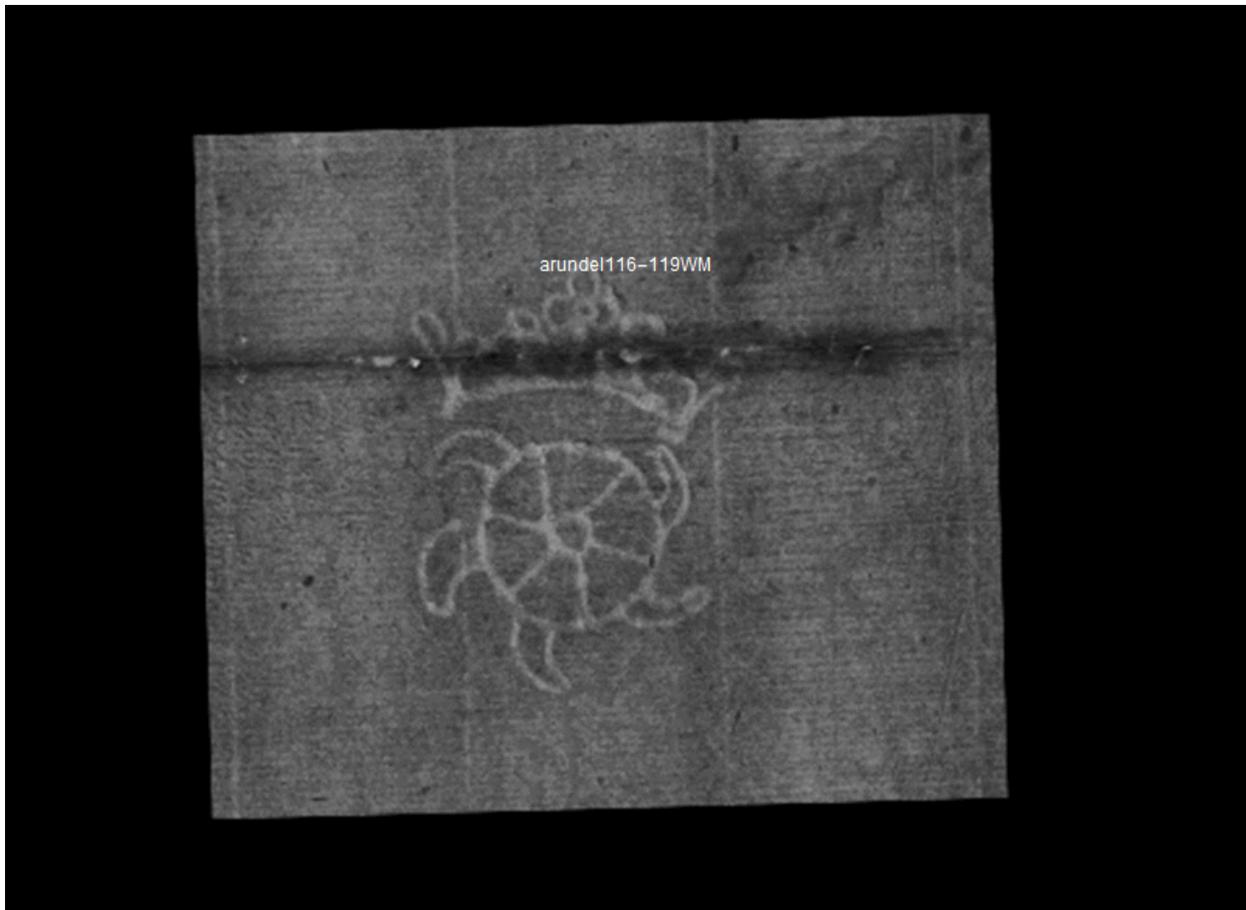


Figure 3. Animated overlay of RCIN 912293 and Arundel ff. 116-119 (video produced by C. Richard Johnson, Jr.)

The moldmate status of Arundel ff. 116-119 and RCIN 912293 could be additionally confirmed by comparing and matching the chain line intervals found in both sheets. This could be done via coding of their intervals or by simple visual inspection due to the presence of an idiosyncratic curved chain line clearly visible in the lower right portion of Arundel ff. 116-119 (figure 4). It should be noted that RCIN 912293 measures 25.7 x 16.6 cm. and appears to be approximately 3.5 centimeters smaller than the Arundel sheet, approx. 29 x 20.5 cm (11 3/8" x 8 1/4"),<sup>9</sup> which would theoretically leave seven chain lines for comparison. Therefore, a transmitted light image of RCIN 912293 in its entirety would quickly confirm moldmate status.

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<sup>9</sup> The dimensions given for the Codex Arundel are an average for the folios in the entire manuscript.

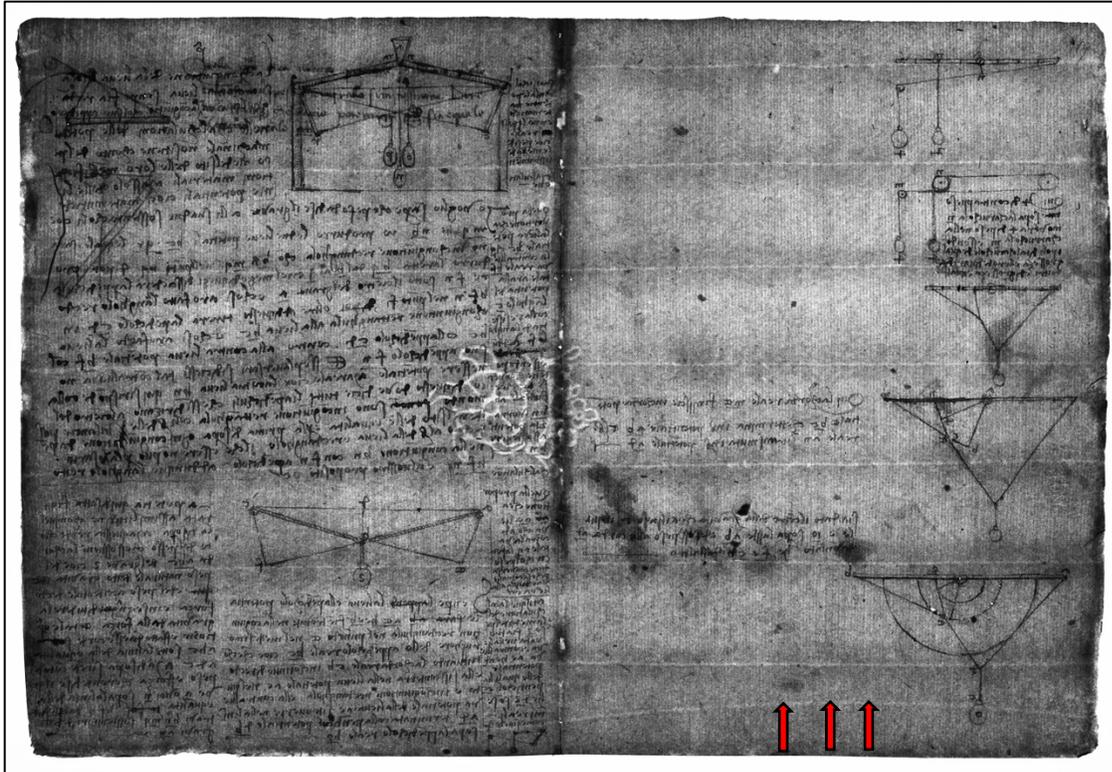
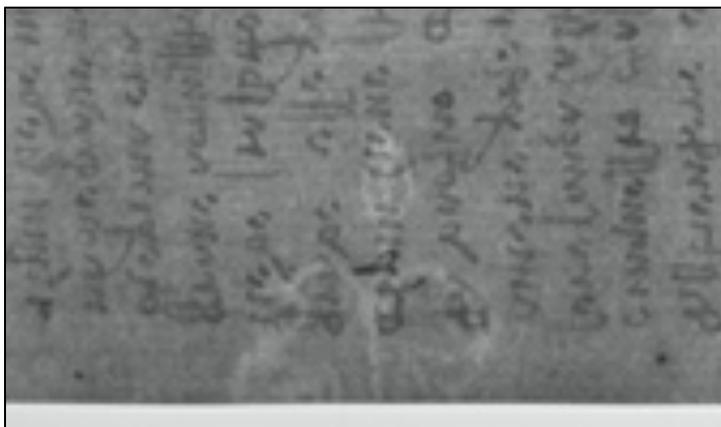


Figure 4. The red arrows point to a distinctive curved chain line in Arundel ff. 116-119 (transmitted light image ©British Library Board)

The identification of the second St. Catherine's wheel watermark type found in the Codex Arundel remains provisional. Pedretti and Vecce tentatively identified a partial watermark observed in Arundel f. 211 as three leaves branching from one stem that surmounts a missing six-bladed wheel (figure 5).<sup>10</sup>



<sup>10</sup> Pedretti, Carlo and Carlo Vecce. *Il Codice Arundel 263 nella British Library: edizione in facsimile nel riordinamento cronologico dei suoi fascicoli*. Florence: Giunti, 1998, vol. 4, p. 59.

Figure 5. Pedretti and Vecce suggest that a three-leaf finial theoretically surmounts a six-bladed St. Catherine's wheel watermark in Arundel f. 211 (transmitted light image ©British Library Board)

Pedretti and Vecce offer Briquet 13349 as the basis for their suggestion (figure 6).

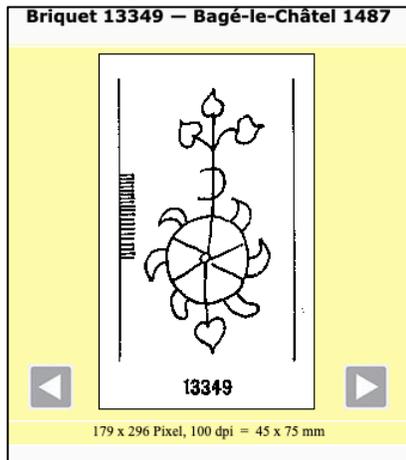


Figure 6. A three-leaf branch surmounting a St. Catherine's wheel watermark recorded by Briquet (See <https://memoryofpaper.eu/briquet/BR.php?refnr=13349&lang=fr>)

Notwithstanding the authors' remarkable powers of perception, the similarities are slight and the difference in date is quite broad. Furthermore, a cursory examination of the chain lines indicates that those of Arundel f. 211 are more widely spaced. A three-flowered branch surmounting a six-bladed St. Catherine's wheel has been recorded in RCIN 912344, however, the differences preclude any conclusions regarding its potential relationship with the Arundel sheets.<sup>11</sup>

Similarities among the St. Catherine's wheel watermark types found on four RCIN drawings – 912291, 912292, 912303, and 912309 – have been noted on the Royal Collection Trust website, however, only one image of the watermark, RCIN 912292, is available to be downloaded.<sup>12</sup> Computational coding of the watermarks and chain line intervals found in these four sheets might result in moldmate matches among them.

The identification of moldmates can significantly narrow speculation regarding the date and place of origin of these sheets. Papermaking molds, especially popular sizes,<sup>13</sup> had a functional life of approximately two years. While molds were bought and sold and could, thus, change mill locations, this would have to have occurred during the limited time that Leonardo was working in France.

<sup>11</sup> Image available: <https://www.rct.uk/collection/search#/2/collection/912344/designs-for-an-equestrian-monument>

<sup>12</sup> See footnote 2 above.

<sup>13</sup> The location and orientation of the watermark in Arundel ff. 116-119, having a quarto format, suggests that the original paper dimensions correspond to a French "pot" format, measuring 31 x 40 cm (12 ¼" x 15 ½"). Dimensions provided for the Codex Arundel are an average for the entire manuscript, not individual folios.

While watermark types can be used for decades, or even centuries, and across broad geographic regions, moldmates can suggest interconnections of time and place between specific sheets. That two long-separated works by Leonardo were created on papers made from the same papermaking mold invites investigation into historical connections between them.

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