

# Dating Maps with Sir Francis Drake's Route of Circumnavigation

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*This paper describes the nine sixteenth-century maps, texts, and globes that showed Sir Francis Drake's route of circumnavigation of the world. It shows the relationships between these nine artifacts and suggests the year of disclosure for each. The oldest of these is the Whitehall map, which was the direct or indirect precursor of the Drake-Mellon map, the French-Drake Van Sype map, the Dutch-Drake map, and the Hondius Broadside map. Most world maps published between 1561 and 1588 have a huge bulge on the coast of Chile. However, eight of the maps discussed in this paper shrank the bulge and moved it to the southern tip of Chile, using updated information from Drake's voyage.*

**KEYWORDS:** Whitehall map; Nicola van Sype; nautical charts; Sir Francis Drake; circumnavigation; bulge on the coast of Chile; Drake-Mellon map; Silver maps; Spanish Armada; sixteenth century

## INTRODUCTION

SIR FRANCIS DRAKE (CA. 1541<sup>1</sup>–1596) WAS AN English admiral, ship captain, naval navigator, world explorer, war hero, and privateer. The Spanish, however, viewed him as a ruthless pirate and called him *El Draque*, *The Dragon*. Drake commanded the second ship to circumnavigate the earth. This paper is about the first descriptions of Drake's route of circumnavigation.

Drake sailed from England in December of 1577 with a fleet of five ships and headed southwest across the Atlantic through storms, starvation, and mutiny. His purpose may have been to recover his losses to King Phillip II of Spain, to avenge his grievances against this king, or maybe it was to seize Spanish treasures. He passed through the Strait of Magellan and reached the Pacific Ocean in September 1578 with one remaining ship, the *Golden Hind*. Then, as he sailed north, he plundered Spanish ships and ports along the west coast of South America.

In June of 1579, he gave up pirating and searching for the Northwest Passage and spent five weeks onshore on the northwest coast of America repairing his ship and

preparing for a long voyage west across the Pacific Ocean. Then he sailed perhaps 10,000 miles non-stop in 100 days, an unprecedented feat, and arrived at his intended destination without running out of food or water. This was an unparalleled feat of navigation.

Drake sailed through the Spice Islands (the Moluccas or Maluku Islands) in November 1579 and then around the Cape of Good Hope. On the unremarkable final leg of his journey northwards up through the Atlantic Ocean, he stayed far away from Spain. He returned to England in September of 1580. His ship was bulging with stolen gold and silver from Spanish ships and ports, rare porcelains and silks from China, and spices from islands of the East Indies.

When he met with Queen Elizabeth on his return to England, Drake presented to her a map of the world with his route of circumnavigation drawn on it. She hung this map on a wall of her private quarters in her Whitehall Palace, hence its name, the *Whitehall* map. In honor of his circumnavigation of the world, in 1581 she knighted him.

1. Drake was born in the 1540s. The Library of Congress states 1543. Wagner (1926, 457) states between 1541 and 1545. Drake (1854, vi) states 1544. A quick survey of Internet sources with Drake's birthdate yielded  $\bar{x} = 1540.9$ ,  $\sigma = 1.4$ ,  $n = 33$ , and range = 1540 to 1545. We will use 1541. The reader can ignore all footnotes in this paper without a lack of continuity.



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About eight years later, world maps showing his route suddenly appeared. The purpose of these maps was presumably to honor Drake's achievement and show his route of circumnavigation. The following contemporary maps, globe, and book describe Drake's general route of circumnavigation.<sup>2</sup> No papers in the literature describe these nine artifacts as a group. In this list, we also give our final determination of their years of disclosure.<sup>3</sup>

- The *Whitehall* map 1580, burned in the seventeenth century.
- *Drake-Mellon* map 1589, *Vera descriptio expeditionis nauticae* . . . .
- Drake *Silver maps* 1589; see also [hdl.loc.gov/loc/rbc/rbdk.d058](http://hdl.loc.gov/loc/rbc/rbdk.d058).
- Richard Hakluyt 1589, "The famous voyage of Sir Francis Drake . . ." in *The Principall navigations* . . . , text only, no map.
- *French-Drake Van Sype* map 1589, *La Herdike Enterprinse* . . . .
- *Dutch-Drake* map 1594, *La Heroike Interprinse* . . . .
- Emery Molyneux 1592, *Petworth House Globe*.
- Jodocius Hondius 1595 map, *Vera Totius Exbitionis Nautica*, (*Broadside* map).
- Theodor de Bry 1599 map, *America Pars VIII*, a copy of the Hondius *Broadside*.

In this paper, these nine descriptions of Drake's route of circumnavigation will collectively be called the C9. The C9 without the *Whitehall* map will be called the C8. We recommend that the readers look ahead in this paper and familiarize themselves with Figures 2–8, which show the C8. URLs for these and all other maps mentioned in this paper are given in our list/database located at [sysengr.engr.arizona.edu/URLsForSixteenthCenturyMaps.xlsx](http://sysengr.engr.arizona.edu/URLsForSixteenthCenturyMaps.xlsx).

Why was there a gap of over eight years between the completion of Drake's voyage and the first public descriptions of his route? Probably because Queen Elizabeth wanted to keep all of Drake's discoveries secret from the despised and feared Spanish. This included where Drake had been, the fact that he had circumnavigated the world, how much gold and silver he had brought back, and most importantly his route of circumnavigation. The Queen forbade her subjects to disclose these state secrets *under pain of death* (de Mendoza 1896; Colthorpe 2017, 29).

As will be shown below, four of the C9 (the *Drake-Mellon*, the *French-Drake*, the *Dutch-Drake*, and the Hondius *Broadside* maps) were certainly based on the *Whitehall* map, either directly or indirectly: it was their common precursor. Figure 1 shows, with black arrows, information flows between the C9; grey arrows indicate uncertain information flows. This figure summarizes the literature about sixteenth-century maps that contain the route of Drake's circumnavigation of the world. While our general principle in this paper is to use only information contained on the maps themselves, this figure is an exception. It instead uses information from historical texts, sixteenth-century family, friendship, and religious relationships, language, geographical location of the cartographers, and chronology of the maps.

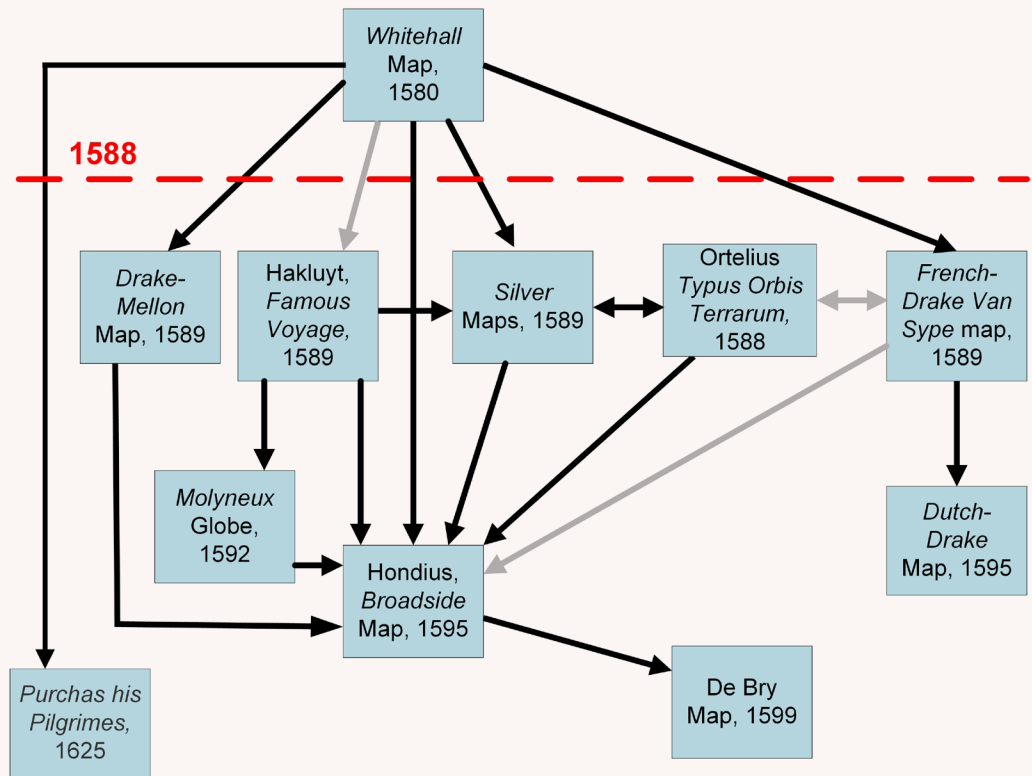
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2. We have found no other sixteenth-century maps or texts that show or describe the route of Drake's circumnavigation of the world, except possibly for the following four. The John Blagrave 1596 *Nova Orbis Terrarum Descriptio* map has the routes of circumnavigation of Drake and Cavendish (Shirley 1983, entry 191; Wallis 1984, 155). However, it uses a unique projection, featuring a north polar stereographic for the northern hemisphere, with the southern hemisphere added in four corner pieces to extend the map into the shape of a square. It is mathematically elegant but practically useless for our purposes because Drake's path cannot be readily followed into the corners. Gastaldi & De Jode's 1600 *Nova Totius Orbis Descriptio* map also had Drake's path but we did not include it in this paper because its origin is obscure and it was published too late to have affected the maps discussed in this paper (Shirley 1983, entry 174). It can be seen at <https://objects.library.uu.nl/reader/img.php?obj=1874-12850&img=/11/77/86/117786291475277382385409027987969932909.jpg>.

Bawlf (2015, 33) and Wallis (1984, 132) each show a copy of Ortelius's 1579 *Typus Orbis Terrarum map* from the British Museum that has Drake's route drawn on it. However, because Drake did not return to England until 1580, this route must have been added by an unknown person at an unknown later date. Furthermore, no other copies of the *Typus Orbis Terrarum* have Drake's route. Crispin de Passe in his 1598 *Effigies Regum ac Principum* has a portrait of Drake along with a simplified miniature of the Hondius 1595 *Broadside* map. However, it adds nothing new to our discussion. Of course, there may have been other maps with Drake's route that have simply disappeared over the last five centuries.

3. The years of disclosure mean when the creator first made the maps, etc. available for others to view. These dates are probably accurate to the year, not the month (Thrower 1984, 36). Our years of disclosure are usually the year after an enabling event. For example, Rumold Mercator first published his double-hemisphere equatorial stereographic map projection in 1587. We think that it would take a year to learn a new technique, make a new map or write a text, and then publish it. Therefore, the earliest year of disclosure we give for maps using that projection is 1588. In a similar way, the Spanish Armada was destroyed in August 1588. So, we state that maps and texts that depend on that event could have first been made public in 1589.

When we began this research, the state of knowledge about the information sharing between these sources was as shown in Figure 1. However, no previous papers have shown all of this in an integrated form. Although the *Ortelius Typus Orbis Terrarum* does not contain Drake's route of circumnavigation, it is included in Figure 1 because it is central to late sixteenth-century nautical world maps. Figure 1 foreshadows the findings of this paper, suggesting the incipient relationships between the C9 that will be revealed. Two purposes of the research presented in this paper are to find the relationships and the years of disclosure of these maps, globes, and books. We will start at the top of Figure 1 with the *Whitehall* map.



**Figure 1.** A flashforward suggesting the derivation and chronology of the first descriptions of Drake's route of circumnavigation of the world shown in this paper. Time runs roughly from the top to the bottom.

## METHODS

THIS PAPER ANALYZES THE RELATIONSHIPS OF THE sixteenth-century C9 that show Drake's route of circumnavigation of the world, based only on information shown on the maps themselves. My colleagues and I inspected over 2,000 sixteenth-century nautical charts and maps<sup>4</sup> that were available on the Internet. We downloaded 500 of these maps and examined them in detail. Of these, we recorded the 180 most relevant to Drake's route in our database, which is located at [sysengr.engr.arizona.edu/URLsForSixteenthCenturyMaps.xlsx](https://sysengr.engr.arizona.edu/URLsForSixteenthCenturyMaps.xlsx). Then the C9 were studied and dated in this paper.

This is not a traditional history paper as is commonly found in the fields of cartography. Instead, this paper introduces

a new genre of research writing about sixteenth-century nautical charts, by being based *only* on material contained in those charts and not modern interpretations of them. We do not make a statement about a map and then reference an earlier paper that made a similar statement. Rather we make a statement and then point to a feature on a map that supports that statement. We do not arrange the maps in chronological order. This paper does not present the religious, familial, or nationality relationships of the cartographers, or try to analyze their thinking or what their motives were. Nor does it present their ages, native languages, educations, or alma maters. In general, we do not use manuscript maps because the date can never be ascertained with certainty. We do not interpret our maps as

4. What is the difference between a nautical chart and a map? In general, a nautical chart is designed for navigation on the water. They emphasize oceans, seas, bays, and rivers and islands and shoals within them. Depending on the scale, they might give water depth. They show features along the coasts, like lighthouses and harbors, but do not emphasize inland features, like roads. An example would be a chart of the Pacific Ocean. In contrast, several types of land maps show mountains and their elevations, cities, political boundaries, railroad tracks, and other inland features. A map of Portugal would not be a nautical chart (Gaspar and Leitão 2019).

vehicles for the exercise of power to effect social-political ends as was done by Harley (1988 and 1989) and Edney (2019). This paper is an experiment. We wanted to show that research papers like this could be written based solely on information shown on charts and maps that are freely available on the Internet. Long trips to libraries are no longer necessary.

After we wrote this paper and ushered it through four rounds of reviews, we discovered the David Rumsey Map Center at Stanford University ([davidrumsey.com](http://davidrumsey.com)). It is the perfect solution for what we are trying to do. This online digital database contains over 125,000 maps and related

images dating from the sixteenth to the twenty-first century, and can be read by anyone, anywhere. Rumsey has said that he wanted to provide “open access to all art . . . freely available via the Internet” (Hessler 2023). The David Rumsey Map Collection’s capabilities exceeds our needs: “It allows searching maps by toponyms and text on the maps” (Hessler 2023). This database should further enable the new genre of map research we are suggesting here.

Of course, there are limitations to using only information on digitally published maps in research on nautical world maps. These are presented in the Limitations section of this paper.

## PURPOSES & ASSUMPTIONS

THE PURPOSES OF THIS PAPER ARE TO

- identify and describe all of the sixteenth-century maps, globes, and texts that describe Drake’s route of circumnavigation;
- use the information on these “maps” to adjust and justify the relationships and years of disclosure shown in Figure 1;
- describe the *Whitehall* map that Drake presented to Queen Elizabeth in 1580; and
- introduce a new genre of research papers about sixteenth-century nautical charts, ones based only on material contained on the maps themselves and not interpretations of them.

We made many assumptions while researching and writing this paper, and we continually checked their validity. These are some of the initial assumptions that were, in the end, deemed important and valid.

- The C9 were made in the last two decades of the sixteenth century.
- The C9 were made by different people.
- The *Whitehall* map was the first to shrink the large bulge on the west coast of Chile and move it to the southern tip of South America.
- Some of the C8 cartographers saw the actual *Whitehall* map and some did not.
- Queen Elizabeth’s ban on disclosing the details of Drake’s circumnavigation was effective for eight years, until the defeat of the Spanish Armada in 1588.
- We have found all of the sixteenth-century nautical maps that contain Drake’s route of circumnavigation.

One initial assumption that was discarded was that the *Whitehall*-derived maps were made in southern England.

## SIXTEENTH-CENTURY MAPS WITH DRAKE’S ROUTE OF CIRCUMNAVIGATION

IN THIS SECTION, WE GIVE GENERAL DESCRIPTIONS OF THE C9. Details will be added in later sections.

### WHITEHALL MAP

On his voyage of circumnavigation, Drake had with him maps and charts, along with paint brushes and pens for embellishing them. Furthermore, he took the maps from

every Spanish ship he seized. We speculate that during the voyage, he and his cousin John drew his route of circumnavigation on one of them. Then on his return to England in 1580, he presented it to Queen Elizabeth (Colthorpe 2017, 27). This map then joined the royal map collection in her “Majesties Gallerie at Whitehall, neere the Privie Chamber” (Purchas 1625).<sup>5</sup> No modern cartographer has seen the *Whitehall* map because everything in the royal

5. This map might have been put on public display in the Whitehall Palace after 1589 (MacGregor 2013).



map collection at Whitehall was presumably destroyed in fires in the seventeenth century. The only known first-hand visual description of this map was made by Samuel Purchas (1625).

### DRAKE-MELLON MAP

The *Drake-Mellon* map (Figure 2) was made with pen, ink, and watercolors on vellum. This manuscript map is held in the Paul Mellon Collection, Yale Center for British Art at Yale University Library, [collections.britishart.yale.edu/catalog/orbis:9579023](https://collections.britishart.yale.edu/catalog/orbis:9579023). It is not attributed to any particular cartographer or artist (Wallis 1984, 141–145). Its text is in Latin. Wallis (1984) dates it as “after 1586” (138) and “not later than 1590” (141). It includes Drake’s Caribbean voyage of 1585–86. Because it is a manuscript map, it is hard to be sure of its cartographer and date.

This map has flags with the cross of St. George planted four places in the Americas. This map also contains the names *Virginea* [sic] and *California*.

This map shows the general route that Drake took during his circumnavigation. However, the route is not detailed enough to be used for navigation. Presumably, the purpose of this map was to document Drake’s unique feat, not to give directions for replicating it. It might have never been put on public display.

### DRAKE SILVER MAPS

The *Drake Silver* maps are 68 mm (2.7 in) diameter sterling silver disks with maps of the known world in the sixteenth century, featuring Drake’s route of circumnavigation stamped on them (Christy 1900; Hague 1908; [hdl.loc.gov/loc.rbc/rbdk.d058](https://hdl.loc.gov/loc.rbc/rbdk.d058)). The nine existing medallions have weights from 260 to 424 grains (0.6 to 1 oz, 17 to 27 g) (Kraus 2022a, item 58). Each of these medallions has a diameter that is about the same as that of a tennis ball. The variation in weight is due to differences in thickness: the lightest one is as thin as a thumbnail (0.46 mm) and the heaviest one is as thick as a credit card (0.76 mm) (Bahill 2022b). Christy (1900) emphatically states that they were created in 1581. MacGregor (2013) states 1589.



**Figure 2.** The *Drake-Mellon* map (*Vera descriptio expeditionis nauticae Francisci Draci Angli . . .*) shows Drake’s approximate route of circumnavigation of the world in 1577–80 with black dots on brown lines and his Caribbean voyage of 1585–86 with black lines. This manuscript map uses an equirectangular map projection.



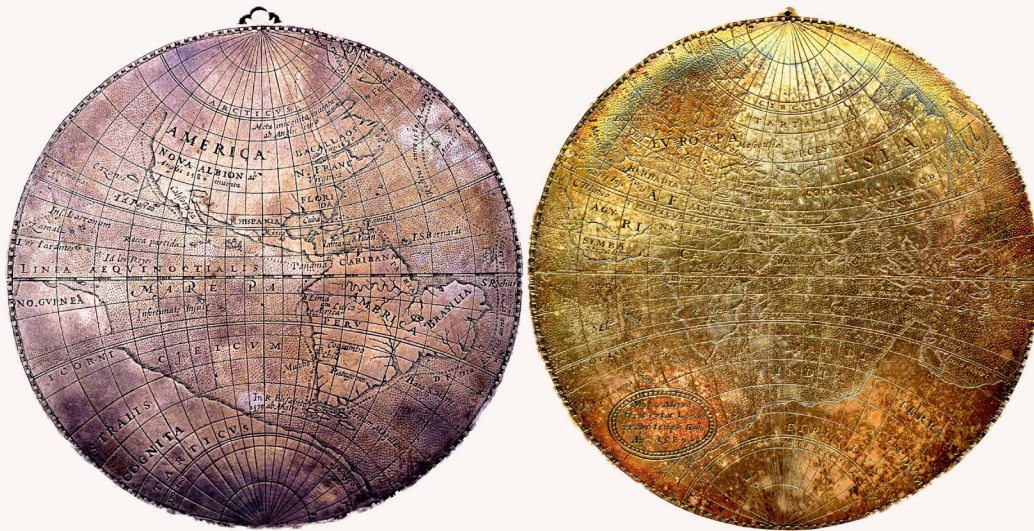
## RICHARD HAKLUYT'S BOOK

“The famous voyage of Sir Francis Drake into the South Sea, and there hence about the whole Globe of the Earth, begun in the yeere of our Lord, 1577,” is a section that comprises twelve unnumbered pages in Richard Hakluyt’s

1589 volume *The Principall navigations, voiajes and discoveries of the English nation*, which he self-published.

The content of these pages is also given in *The World Encompassed* (Drake 1854, 92–93), *The Anonymous Narrative* (Wagner 1926, 277–285), and *The English Hero* (R. B. 1695).

This summary of Drake’s voyage was corroborated and elaborated by John Drake, Sir Francis Drake’s cousin (sometimes mistakenly called his nephew), who was on the voyage of circumnavigation, in his testimony before the Spanish Inquisition in March 1584 and January 1587 (Nuttall 1914). However, these declarations were presumably not seen by an Englishman



**Figure 3.** Drake Silver maps. The medallion on the left, showing the western hemisphere is from the British Museum (2024). On the right, the eastern hemisphere is from the Library of Congress. These medallions are 68mm in diameter and are shown at their actual size. Each medallion uses a Mercator double-hemisphere equatorial stereographic map projection. The maps have parallels and meridians every ten degrees.



**Figure 4.** French-Drake Van Sype map, *La herdike enterprinse faict par le Signeur Draeck D’Avoir circuit toute la Terre*. This is on an equirectangular map projection. Note the cartouches.



for a long time, because they were state secrets of the Spanish Inquisition.

### FRENCH-DRAKE VAN SYPE MAP

The *French-Drake Van Sype* map, *La herdike enterprinse fait par le Signeur Draeck D'Avoir cirquit toute la Terre*, is seen in Figure 4 (Shirley 1983, entry 149). This map is attributed to Nicola van Sype (or van Sype), whose name is engraved to the right of the distance scale in the lower right-center. Most assume that this was the name or pseudonym of the cartographer, the engraver, or a friend of theirs. However, nothing is known about Nicola van Sype (Wallis 1984). The *La Herdike Enterprinse* map, shown in Figure 4, was written in French, and is usually called the *French-Drake* map (Wagner 1926, 427–434). It was printed from an engraved copper plate. The Kraus Collection at the Library

of Congress **dates it to 1581**. Wallis (1984) dates it as “1582–83 or later” (143) but “not later than 1590” (141). Aker (1970, 70) wrote a “date not later than c. 1585.”

### DUTCH-DRAKE MAP

The *Dutch-Drake map*, *La heroike interprinse fait par le Signeur Draeck D'Avoir cirquit toute la Terre*, was a copy of the *French-Drake Van Sype* map. It uses French for the title, a mixture of Early Modern Dutch and French for the cartouches, and Latin and Spanish for the toponyms. See Figure 5 (Shirley 1983, entry 151). Wagner (1926, 424–426) dates it as 1641.<sup>6</sup> Aker (1970, 77) opines that the *Dutch-Drake* map was published after the *French-Drake* map, but he estimates the *Dutch-Drake*'s date of publication as 1581.

6. Wagner (1926) has two mistakes. On page 424 the heading has the word *Enterprinse* whereas it should be *Interprinse* and on page 427 the heading has *Interprinse* which should be *Enterprinse*. Aker (1970, 68; 77) caught one of these mistakes but left the other. He called both the *French-Drake* and the *Dutch-Drake* maps *La Heroike Enterprinse*.



Figure 5. Dutch-Drake map *La heroike interprinse fait par le Signeur Draeck D'Avoir cirquit toute la Terre*. This map is on an equirectangular projection.



## MOLYNEUX PETWORTH HOUSE GLOBE

Emery Molyneux's *Petworth House Globe* was made in 1592 (Figure 6). It has the routes of circumnavigation of both Sir Francis Drake (1577–80) in red and Sir Thomas Cavendish (1586–88) in blue (Wallis 1951; Wallis 1984; Dekker 2007; Blundeville 1613). This may be the first public display of Cavendish's route of circumnavigation.

## JODOCIUS HONDIUS BROADSIDE MAP

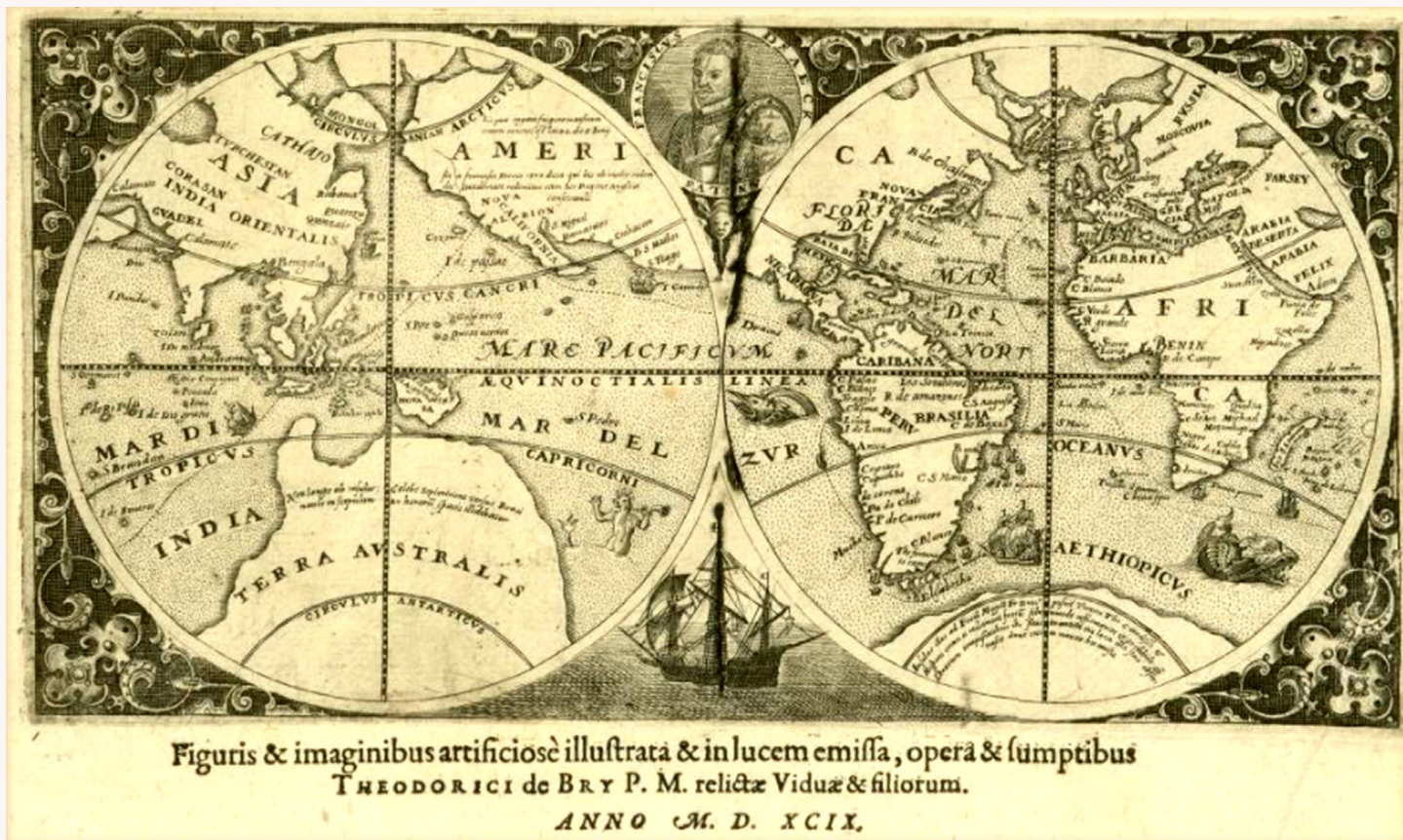
The Jodocius Hondius 1590 and 1595 map *Vera Totius Exbitionis Nautica* (Figure 7) is commonly known as the *Broadside* map. Generally, a broadside was a large sheet of paper having words and graphics printed on one side only, such as a poster or handbill. This particular broadside has

**Figure 6, right.** Molyneux's 1592 *Petworth House Globe*. It is about two feet one inch (63.5 cm) in diameter.

**Figure 7, below.** Hondius 1595 *Broadside* map. This piece is on a Mercator double-hemisphere equatorial stereographic projection. For convenience, it uses a ten-degree graticule.







**Figure 8.** The De Bry 1599, *America Pars VIII* map, like the Hondius *Broadside* map, is a Mercator double-hemisphere equatorial stereographic projection.

the routes of circumnavigation of both Drake (1577–80) and Cavendish (1586–88). See Shirley (1983, entry 188) and [lcn.loc.gov/92680608](http://lcn.loc.gov/92680608).

Hondius lived in London from 1584 to 1593. Wallis (1984, 145) states that of the six surviving copies of the *Hondius Broadside* map, three were issued in London in 1590 and the other three in the Netherlands in 1595. Wallis (1984, 145) and Aker (1970, 102) both mention the “Jodocus Hondius fecit Londini” written on the back of one of these maps. Wagner (1926 239) states that the *Hondius Broadside* map was engraved in 1595.

### THEODOR DE BRY MAP

The De Bry map *America Pars VIII* (Figure 8) is nearly the same as the *Hondius Broadside* map (Shirley 1983, entry 219; van Groesen 2007), and is viewable at [jcb.lunaimaging.com/luna/servlet/s/j4s58c](http://jcb.lunaimaging.com/luna/servlet/s/j4s58c).

We have found no other sixteenth-century maps or texts that show or describe the route of Drake’s circumnavigation of the world; however, see footnote 2.

## TEXT IN BOTTOM CENTER CARTOUCHES

THE TEXTS IN THE CARTOUCHES OF THE *DRAKE-Mellon*, *French-Drake*, and *Dutch-Drake* maps (Figures 2, 4, and 5) are surprisingly similar and are consistent with the description of the *Whitehall* map given by Purchas

(1625, 461–462). We will now compare Purchas’s comments about the *Whitehall* map to the texts in the bottom center cartouches of the other three maps.

## PURCHAS' COMMENT ABOUT THE WHITEHALL MAP

This is the complete comment by Purchas (1625, 461–462) about the *Whitehall* and *Silver* maps.

... I adde their New Straights Southwards from those of Magelane were discovered before by Drake, as in the Map of Sir Francis Drakes Voyage presented to Queene Elizabeth, still hanging in His Majesties Gallerie at White Hall, neere the Privie Chamber, and by that Map (wherein is Cabotas [Sebastian Cabot's] Picture, the first and great Columbus for the Northerne World) may be seene. In which Map, the South of the Magelane Straits is not a Continent, but many Is[lands], and the very same which they have stiled in their Straits. Barneuels Is[lands] had long before been named by the most auspicate of Earthly Names (and let themselves be Judges, with which the other is as little worthie to be mentioned, as a kind Mother, and an unkind Traitor. The name Elizabeth<sup>c</sup> is expressed in golden Letters, with a golden Crowne, Garter, and Armes affixed: The words ascribed there unto are these, Cum omnes feré hanc partem Australem Continentem esse putent, pro certo sciant Insulas esse Navigantibus periurias, earumqum australissimam ELIZABETHAM à D. Francisco Draco Inventore dictam esse. The same height of 57. degrees, and South-easterly situation from the Magelan Westerne Mouth give further evidence. And my learned friend Master Brigges told me, that he hath seene this plot of Drakes Voyage cut in Silver by a Dutchman (Michael Mercator, Nephew to Gerardus) many years before Scouten or Maire [Williem Schouten and Jacques Le Maire] intended that Voyage. As for Nova Zemla by Stephen Burrough, and others, long before discovered, they also have given new names, which, I envie not: only I feare a vae soli [being alone] and hate ingratitude both ours and theirs. But too much of this. Next to this more generall Discourse shall follow the Dutch Northerne Voyages, and the English North-easterne: after which wee will take a more complementall leave of that Continent, and from thence visite the Northerly

and North-westerne Discoveries; at once hunting for a New World and a New passage to This

<sup>c</sup> [footnote in original] In the [s]aid Map is Queene Elizabeths Picture, with Neptune yielding his Trident, and Triton sounding her Fame, with these Verses, Te Deus aequoreus donat Regina Tridente, Et Triton laudes esslat ubique tuas.

The following is our summary of the comments by Purchas (1625) about the *Whitehall* map.<sup>7</sup>

- The *Whitehall* map was hung next to a map by Sebastian Cabot that had Cabot's picture on it.
- It was hung in the Whitehall Palace near the Privy Chamber (the private apartment of the sovereign).
- It had the name Elizabeth in gold letters. It had Queen Elizabeth's coat of arms encircled with a garter belt and topped with a crown.
- It had Queen Elizabeth's picture with Neptune yielding his trident.
- It shows or reports that Drake was at 57° S latitude, southeast of the western mouth of the Strait of Magellan.
- There was not a continent south of the Magellan Straits, but, rather, there were many islands.
- Latin was used for all text.
- These words were inscribed on it (our translation): "Since almost all think that south of this part is a Continent, let them know for certain that the islands are passable by those sailing on it, and that the southernmost part of them is named ELIZABETH by the discoverer Francis the Dragon."

## COMPARISON OF TEXT IN THE BOTTOM-CENTER CARTOUCHES

We will now use this quotation to examine maps that were clearly copied from the *Whitehall* map, Table 1. Purchas did not specify where on the *Whitehall* map the Latin inscription appeared. But a similar sentence appears in the bottom center cartouche of the *Drake-Mellon*, the *French-Drake*, and the *Dutch-Drake* maps shown in Figures 2, 4, and 5, respectively.

7. Please note that *Purchas, his pilgrimage* ... 1613, *Purchas, his Pilgrim* ... 1619, and *Purchas his Pilgrimes* ... 1625 are three entirely different books written by Samuel Purchas (1577–1626).



<b>Whitehall map, Purchas (1625, 461–462)</b>	<b>Translation by the author</b>
<b>Latin</b> Cum omnes feré hanc partem Australem Continentem esse putent, pro certo sciant Insulas esse Navigantibus peruias, earumqum australissimam ELIZABETHAM à D. Francisco Draco Inventore dictam esse.	<b>English translation</b> Since almost all think that south of this part is a Continent, let them know for certain that the islands are passable by those sailing on it, and that the southernmost part of them is named ELIZABETH by the discoverer Francis the Dragon.
<b>Drake-Mellon map, Figure 2</b>	<b>Translation by the author</b>
<b>Latin</b> Cum omnes feré hanc partem australem continente esse putent, pro certo sriant insulas esse earugum australissimam ELIZABETHAM dictam esse, a Francisco Draco eiusde inventore	<b>English translation</b> Since almost everyone thinks that this southern part is the continent, for certain they must be the southernmost of the islands, ELIZABETH, that it was said to have been discovered by Francis the Dragon.
<b>French-Drake map, Figure 4</b>	<b>Translation by Mike Horner</b>
<b>French</b> Combien que l'on pense que la partie meridionale du destroit soit terre ferme chÿ et ce qu'elle est tres certain que ne sont gillas la prochain de midi à l'este nommé Elisabete par le dirt sig drack qui pmier la descouverte.	<b>English translation</b> However much one may think, that south of the strait is terra firma it is very certain that [these are islands] of which the next from South to East named Elizabeth by the said Seigneur Drake who first discovered it.
<b>Dutch-Drake map, Figure 5</b>	<b>Translation from Aker (1970, 80)</b>
<b>Dutch</b> Dat Suÿderste deel van Mageliano den. Draeck eerst Ontdaen en Sin niet ðan Eÿlande. Waer af tsuÿderste bÿ hem gename .S. Elisabet. La Partie mēridionale Magellānes ne Sont qù isles. [This sentence is in French.]	<b>English translation</b> The southern part of the Magellanes, which Drake first discovered, are not but isles of which the most southern was named by him S. Elizabeth. The southernmost part of the Magellanes are nothing but islands.

**Table 1.** Comparison of texts on the *Whitehall*, *Drake-Mellon*, *French-Drake*, and *Dutch-Drake* maps.

These four descriptions of the southern tip of South America are remarkably similar. From these wordings, we should assume that the *Drake-Mellon*, *French-Drake*, and *Dutch-Drake* maps were derived from the *Whitehall* map.

Earlier researchers, for example, Shirley (1993, entries 149 and 151), have further concluded that the *Dutch-Drake* map is a copy of the *French-Drake* map. We agree with this conclusion.

## TEXT IN THE UPPER-LEFT CARTOUCHES

THE *DRAKE-MELLON*, *FRENCH-DRAKE*, AND *DUTCH-DRAKE* maps also have cartouches in their upper left, and the texts in these are also similar to each other. And in this case, a fourth map, the Hondius *Broadside*, contains a title box with similar text, as shown in Table 2.

Using these translations for the text in the cartouches, we can easily infer the flow of information from the *Whitehall* map to the Hondius *Broadside* map indicated in Figure 1.

Moreover, all four of these maps have cartouches in the bottom corners. Those in the bottom-right represent the *Golden Hind* being aground on a shoal off of Celebes island in January of 1580. The cartouches in the bottom-left corners show the *Golden Hind* being triumphantly towed into Ternate, one of the Moluccas islands. We now wish to offer evidence for the information flow arrows from the *Whitehall* map to the Hakluyt text, to the *Silver* maps, and thence to the Hondius *Broadside* map.

<b>Drake-Mellon map, Figure 2</b>	<b>Translation by the author</b>
<p><b>Latin</b>  Vera descriptio expeditionis nauticae, Francisci Draci Angli, equitis aurati, qui quinq[ue] navibus probe instructis, ex occidentali Anglia parte anchoras solvens, tertio post decimo Decembris An[n]o MDLXXVII, terrarum orbis ambitum circumnavigans, unica tantum navi reliqua (alijs fluctibus, alijs flamma correptis) redux factus, sexto supra vigesimo Sep. 1580.</p>	<p><b>English translation</b>  A true description of the naval expedition of Francis Drake, Englishman and Knight, who with five ships departed from the western part of England on 13 December 1577, circumnavigated the globe, and returned on 26 September 1580, with one ship remaining, the others having been destroyed by waves or fire.</p>
<b>French-Drake map, Figure 4</b>	<b>Translation by Mike Horner</b>
<p><b>French</b>  La vraie description du voyage du sr fransoys draeck Chevalier lesquel estant acompaigne de cing navires deux desquel il brula ung aultre sen retourna et la quarter fuit peris il partit d'Angleterre le 13 desembre 1577 passa oultre et fit le sirquit de toute la terre et retourna audict royaume le z6 Septembre 1580</p>	<p><b>English translation</b>  The true description of the journey of Seigneur Francis Drake Knight who is accompanied by five ships two of which he burned another returned and the fourth perished. He left from England on 13 December 1577, passed beyond and made the circuit of all the earth and returned to the said kingdom 26 September 1580</p>
<b>Dutch-Drake map, Figure 5</b>	<b>Translation from Aker (1970, 79)</b>
<p><b>Dutch</b>  Beschriuinge vān Reÿse gadaen by Francoÿs Draek met 5 schepen. Waer af .2. Verbrande eeniuce derkē en een vergink if Seÿlende Vÿt Engelant den: 13 dissember .7.7. Naeden westen om die Ganse Cloot des Aertrix int Onsl wederom opcomende eade Alsoo In Engelant Den. 26. September 1580. Comme le Cap. <sup>ne</sup> Draeck Singlant d'Angleterre a, cercui Entre'lan '77. et 80 Toute la terre. [This sentence is probably in French.]</p>	<p><b>English translation</b>  Description of the journey made by Francis Drake with 5 ships of which 2 burnt down, one returned and one was wrecked sailing off from England the 13th of December '77 in west direction around the whole Globe of the earth, in the east coming up again and on this way back in England the 26 September 1580. Captain Drake sailing from England, has circumscribed between the years '77 and 80 all of the earth.</p>
<p><b>Hondius 1595 Broadside map, Figure 7. The contents of the title box are equivalent to the upper-left cartouches of Figures 2, 4, and 5.</b></p>	<b>Translation by the author</b>
<p><b>Latin</b>  Descriptio D. Franc Draci qui 5, navibus probé instructis, ex Anglia solvens 13 Decembris anno 1577, terrarum orbis ambitum circumnavigans, unica tantum navi, ingenti cum gloria, ceteris partim flammis, partim fluctibus correptis, in Anglim 27 Septembris 1580.</p>	<p><b>English translation</b>  The description of D. Francis Drake who with 5 ships properly equipped, departing from England 13 December 1577, circumnavigating the compass of the world only one boat returned with great glory in England 27 September 1580, some of the others burned, some were caught by the waves.</p>

**Table 2.** Comparison of texts in the upper-left cartouches of the *Drake-Mellon*, *French-Drake*, and *Dutch-Drake* maps and the title box of the *Broadside* map.

## FROM WHITEHALL TO HAKLUYT TO THE SILVER MAPS TO THE HONDIUS BROADSIDE

ISLA MOCHA, OFF THE CENTRAL CHILEAN COAST (38° S, 74° W), was a significant stop for Drake and his men. Two of his crew were killed and Drake was shot

with arrows. This island is shown as a stop and is labeled as Mucho on the *Drake-Mellon* map, the *Silver* maps, and the Hondius *Broadside* map and is described in detail in



the text “The famous voyage of Sir Francis Drake . . .” (Hakluyt 1589; Drake 1628). Therefore, Isla Mocha is a link between these sources of information. The *French-Drake* and *Dutch-Drake* maps did not label the island. Therefore, they are more distant from the Whitehall map.

The *Silver* maps and the Hondius *Broadside* map show a large inland lake, the precursor of the Salton Sea in southern California. The *Drake-Mellon*, *French-Drake*, and *Dutch-Drake* maps do not show this lake. The *Silver* and *Broadside* maps also show and label the Pacific Ocean islands named Rocca Partida, Cazones, I. de Pasiao, and Ambon. The *Drake-Mellon*, *French-Drake*, and *Dutch-Drake* maps might show these islands but they do not label

them. Again, this shows the affinity of the *Silver* maps and the Hondius *Broadside* map and their detachment from the *Drake-Mellon*, *French-Drake*, and *Dutch-Drake* maps.

The *Drake-Mellon*, *French-Drake*, and *Dutch-Drake* maps draw Japan as a horizontal oval centered on 155° W latitude. The *Silver*, *Broadside*, and de Bry maps orient it vertically centered on 175° E.

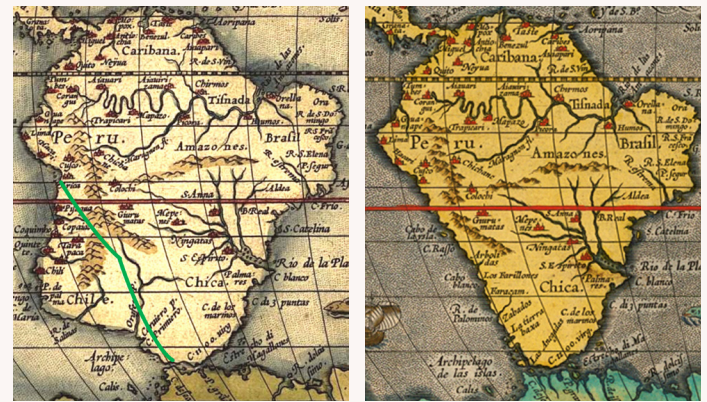
These paragraphs suggest that there was an information flow from the Whitehall map to the Hakluyt text to the Silver Maps and finally to the Hondius *Broadside* map. The *French-Drake* and *Dutch-Drake* maps were not a part of this flow.

## THE BULGE ON THE COAST OF CHILE

GIROLAMO RUSCELLI, IN HIS *ORBIS DESCRIPTIO* MAP in his 1561 atlas *La Geografia di Claidio Tolomeo Alessandrino*, put an enormous bulge on the coast of Chile. This bulge is more than four times the size of Spain. He was followed by Pablo Forlani in 1562, Giacomo Gastaldi circa 1561 and 1565, Diogo Homen in 1565, and many others. This bulge lies between the Tropic of Capricorn (23.4° S) and 45° S latitude as shown in the lefthand portion of Figure 9 (Bahill 2022a).

Abraham Ortelius published his atlas *Theatrum Orbis Terrarum* in 1570. Then he updated and reissued it just about every year. The *Typus Orbis Terrarum* maps in his atlases from 1570 to 1587 had this enormous bulge on the coast of Chile, as he was (along with Mercator in 1569) an early adopter of this feature. Others followed Ortelius by adding bulges to their coasts of Chile, for example, André Thevet 1575, Francisco de Belleforest 1575, Gerald de Jode 1578, Joan Martines 1582 and 1587, Rumold Mercator 1587, Urbano Monte 1587, Sebastian Munster 1580 and 1588, Cornelius De Jode 1589, Theodor de Bry 1592, Michael Mercator 1595, and Arnolfo di Arnoldi, 1600. Note that URLs for these maps (and others mentioned without a formal reference in this paper) are available in our database at [sysengr.engr.arizona.edu/URLsForSixteenthCenturyMaps.xlsx](https://sysengr.engr.arizona.edu/URLsForSixteenthCenturyMaps.xlsx).

Drake was known to have taken maps with him on his trip of circumnavigation. Furthermore, whenever he seized a



Abraham Ortelius 1587 (P2S2)

Abraham Ortelius 1588 (P2S3)

**Figure 9.** Parts of *Typus Orbis Terrarum* by Ortelius 1587 (P2S2) (left) and 1588 (P2S3) (right). Land to the west of the green line is the bulge (Bahill 2022a). The only differences between the two maps are to the left of the green line. To the right of the green line, land, rivers, mountains, and other toponyms on these maps can be superimposed. The abbreviations P2S2 and P2S3 stand for plate-2 state-2 and plate-2 state-3, respectively. It is shorthand to distinguish maps with small variations (Shirley 1983). These are in Ortelius oval map projections. Parallels of latitude and meridians of longitude are spaced ten degrees apart.

Spanish ship, he took their maps and navigation charts. He may have had some of the above-mentioned maps with him. However, no known European explorer or cartographer had been to this section of the coast of Chile before Drake in 1578.<sup>8</sup> Therefore, when Drake followed existing, unfounded maps, he got lost.

8. Magellan sailed through this area. Albo's log of Magellan's route (Albo 1874) lists him as cruising northward along the Chilean coast from 48° S latitude up to 36° S latitude where he headed west out into the Pacific Ocean. But Magellan left no maps. Ribero made an accurate map in 1529, but it only went up as far as 52° S.

Several textual descriptions of Drake's voyage describe his sailing from the southern tip of South America. Nuño da Silva's<sup>9</sup> deposition to the Spanish Inquisition (Wagner 1926, 342; Moreno Madrid 2022) stated that from November 1 to 5 they sailed northwest. This is four-plus days. Assume they sailed at a slow 50 miles (80 km) per day. This would give them over 200 miles (320 km). The protrusion on the Wright-Molyneux 1599 map (Gitzen, 2014) of Figure 10 is about 220 miles (350 km) at 49° S latitude. Da Silva continued, then they changed direction to the northeast for a few days and then to the north for 20 days: finally, they landed at Isla Mocha (Mucho Island). This meandering is described by the red track at the southern end of South America in Figure 10. The above synopsis is from Nuño da Silva's deposition. However, there are several similar descriptions.<sup>10</sup>

This Chile bulge mistake in the maps seems to have vexed Captian Drake, who wrote:

... we continued our course, *November 1*, [1578] still North-west, as wee had formerly done, but in going on we soone espied, that we might easily have beene deceived; and therefore casting about and steering upon another [compass] point, wee found, that the general mappes did erre from the truth in setting downe the coast of *Peru*,

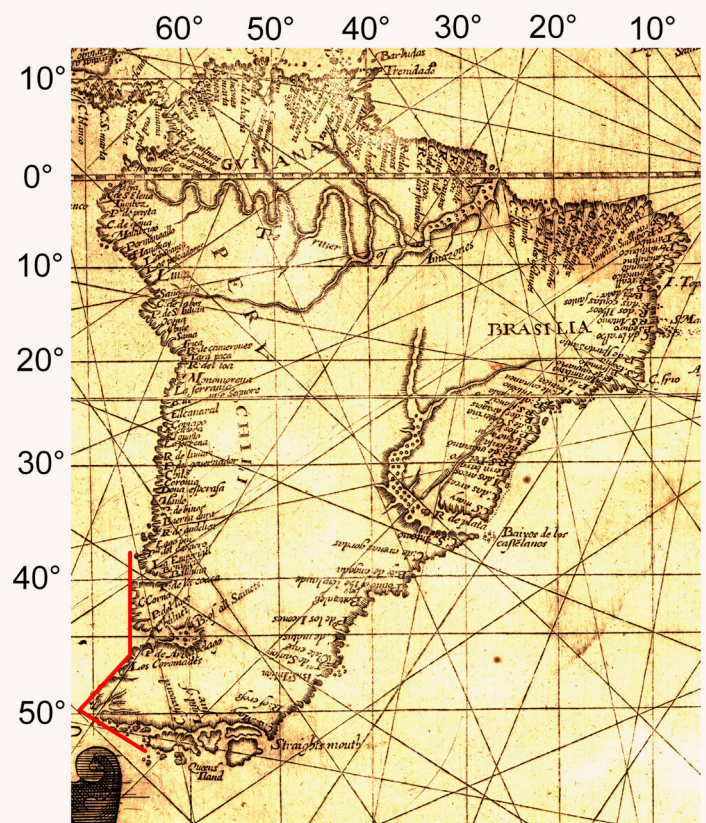
Drake refers to the whole South American coast as Peru, not differentiating between Chile and Peru. After describing the section of the coast between 52° S and 40° S latitude, he continues:

... perceiving hereby that no man had ever by travell discovered any part of these 12. deg., and therefore the setters forth of such descriptions are not to be trusted, much less honored, in their false and fraudulent coniectures which they use, not in this alone, but in divers other points of no small importance. (Drake 1854, 92–93)

At the end of his circumnavigation of the world, Drake returned to England in 1580. We conjecture that he expressed his displeasure to some cartographers and

presumably he corrected the coast of Chile on his *Whitehall* map because afterwards, there was a proliferation of changes to this coastline. When the changes appeared, there were three distinct manifestations: one group of cartographers omitted the bulge entirely (Figure 9), a second group shrunk the bulge and made it a small protrusion between 52° S and 44° S latitude (Figures 2, 4, 5, 7, 8, and 10) and finally a third group fell behind the times and continued to publish maps with the big bulge on the coast of Chile.

Ortelius omitted the bulge on his *Typus Orbis Terrarum* map that was printed in 1588 (Figure 9, right). He did the



**Figure 10.** A section of the Wright-Molyneux 1599 map showing South America with a part of Drake's path shown in red. Other cartographers probably used this description (in red) to fill in the land behind it. This is a Mercator projection map. However, this does not preclude wind roses with correctly interconnected rhumb lines throughout the whole map. Parallels of latitude and meridians of longitude are spaced ten degrees apart.

9. Nuño da Silva was a Portuguese pilot. He was captured by Drake in the Cape Verdes in January of 1578 and was released in Mexico in May 1579. He served as Drake's pilot along both sides of South America.

10. This same description is given in *The World Encompassed* (Drake 1854, 92–93), "The famous voyage of Sir Francis Drake" (Hakluyt 1589), *The Anonymous Narrative* (Wagner 1926, 277–285), *The English Hero* (R. B. 1695), and John Drake's testimony before the Spanish Inquisition (Nuttall 1914).



same on his *Americae Sive* 1587,<sup>11</sup> and his *Maris Pacifici* 1589. For the most part, these maps were all contained in his atlases: they were not published individually. This, therefore, makes their dating fairly certain. However, we do not know the month in 1588 when he published his map. So, we do not know if he had a head start on the other C8 cartographers.

Ortelius and his followers constituted the first group of cartographers who either removed the bulge on the southern coast of Chile after 1588 or had never put it there in the first place. These cartographers included: the *Silver* maps 1589, Plancius 1590 and 1594, C. de Jode 1593 (*Brasilia et Peruvia*), Vrients 1596, Lavanha & Teixeira 1597, Hondius 1592 and 1597, and Ricci 1602 (Bahill 2022a).

Our second and most important group of cartographers did not omit the bulge but instead shrunk it and made it a small, protrusion between 52° S and 44° S latitude with a peak at 49° S (see Figures 2, 4, 5, 7, 8, and 10). They moved it around a thousand miles (1600 km) down the coast. The average area of the bulge on these maps is 10% of that of the large bulges on pre-1588 maps (Bahill 2022a). Maps and other artifacts that have this small protrusion at the very southern end of South America include the 1580 *Whitehall* map (probably), the 1589 *Drake-Mellon* map, the 1589 Hakluyt text, the 1589 *French-Drake* map, the 1594 *Dutch-Drake* map, the 1592 Molyneux globe, the 1595 Hondius *Broadside* map, the 1599 Theodor de Bry map, and the 1599 Wright and Molyneux map of Figure 10; but not the 1589 *Silver* maps. This group is the C9 plus the Wright and Molyneux map but without the *Silver* maps.

The red path shown in Figure 10 was constructed from descriptions given in “The famous voyage of Sir Francis Drake” (Wagner 1926, 277–285; 342; Moreno Madrid 2022; Drake 1854, 92–93; Hakluyt 1589; R. B. 1695). It outlines the small protrusions that are seen on the maps of the second group of cartographers. These protrusions are almost the same among the C8-minus-Silver-maps and no other maps have this protrusion.<sup>12</sup> This is strong evidence

of a common ancestor for these maps, shown in Figure 12—namely the *Whitehall* map or “The famous voyage of Sir Francis Drake” text.

We speculate that cartographers started with this description of Drake’s path (in red in figure 10) and filled in the land behind it. In Figure 10 and the C8, toponyms are dense along the whole coast of South America, except along this fictitious peninsula. Cartographers typically invented toponyms to fill in empty space. But they did not do that here. This must mean that they had no information and, in this case, they did not want to invent any.

This description of the Chilean coast of South America was probably one of the Queen’s most prized secrets because at the time there were no good maps of this region and the undocumented maps that Drake had on board got him lost.

The third, and least important, group of cartographers did not get the word and continued to publish maps with the bulge on the southern coast of Chile; for example, Munster 1588, C. De Jode 1589, Theodor de Bry 1592, M. Mercator 1595, and Ruscelli 1599.

Because this section is so important, it merits a summary. Starting in 1561 several cartographers drew their nautical world maps with a huge bulge on the coast of Chile. Within the next dozen years, many cartographers followed suit. It is quite likely that the maps Drake had with him on his voyage of circumnavigation had this incorrect bulge, causing him difficulty navigating the southern coast of Chile. When Drake returned to England, we speculate that he had stern words with cartographers about their “false and fraudulent coniectures” (Drake 1854, 92–93). Speculating again, we suggest that this caused them to correct their mistakes in one of two ways. The maps show that one group of cartographers omitted the bulge completely and the second group shrunk the bulge and moved it to the southern tip of Chile. Most of our C9 were in the second group (all except for the *Silver* maps). This shows a previously unnoticed commonality of the C9 that is not described in the literature.

11. This map is dated 1587. So, it seems to have an earlier date than the 1588 Ortelius *Totius Orbis Terrarum*. In addition, the *Novus Orbis* map that was published in Paris and is dated 1587 and was included in Hakluyt’s text of 1587 also seems to have a confusingly earlier date.

12. The 1602 LeClerc and Hondius *Orbis Terrae Novissima Descriptio* also has this protrusion (Shirley 1983, entry 233) but it is not included in our C9 because it does not have Drake’s route of circumnavigation and it was published in the seventeenth century.

## SIMILARITIES AND DIFFERENCES BETWEEN THE MAPS

THE MAIN PURPOSE OF THIS SECTION IS TO SHOW the relationships between the C9 as shown in Figure 1. We will start with the *Drake-Mellon*, *French-Drake*, and *Dutch-Drake* maps. These relationships, shown in Table 3, help derive the years of disclosure of these maps and they help show who copied from whom.

### IMPORTANT SIMILARITIES OF THE WHITEHALL-DERIVED MAPS

The comparisons in Table 3 imply that, first, the *Drake-Mellon*, the *French-Drake*, and the *Dutch-Drake* maps

without a doubt drew information from the same common precursor, either directly (black arrows in Figure 1) or indirectly (grey arrows). Second, the *Dutch-Drake* map was derived from the *French-Drake* map (Shirley 1983). It probably did not draw information directly from the *Whitehall* map. It drew information from other contemporaneous maps. We can assume that the *Drake-Mellon*, the *French-Drake*, and indirectly the *Dutch-Drake* maps were derived from the same common precursor, the *Whitehall* map. Therefore, in this section, we will call these collectively the Whitehall-derived (WHD) maps. These three WHD maps look generally alike.

Aspect	Feature	Drake-Mellon map	French-Drake map	Dutch-Drake map
Route Similarities	<b>Drake's route of circumnavigation is</b>	<b>almost the same on all three maps</b>		
Text Similarities	Words in the title	none	La <b>Herdike</b> <b>Enterprinse</b> Faict Par Le Seigneur Draeck D'Avoir Cirquit Toute La Terre	La <b>Heroike</b> <b>Interprinse</b> Faict Par Le Seigneur Draeck D'Avoir Cirquit Toute La Terre
	Language of the title	none	French	
	<b>The contents of the five cartouches describe</b>	<b>the same events</b>		
Text Differences	The engraver's or cartographer's name	none	Nicola van Sype?	none
	Note in the lower-right	none	map seen and corrected by the said signeur Drack	none
	The language used in cartouches is	Latin	French	Dutch and French
	The number 2 is represented by	2's and z's	the letter z	the number 2
	Text in cartouches have	different handwriting		
	Compare the handwriting of	"Reditus" below the Cape of Good Hope	"Route De retour" below the Cape of Good Hope	"Route de retour," Nicaragua, and Guatemala
	Font labeling oceans	simple	simple	fancy

**Table 3.** Similarities and differences between the *Drake-Mellon* map, the *French-Drake* map, and the *Dutch-Drake* map. Cells in a **boldface** font are especially important. Table continues on following pages.



Aspect	Feature	Drake-Mellon map	French-Drake map	Dutch-Drake map
Ornament Similarities	<b>Galleon icons showing the number of major ships in Drake's fleet at that location</b>	<b>are the same</b>		
	Shadows on cartouches	are correct (Bahill 2021)		
Ornament Differences	Portrait of Drake	none	oval containing an engraving of Drake stating his age as forty-two	circular ring with lettering and a different engraving of Drake
	Coats of arms of Queen Elizabeth	instead, it has flags with the cross of St. George	one in Nova Albion and one below the Strait of Magellan	none
	Has sea monsters	no	yes	no
Land Similarities	Latitude of islands off the NW coast of America	<b>39°</b> , boldface indicates a landing site	38°, <b>40°</b> , 41°, 43°	39°, <b>40°</b> , 42°, 45°
	Drake's maximum north latitude	39°	45°	47°
	North America, South America, Europe, and Asia	are similar		
	<b>Bulges on the southern coast of Chile are</b>	<b>the same unusual size, shape, and southern position (49° S)</b>		
	Shape and position of Japan	the same shape (horizontal oval) and position (155° W)		
Land Differences	Isla Mocha is labeled (as Mucho)	yes	no	no
	The land above Europe and the Arctic Circle	none is shown		Terra Forma, Nova Zembla
	Newfoundland is	a peninsula		an island
	The shape of the Black Sea is	good	rudimentary	basic
	The shape of the Mediterranean Sea between Italy and Spain is	good	grossly wrong	good
	The position of the Azores Islands is	west of the zero-longitude meridian		Incorrectly east of this meridian

**Table 3**, continued.

Aspect	Feature	Drake-Mellon map	French-Drake map	Dutch-Drake map
Land Differences	The shape of Madagascar is	one large island	many islands near the coast	One large island
	Unique mid-ocean islands	none	huge imaginary island between India and the Red Sea	Saint Helena in the South Atlantic
	The Pacific coast of North America has labels for	California	no toponyms	Quivira, California Nicaragua, and Guatemala
	Florida is labeled	yes	no	yes
	Virginia is labeled	yes	no	
	Has Terra Australis	no	yes	
	The Amazon River is	shaped like a giant snake	Straight and wide	
	The Nile River	connects the Mediterranean Sea to the Atlantic or the Indian Ocean in South Africa		
Cartographic Similarities	<b>Mapping projection is</b>	<b>equiarectangular</b>		
	<b>The maps have a prominent equator and linearly graduated central meridian</b>	yes		
	The zero-longitude (central) meridian is	Cape Verde Islands, 23° W	25° W	28° W
Cartographic Differences	Meridians of longitude are numbered 10, 20, 30, etc. from the central meridian going	<b>eastward</b>		<b>westward!</b>
	Materials	drawn with pen and ink and watercolors on vellum	printed on paper from engraved copper plates	
	The Tropics of Cancer and Capricorn	are labeled		are shown but are not labeled
Other	Size (width by height) cm	43 by 22	44 by 24	44 by 24
	Estimated year of disclosure	1589	1589	1594

Table 3, continued.

In addition, the following specific features from Table 3 and earlier sections strongly suggest that these three maps had a common precursor.

- All three WHD maps have a cartouche in the bottom center-left with near-identical text, which is almost the same as that described by Purchas (1625) as being on the *Whitehall* map.
- The five cartouches on each of these three WHD maps describe the same items and events. The top-left corner cartouches describe the overall voyage. The bottom-left corner cartouches show the *Golden Hind* being towed ceremoniously into Ternate in the Moluccas Islands. The bottom left-center cartouches describe land south of the Strait of Magellan. The bottom right-center cartouches contain the scale of distance. The cartouches in the bottom-right corner show the *Golden Hind* grounded on a reef near Celebes Island. (The Hondius 1595 *Broadside* map, has similar drawings in similar cartouches.)
- All of the WHD maps used the equirectangular projection, which was antiquated and uncommon in the late sixteenth century. For maps published in Shirley (1983) and dated between 1587 and 1607, 31% used the Ortelius oval projection, 26% used the Mercator double-hemisphere equatorial stereographic projection, only 8% used an equirectangular projection and the rest used one of a dozen other projections.
- All three of these maps have a prominent equator and central meridian. Their graticules are evenly spaced labeled in degrees. The spacing confirms that the maps use an equirectangular projection.
- They each feature the Arctic Circle, the Tropic of Cancer, the Equator, the Tropic of Capricorn, and the Antarctic Circle. Their spacings further confirm the equirectangular projection.
- These maps are in a landscape orientation and all have an approximate size of 44 cm width by 24 cm height (17.3 by 9.5 in).

- The Rio de la Plata is immense on all of these maps.
- They all have the Nile River with connections extending from the Mediterranean Sea to oceans near the Cape of Good Hope.
- The shadows on the cartouches (Bahill 2021) are consistent between all three WHD maps.
- They have the Pacific Coast of North America at least up to 50° N latitude.
- Zero-longitude meridians on the three are 23° W, 25° W, and 28° W of Greenwich.
- All three of these maps have Drake's general route of circumnavigation with only minor differences. Most of these differences are ports and islands where he landed.
- Aside from landing point differences, these three routes are almost the same. There is one feature in particular that shows a good knowledge of Drake's route. That is the place south of the Strait of Magellan where a huge storm blew his ship backward down to 55°–57° S latitude. At this point, Drake named the southernmost island Elizabeth.<sup>13</sup> Purchas (1625) refers to Drake being at 57° S latitude, southeast of the western mouth of the Strait of Magellan. All three of our WHD maps have this detail the same.
- All three of the WHD maps have galleon icons showing the number of major ships in Drake's fleet at various locations. However, from time to time, Drake captured and released Spanish ships, barks, and pinnaces.
- The three WHD maps have the same shape and position for Japan.

Besides the maps mentioned in this paper, no other maps have all of the above features. Most assuredly, the three WHD maps had a common precursor, and that precursor was the *Whitehall* map.

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13. Wagner (1926, 91) quotes an account that states that Drake "going ashore, carried a Compaſſe with him, and seeking out the Southermost part of the Iland, cast himselfe downe upon the uttermost point groveling, and so reached out his bodie over it. Presently he imbarked, and then recounted unto his people, that he had bene upon the Southermost knowne Land in the World, and more further to the Southwards upon it, then any of them, yea, or any man as yet knowne." Francis Fletcher, however, wrote the same story but claimed that it was *he* (Fletcher) who performed this dramatic act (Drake 1854, 88).

## THE NILE RIVER

The three WHD maps in Figures 2, 4, and 5 have the source of the Nile River in South Africa, as most other sixteenth-century nautical world maps. This model for the Nile River originated with Ptolemy in the Second Century AD.

The *Drake-Mellon*, *French-Drake*, and *Dutch-Drake* maps have simplistically drawn river systems. The *French-Drake* and *Dutch-Drake* maps, however, each have a river flowing out of the more southern of the Nile River source lakes going to the Atlantic Ocean near the Cape of Good Hope. In a similar way, the *Drake-Mellon* map, and some other sixteenth-century maps have a river flowing from one of these lakes to the Indian Ocean. Thus, many maps have a continuous, but non-navigable, waterway from the Mediterranean Sea to the Atlantic and/or the Indian Ocean in Southern Africa.

## IMPORTANT DIFFERENCES BETWEEN THE WHD MAPS

The handwriting in the cartouches is different in the three WHD maps. See in particular the handwriting in the upper-left cartouche. These differences suggest that these three maps had different illustrators/engravers.

Both the *French-Drake* and the *Dutch-Drake* maps mistakenly label the Moluccas Islands at 20° N latitude. However, these are the Mariana Islands. The Moluccas Islands are on the equator. The *Drake-Mellon* map correctly labels these Mariana Islands as Ini Ladrones.

## UNIQUE FEATURES ON THE DRAKE-MELLON MAP

Between 1545 and 1600, most maps that included South America represented the Amazon River shaped as a giant snake, as in Figures 2, 3, 9, and 10 (Bahill and Gitzen 2021). Of our three WHD maps, only the *Drake-Mellon* map has this feature. We do not know about the *Whitehall* map but it might have been influenced by the Sebastian Cabot map of 1544 and that map does represent the Amazon River shaped as a giant snake.

The *Drake-Mellon* manuscript map was made with pen, ink, and watercolors on vellum. As a result, only one copy was probably made, unlike the *French-Drake* and *Dutch-Drake* maps, which were printed from engraved

copper plates. That one copy is now in the Yale University Library. It is an undated manuscript map. Below the label for VIRGINEA is this text (originally in Latin): “VIRGINEA Colony was led into this part of the continent by Walter Raleigh knight in 1583.” Therefore, this map was surely finished after 1583. Raleigh was knighted in 1585. If the labeling of Virginia and the route of Drake’s Caribbean voyage were added to this map at a later date (for example after 1586), then the *Drake-Mellon* map could be the original *Whitehall* map!

## UNIQUE FEATURES OF THE FRENCH-DRAKE MAP

A grossly incorrect feature on the *French-Drake* map is a peninsula protruding from Marseille, France almost to Africa. The western Mediterranean Sea had been drawn accurately on many fourteenth- and fifteenth-century portolan charts. Therefore, the introduction of such a careless error is surprising. Greg McIntosh (in a personal communication) wrote that this appears “to be an area of the plate that was left unengraved by mistake, then made into a coastline. Very strange. Most likely an error of the engraver, not of the cartographer.”

Another mistake on this *French-Drake* map was drawing Madagascar as several small islands close to the coast of Africa. From Gemma Frisius’s 1544 *Charta Cosmographica* and afterward, almost everyone drew Madagascar as one large island quite detached from Africa. One final mistake is the huge island (the size of Great Britain) between India and the Horn of Africa. Wallis (1984) suggested that the cartographer of the *Drake-Mellon* map had more time to study the *Whitehall* map than the cartographer of the *French-Drake* map and therefore was more correct.

The following two items are unique to the *French-Drake* map, but they do not help us to differentiate or date the maps. In some Medieval and Renaissance styles of writing, the letter z stood for the number 2. This evaluation criterion differentiates maps from the first and second halves of the sixteenth century, with earlier maps more likely to use z=2. In concurrence, the last map we have found with this is the D. Teixeira 1573 *World* map (Bahill 2021). The *French-Drake* map is anomalous in this respect because it consistently used z=2. This could hint at an earlier year for the *French-Drake* map. The *French-Drake* map had two icons of Queen Elizabeth’s coat of arms, one below Terra del Fuego and the other west of Nova Albion. This also did not help date this map.



## DRAKE PASSAGE

The bottom center cartouches on all three WHD maps state that below the Strait of Magellan, there are many islands and not a large continent. Earlier maps, for example, by Mercator in 1569 and Ortelius in 1570, show a southern continent (Terra Australis) close to the South American mainland, so that the Strait of Magellan is the only route between the Atlantic and Pacific Oceans. However, the *French-Drake*, *Dutch-Drake*, *Hondius Broadside*, and *Silver* maps have their southern continent around 500 to 700 miles away from the South American mainland. This is the Drake Passage.

The *Drake-Mellon* map, the J. S. G map in Hakluyt (1587) (sometimes called the Martyr-Hakluyt map), the Molyneux globe, the De Bry map, and the Wright-Molyneux map do not have this southern continent at all. Therefore, they also have ample room for the Drake Passage below South America. Most other maps of this era have Terra Australis close to the South American mainland. This wide passage was touted by many as an important discovery by Drake. All of the C8 have this wide Drake Passage.

Drawing Terra Australis on a sixteenth-century map was certainly not new. The first such representation may have been on the Piri Reis 1513 map (McIntosh 2000). Later cartographers who did this included Cabot in 1544, Mercator in 1569, and Ortelius in 1570. What was unique about the *French-Drake*, *Dutch-Drake*, *Hondius Broadside*, and *Silver* maps was leaving a large expanse of open ocean south of mainland South America and north of Terra Australis.

The C8 correctly did not put toponyms on Terra Australis. Sixteenth-century maps with toponyms on the Terra Australis are pure fantasy. These can be found, for example, in Gutiérrez & Cock 1562, G. Mercator 1569, Ortelius 1570 to 1587, Thevet 1575, R. Mercator 1587, Plancius 1590 and 1594, De Jode 1593, and Van Langren 1596.

## UNIQUE FEATURES OF THE DUTCH-DRAKE MAP

The *Dutch-Drake* map cleaned up some of the *French-Drake* map's mistakes by (1) removing the peninsula protruding from Marseille, France almost to Africa, (2)

drawing Madagascar as one large island well separated from Africa, (3) removing the huge island between India and the Horn of Africa, and (4) adding land above Europe, north of the Arctic Circle. It left some mistakes, and it added some of its own, such as moving the Azores east of the zero-longitude meridian.

The *Dutch-Drake* map uses Dutch and French for the cartouches, Latin and Spanish for toponyms, and French for the title. The *Dutch-Drake* map shows a wide Northwest passage. This passage looks similar to those of Gerald Mercator 1569, Ortelius 1570–1587, Belleforest 1575, Urbano Monte 1587, and Rumold Mercator 1587. It has also added the Northeast Passage and Florida.

There are two versions or states of the *Dutch-Drake* map. The one in the Huntington Library has the letters MA RE O C CE AN US spread out across the Atlantic and Indian Oceans. The copies at Christie's (since sold, but an image can still be reviewed) and Daniel Crouch Rare Books (Figure 5) instead spell out MAR DEL NORTE, OCEANUS AETIODICUS, and MAR INDICUM (Aker 1970, 77).

A very strange feature of the *Dutch-Drake* map is that it labels the meridians of longitude starting with zero and increasing going *westward* to 360°. The only other cartographer that we know of who consistently followed this practice was Herman Moll, who published in the eighteenth century. We have no conjecture about this very odd feature.

## UNIQUE FEATURES ON THE SILVER MAPS

The *Silver* maps were commissioned by Drake. We assume that he gave the cartographer directions and maybe a map with his route of circumnavigation. Therefore, the cartographer would not have needed to see the *Whitehall* map. Thus, the arrow from the *Whitehall* map to the *Silver* maps has been diminished going from Figure 1 to Figure 12. The cartographer of the *Silver* maps was not Michael Mercator. Born in 1567, he was probably too young. He was the engraver of only the cartouche and the maker of only one of the silver medallions. The handwriting in the cartouche is different than the handwriting on the rest of the medal (Bahill 2022b).

The *Silver* maps label the landing at Mucho island (the *Drake-Mellon* map, the *Broadside* map, and the Hakluyt

text also do) and do not have the landings at Río de la Plata, S. Julian, Pe lima, and Sierra Leone as the *French-Drake* and *Dutch-Drake* maps do.

The *Silver* maps are the only constituents of the C8 that removed the bulge on the coast of Chile, like the Ortelius 1588 *Typus Orbis Terrarum* (Figure 9), unlike the other C8 that shrank it and moved it to the southern tip of Chile as shown in Figure 10. Hence the *Silver* maps have minimal relationships with the three WHD maps.

Another unique feature is that only the *Silver* maps, the *Drake-Mellon* map, and the Molyneux globe label Virginia. The *Silver* maps label Terra Australis and place it far away from South America, so that there is plenty of room for the Drake Passage. Only the *French-Drake*, *Dutch-Drake*, Hondius *Broadside*, and *Silver* maps have this feature.

The *Silver* maps do not have the cartouches that (1) state “Since almost all think that south of this part is a Continent . . . ,” (2) show the *Golden Hind* being towed ceremoniously into Ternate, or (3) show the *Golden Hind* grounded on a reef near Celebes island.

These features emphasize that the *Silver* maps are different from the WHD maps. The *Silver* maps have greater affinity with the Hakluyt text and the Ortelius *Typus Orbis Terrarum* map. We conclude that the cartographer of the *Silver* maps received his information from Drake himself, whereas the cartographers for the Whitehall-derived maps received their information from the *Whitehall* map.

## WHO COPIED FROM WHOM?

ONE OF OUR NOT-VERY-SPECULATIVE CONCLUSIONS IS that the *Dutch-Drake* map was copied from the *French-Drake* map. This is also the conclusion of Shirley (1983) and of many others. The *Dutch-Drake* map was made in a later year by a mapmaker different than the one that made the *French-Drake* map. The general route of Drake’s circumnavigation is the same on both maps. However, the *Dutch-Drake* map has many additional toponyms that are not on the *French-Drake* map, such as California, Guatemala, Nicaragua, and Saint Helena; no toponyms

## FEATURES OF THE MOLYNEUX GLOBE

The Molyneux Globe 1592 has the routes of circumnavigation of both Sir Francis Drake 1577–80 and Sir Thomas Cavendish 1586–88. The Molyneux globe has the distinctive bulge at the southern tip of Chile (Wallis 1984, 152).

## UNIQUE FEATURES ON THE HONDIUS BROADSIDE MAP

The Jodocius Hondius 1595 map, *Vera Totius Exhibitionis Nautica*, nicknamed *Broadside*, is similar to the *Drake-Mellon*, *French-Drake*, and *Dutch-Drake* maps, with respect to Drake’s route of circumnavigation and the cartouches at the bottom of the maps.<sup>14</sup> Its major difference is that it uses the Mercator double-hemisphere equatorial stereographic projection instead of an equirectangular. However, numbers along the equator indicating longitude in the western hemisphere are all ten degrees too large. This map is 56 cm wide and 41 cm high.

## FEATURES ON THE DE BRY MAP

The 1599 De Bry map is a copy of the 1595 Hondius *Broadside* map, except that it has no cartouches or graticule. The De Bry map has the distinctive small bulge on the southern coast of Chile. Although it is not as distinctive as the other C9 maps, it does complete the collection of sixteenth-century maps with Drake’s route of circumnavigation. There are many copies of this map in varied sizes. The map on the front cover of his book is about 23 cm wide and 12 cm high.

from the *French-Drake* map were removed. Secondly, the *Dutch-Drake* map more accurately depicts the shapes of the Black Sea, the Mediterranean Sea, Madagascar, Newfoundland, and all lands north of the Arctic Circle. As expected, new knowledge made the copy more correct than the original. Third, the handwriting in the cartouches is different between the two maps. The original and the copy were engraved by different hands. Figure 1 shows the *Drake-Mellon* and *French-Drake* maps being derived from the *Whitehall* map and the *Dutch-Drake* map being derived

14. This map has an additional inset in the upper-left corner labeled “Portus Novae Albionis” that describes the place where Drake spent five weeks in the summer of 1579. However, this is not useful for us, because in 1700 AD the magnitude 9 Cascadia Earthquake and its resulting 40 foot (12 m) tsunami wave resculpted the Pacific northwest coast (Schulz 2015; Williams, Marken, and Peterson 2017). Therefore, the bay shown in the inset in the upper-left corner of the map and the place where Drake spent those five weeks, if it still exists, would be completely unrecognizable today.

from the *French-Drake* map. There is no evidence that the creator of the *Dutch-Drake* map used any information directly from the *Drake-Mellon* map or the *Whitehall* map.

Our second conclusion about copying is that the *French-Drake* map was *not* copied from the *Drake-Mellon* map. One piece of evidence for this is the shapes of the Amazon River. Between 1545 and 1600, most maps that included South America represented the Amazon River as a giant snake, as in Figures 2, 3, 9, and 10 (Bahill and Gitzen 2021). The *Drake-Mellon* map has this feature, but the *French-Drake* map does not. Drake's maximum northern latitude is 39° on the *Drake-Mellon* map and 45° on the *French-Drake* map. This was a key point that was widely discussed, as it would help determine how much land the English could claim from the Spanish along the Pacific coast of North America. On the *Drake-Mellon* map, the shape of Madagascar is correctly shown as one large island,

whereas the *French-Drake* map shows it as many small islands near the coast of Africa. The *Drake-Mellon* map labeled three regions in North America, namely California, Florida and Virginia. If the cartographer of the *French-Drake* map had seen this he surely could have remembered them and put them on his map. These two maps were both disclosed in 1589, so there was not enough time for either to copy from the other. Finally, the *Drake-Mellon* map is a manuscript map: we speculate that it was hidden in the privy chamber of the Queen's palace to shield it from the prying eyes of the despicable Spanish.

The purpose of these last two sections has been to show the relationships between the C9. These relationships were applied to Figure 1 to produce Figure 12. No one fact is responsible for any one arrow, but taken together, all of these facts constitute evidence for the arrows. The next section will derive the dates shown in Figure 12.

## DATING THE C9 MAPS

OUR EARLIEST DISCLOSURE DATES ARE USUALLY A year after the event that precipitated them. For example, Queen Elizabeth's ban on disclosing details of Drake's circumnavigation ended in August of 1588. It is unlikely that some cartographer had a map all ready to go when the ban on disclosure evaporated, so that they could quickly release it in the last months of 1588. Therefore, our earliest dates of disclosure are 1589.

Furthermore, we think that it would take around a year to learn a new map projection, engrave a new map or set of dies, and then publish the map or stamp the medallions. For example, the Mercator double-hemisphere equatorial stereographic map projection was first published in 1587 by Rumold Mercator. So, maps that used this projection were certainly made years after 1587. Indeed, the first maps adopting this map projection were the 1589 *Silver* maps and the Plancius 1590 map. Similarly, the name Virginia originated in 1584, but it did not appear on a known map until the 1587 Hakluyt-Martyr map (Hakluyt 1587, 19).

The purpose of this section is to present evidence for the years of disclosure given in Figure 12. For maps that were printed, this would be the year of publication, if this were known. For one-of-a-kind objects, like the *Whitehall* map, the *Drake-Mellon* map, or the Molyneux globe, this would be the year the creator gave the object to its recipient or

made it open for public view. Thus, these would be the years that:

- The *Whitehall* manuscript map was presented to Queen Elizabeth.
- The *Drake-Mellon* manuscript map was drawn.
- The *Silver* maps were stamped into silver disks.
- The Richard Hakluyt text was published.
- The *French-Drake* maps were printed.
- The *Dutch-Drake* maps were printed.
- The Emery Molyneux *Petworth House Globe* was unveiled.
- The Jodocius Hondius *Broadside* map was published.
- The Theodor de Bry map was published.

This section breaches our general principle of using only information printed on maps.

## GENERAL CONSIDERATIONS

### *Extinction of the Ban on Disclosure*

Drake's route of circumnavigation was kept secret for over eight years. Queen Elizabeth wanted to keep all of Drake's discoveries secret from the Spanish, whom she loathed.



Therefore, in 1580, she forbade Drake's crew from revealing any of these state secrets *under pain of death*.

Here is a review of the extinction of the Queen's ban. "Drake had been given express orders that 'none shall make any charts or descriptions of the said voyage,' a prohibition of publication that was to remain in force until 1588" (Harley 1988, 61). "Secrecy about the Drake voyage was kept through the decade. When the new edition of Holinshed's *Chronicles* was published in 1587, it was immediately recalled and censored" (Kelsey 1990, 448). "A further prohibition of any publication giving details of the route and reports of the discoveries appears to have been in force until at least 1588" (Wallis 1984, 136). In 1589 four important descriptions of Drake's route of circumnavigation were published (Toppin 2013), namely: (1) *Vera descriptio expeditionis nauticae Francisci Draci Angli*, colloquially called the *Drake-Mellon* map; (2) Richard Hakluyt, "The famous voyage of Sir Francis Drake. . ." in *The Principall navigations, voiaiges and discoveries of the English nation*, (text only, no map); (3) the *Silver* maps; and (4) the *French-Drake*, *La Herdike Enterprinse Faict Par Le Seigneur Draeck D'Avoir Circuit Toute La Terre*. Because of Queen Elizabeth's ban on disclosing information, we think that all of the *Whitehall* map derivatives were first disclosed in 1589.

In August of 1588, the English navy and a fierce storm in the North Sea destroyed almost all of the Spanish ships, sailors, and soldiers of the Armada. After this calamity for her enemies, the Queen no longer feared the Spanish, and thus her ban on disclosing details of Drake's circumnavigation faded away. Thomas Cavendish completed the third circumnavigation of the world just a month after the defeat of the Spanish Armada and his maps and journals were not subjected to the secrecy that Drake's were.

If the *French-Drake* and the *Dutch-Drake* maps were printed on the European continent, then they may have escaped the Queen's ban on divulging information. But then, how did the cartographers get their information? The Queen's ban seems to have been highly effective for eight years: there were no documented leaks.

The prohibition of disclosing information about Drake's circumnavigation is our strongest evidence for dating all of the C8 as after 1588. In the following paragraphs, we will abbreviate this as "QueensBanEnded1588."

## *Bulge on the Coast of Chile*

Our policy is that we try to only use information contained in maps. We prefer not to rely on (1) historical texts, (2) family, friendship, and religious relationships, (3) geographical location of the cartographers, or (4) present-day human biases, speculation, and mistranslations. In this subsection, we will break with this policy and offer speculation based on historical texts.

Maps of South America were becoming common in the first half of the sixteenth century. However, in the middle of the sixteenth century, on the west coast of Chile, cartographers introduced a large bulge, a bulge three times the size of Chile itself. These are probably the maps that Drake had with him when he rounded the bottom of South America. He started following these maps, but their inaccuracy, along with severe weather, left him wandering the South Pacific. He was angry with the cartographers who provided such lousy maps. On his voyage home he and his cousin John made some good world maps that included the South and North American Pacific Ocean coasts. When he returned to England, he gave an accurate world map to Queen Elizabeth. She loved it, but she did not want the dirty-rotten Spanish scoundrels to profit from knowledge about Drake's voyage. So, she forbade Drake's crew from disclosing any details. It worked. Everyone kept silent.

About eight years later, after the English navy and a horrendous storm demolished the Spanish Armada, the Queen stopped fearing the Spanish and her ban on disclosing details of Drake's circumnavigation faded away. During those eight years, many cartographers evidently began to doubt the existence of the great bulge on the coast of Chile.

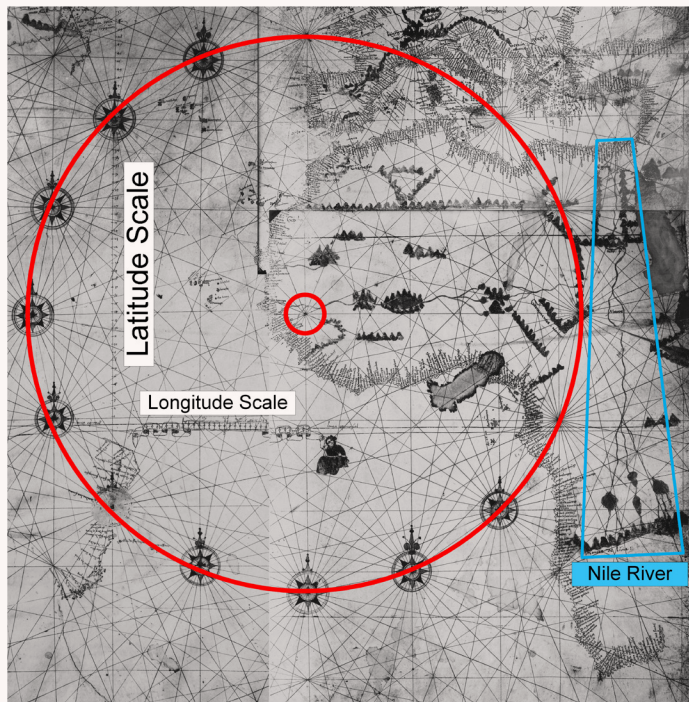
Ortelius had been updating his *Typus Orbis Terrarum* map annually for twenty years. Suddenly, in 1588, he dramatically removed the bulge on the coast of Chile on his *Typus Orbis Terrarum* and two other maps. What followed was a mad scramble by other cartographers to publish their maps without this bulge. A large group of cartographers simply chopped off the bulge, as shown in Figure 9. However, the C8 (without the *Silver* maps) shrank it and moved it down a thousand miles (sixteen hundred km) to the southern tip of Chile (see Figure 10).



Cartographers who had seen the *Whitehall* map or had heard Drake's complaints had a head start on fixing the bulge on their maps. This likely applies to Ortelius, *Drake-Mellon*, *French-Drake*, the *Silver* maps, the Hakluyt text, and Hondius. They may have even secretly started revising their maps earlier. Thus, they were able to get their maps out in 1588–90. For those who did not see the *Whitehall* map, it took longer for them to get their maps published. However, we date all of the C8 as after 1588. In the following paragraphs, we will abbreviate this as “ChileBulgeRemoved1588.”

### *Equirectangular Map Projection*

The equirectangular map projection was used almost exclusively by European cartographers in the fourteenth and fifteenth centuries. All three of the Whitehall-derived maps (the *Drake-Mellon*, *French-Drake*, and *Dutch-Drake*) used this projection, which by the late sixteenth century



**Figure 11.** The *Kunstmann III 1501–02 map*. See also McIntosh and Gaspar (2021, 164). This is an equirectangular latitude chart. It has a latitude scale on the upper-left side. Numerous toponyms arranged perpendicular to the coasts, rhumb lines emanating from the compass/wind roses, and the red circle through them emphasize the map's portolan chart roots. However, the large amount of inland detail and the latitude scale belie its portolan chart origins.

had become antiquated and uncommon. For maps published in Shirley (1983) between 1587 and 1607, less than ten percent used an equirectangular map projection; between 1620 and 1650, none did. These WHD maps were likely some of the last equirectangular maps made in the sixteenth century.

### *Mercator Double-hemisphere Equatorial Stereographic Map Projection*

The 1589 *Silver* maps, the 1590 and 1595 Jodocius Hondius *Broadside* map, the Plancius 1590 map, and the 1599 Theodor de Bry map used a Mercator double-hemisphere equatorial stereographic projection. This map projection was developed by Rumold Mercator and was first published in 1587. This fixes the earliest creation year for these three maps as 1588. This is compelling evidence for dating these maps. In the following paragraphs, we will abbreviate this as “MapProjectionInvented1587.”

### *The Nile River*

The three WHD maps in Figures 2, 4, and 5 use the **Ptolemaic model** for the Nile River system. This model originated with Ptolemy in the second century CE, and began to spread to European maps once his *Geographica* was translated into Latin in the late fifteenth century. In the basic model there are four (or possibly two) lakes around 10° S latitude. Their inputs come from a range of mountains to the south known as the *Montes Lunae* or Mountains of the Moon. The outputs of these lakes feed the White Nile going north, which merges with the Blue Nile to form the Nile River that flows north to the Mediterranean Sea. From the late fifteenth century, this model remained the standard up through the mid nineteenth century.

The 1501–02 *Kunstmann III* map (Figure 11) was a watershed in African cartography (McIntosh and Gaspar 2021). It was the first sixteenth-century map with this model of the Nile River, though not the first map to show the sources of the Nile in the Mountains of the Moon. The contemporary world maps of Cantino 1502 and Juan de la Cosa 1500 do not have use the Ptolemaic model for the Nile River, though Waldseemüller 1507 and later sixteenth-century maps do (Van Duzer 2020). The *Kunstmann III* is also the first of the portolan latitude maps. It has a scale of latitude and a rudimentary scale of longitude, as shown in Figure 11. The *Kunstmann III* map is the predecessor for sixteenth-century maps of Africa.

## The Amazon River

Between 1545 and 1600, most maps that included South America represented the Amazon River shaped as a giant snake, as in Figures 2, 3, 9, and 10 (Bahill and Gitzen, 2021). The first exploration of the Amazon River by Europeans occurred in 1541–42. For the next 60 years, few Europeans explored the Amazon, so the information about it remained static. Then around the turn of the seventeenth century, many explorers and proselytizers traversed South America. Knowledge about the shape of the Amazon River became better. This new knowledge instigated the creation of better models with straight lines rather than snake-like undulations. Of our three WHD maps, only the *Drake-Mellon* map has this snake-like river model. The *Broadside* map does not have the Amazon River at all. Strangely, the *French-Drake* and *Dutch-Drake* maps represent the Amazon as a straight, wide river: this suggests that they were made later.

## Virginia

In the sixteenth century, *Virginia* referred to the east coast region of North America not occupied by Spain or France, roughly present-day North Carolina. In 1584, Sir Walter Raleigh sycophantically suggested the name Virginia for this region in honor of Queen Elizabeth, who was known as the Virgin Queen. Later in that same year, Arthur Barlowe, in “The First Voyage to Roanoke” (Hakluyt 1589), lavishly described “the country now called Virginia.” The next year Raleigh established a colony on Roanoke Island in this region.

The earliest use of this name on a map was likely in Hakluyt’s publication of Peter Martyr’s *De Novo Orbe* on a map dated 1587 (Hakluyt 1587; Verner 1950).<sup>15</sup> The *Drake-Mellon* map, the *Silver* maps, and the Molyneux globe have the label “Virginia” (or “Virginea”). Therefore, they were probably made after 1587. In the following paragraphs, we will abbreviate this as “NameVirginaUsed1587.”

## DATING THE WHITEHALL MAP

Drake returned to England in September 1580. In his first meeting with Queen Elizabeth, Drake presented her with a large map. There is no doubt about when Drake gave the

*Whitehall* map to Queen Elizabeth. Thus, we assign it a year of disclosure of 1580.

## DATING THE DRAKE-MELLON MAP

The *Drake-Mellon* map has Drake’s route of circumnavigation and his Caribbean Sea voyage of 1585–86. Therefore, this map must have been made after the Caribbean trip ended in 1586, assuming that this route was not added later to the finished map. Therefore, this map was certainly created after 1586. This map represents the Amazon River shaped like a giant snake; therefore, it was surely made before 1600.

For the above reasons and because of the factors of the QueensBanEnded1588, the ChileBulgeRemoved1588, and the NameVirginaUsed1587, we date the *Drake-Mellon* map as 1589.

## DATING THE DRAKE SILVER MAPS

There are nine known existing medallions with the *Drake Silver* map. The Library of Congress has two of them and gives the location of the others (Kraus 2022b, item 58). One of these has a cartouche on the old-world side that reads “Micha Merci: fiat extat Londi: prop tempt ũ Gallo: Ano 1589.” We translate this as “Made in London by Michael Mercator . . . 1589 CE.” Therefore, there is no controversy about when this particular medallion was made. Because this cartouche was engraved on the die, this has to be the last of the known medallions made with this die (Christy 1900). The others were made before it, as they feature no cartouche, which is the only known difference between the nine existing medallions. We date the *Silver* maps as 1589.

There are other points in favor of this year. These medallions used the Mercator double-hemisphere equatorial stereographic map projection that was first published in 1587 by Rumold Mercator. So, they were certainly made after 1587 (Bahill 2022b). *This is our strongest point.*

Probably sometime after the destruction of the Spanish Armada in 1588, Drake commissioned these remarkable silver medallions with his route of circumnavigation engraved upon it. We think that it would certainly take more

15. This map is titled *Novis Orbis*. It is signed F. G. S. and is dated 1587. It is contained in Hakluyt’s revised edition of Peter Martyr’s *De Novo Orbe* which was published in Latin in Paris in 1587. Two 1889 copies of the original 1587 map are available online, one in the David Rumsey Map Collection at ([www.davidrumsey.com/luna/servlet/s/98740o](http://www.davidrumsey.com/luna/servlet/s/98740o)) and one at the Art Institute of Chicago ([www.artic.edu/artworks/152508/novus-orbis](http://www.artic.edu/artworks/152508/novus-orbis)).

than a quarter of a year to engrave a set of dies and stamp medallions.<sup>16</sup> Therefore, this further supports the notion that the earliest year of disclosure should be 1589.

For the above reasons but mostly because the QueensBanEnded1588, the ChileBulgeRemoved1588, the MapProjectionInvented1587, and the NameVirginiaUsed1587, we think that the Drake *Silver* map with Michael Mercator's cartouche was made in 1589. The other *Silver* medallions were most likely made earlier in that same year.

### DATING THE HAKLUYT TEXT

A thousand copies of Richard Hakluyt's *The Principall navigations, voyages and discoveries of the English nation*, were printed in London in 1589. A hundred dated copies are still in existence. Therefore, there is little doubt about the year of publication. This assumes that the twelve-page unnumbered section entitled "The famous voyage of Sir Francis Drake into the South Sea, and there hence about the whole Globe of the Earth, begun in the year of our Lord, 1577" was inserted in the original printing of the book and not in a later printing that surreptitiously kept the original publication year.<sup>17</sup> There is no reason to doubt that Hakluyt's text was published in 1589 and that the insert was published with it (Hakluyt 1589, between 643–644). For these reasons and because the QueensBanEnded1588 and the ChileBulgeRemoved1588, we date the Hakluyt text as 1589.

### DATING THE FRENCH-DRAKE MAP

In the upper-left cartouche, this map calls Drake a *Knight* (Chevalier), so this map must have been printed after Queen Elizabeth knighted him in 1581.

Drake was born around 1541 (see footnote 1). The *French-Drake* map has a portrait of Drake in an oval frame stating that he was 42 years old when the portrait was painted. The original portrait, from which the image on the map

came, had to be painted before the map was printed. Therefore, this map must have been printed after 1583.

Wagner (1926, 427–434) dates this map as 1641 because five of the six *French-Drake* maps that he examined were bound in 1641 French translations<sup>18</sup> of "The famous voyage of Sir Francis Drake. . . ." However, this does not preclude the possibility of an earlier publication. The *French-Drake* map treats California as a peninsula, not as an island. Sixty percent of the maps made between 1625 and 1650 that are in Shirley (1983) treat California as an island. None of those published before 1625 do. This is a weak suggestion that the *French-Drake* map was published before 1625.

The *French-Drake* map has the statement, "A map seen and corrected by the aforesaid Sir Drake." It is highly doubtful that his portrait and this statement were on the *Whitehall* map: it just does not fit the character of Drake (Wallis 1984, 143). Therefore, the *French-Drake* map might not have been copied from the *Whitehall* map, but rather from some apocryphal missing copy of it (Wallis 1984, 143): hence the grey dashed arrow in Figure 1. Because of the "A map seen and corrected by the aforesaid Sir Drake" and the fact that Drake died in 1596 means that the *French-Drake* map must have been made in 1596 or before.

For the above reasons but mostly because the QueensBanEnded1588 and the ChileBulgeRemoved1588, we date the *French-Drake* map as 1589.

### DATING THE DUTCH-DRAKE MAP

The *Dutch-Drake* map is a copy of the *French-Drake* map. Therefore, it must have been made after the *French-Drake* map. The version in the Huntington Library is bound in with Bigges (1586) but Stephen Tabor, Curator of Rare Books, has suggested that this is a mis-binding. Furthermore, the Library of Congress's version of Bigges has no maps. Wagner (1926, 424–426) dates the *Dutch-Drake* map as after 1587.

16. Unless the cartographer was Rumold Mercator, who had already engraved the plates for his *Orbis Terrae Compendiosa Descriptio* map using his Mercator double-hemisphere equatorial stereographic map projection.

17. We assume that Hakluyt collected the 800-plus pages that he wanted in his book. He arranged them in sequence and numbered the pages. Then after the defeat of the Spanish Armada, he added the twelve unnumbered pages in between the pages numbered 643 and 644. These are images 661 and 674 in the [Library of Congress copy](#), and images 684 and 697 in the [Hathitrust copy](#).

18. Translation usually refers to translations of the text of an atlas not of text on the maps. In an atlas a single map might have up to a dozen pages of text associated with it. The translation would be of the text pages and perhaps the text on the verso side of the maps. They probably did not change the maps or the words on them.



The *Dutch-Drake* map has a peninsula coming down from the North Pole near Russia that is labeled Nova Zembla. The Ortelius *Typus Orbis Terrarum* 1570 to 1595, R. Mercator 1587, Plancius 1594 *Orbis Terrarum Typus . . .*, Hondius 1597, and Van Langren 1596 maps also label this area but they spell it Nova Zemla. The *Dutch-Drake* map spells it Nova Zembla. Plancius and Waghenauer first used the Zembla spelling on maps in 1592. Therefore, the Dutch-Drake map was surely made after 1592. Nova Zembla on the Dutch-Drake map is drawn as a peninsula of one of the giant circumpolar islands. But in 1594 cartographers started correctly showing it as a discrete island far away from the North Pole. After 1598 almost everyone drew it as a discrete island. After 1603 no one showed it as a peninsula.

Our strongest evidence for dating the Dutch-Drake map as 1594 is its labeling of Nova Zembla and drawing it as a peninsula. It had to be after Plancius and Waghenauer first used the spelling Zembla on a map in 1592 and before everyone started drawing it as an independent island in 1598.

For the above reasons and also because the QueensBanned1588 and the ChileBulgeRemoved1588, we date the *Dutch-Drake* map as 1594.

### DATING THE EMERY MOLYNEUX GLOBE

The Emery Molyneux *Petworth House Globe*, which was unveiled in 1592, is displayed in the Petworth House (Wallis 1951). An early draft of it was shown to Queen Elizabeth in 1591. A copy of it, the Molyneux *Middle Temple Globe* that is kept in the Middle Temple, was printed from the same plates. This revision was made public in 1603.

### DATING THE HONDIUS BROADSIDE MAP

The Jodocius Hondius map, *Vera Totius Exbitionis Nautica* (colloquially called the *Broadside* map) shows the circumnavigation routes of Sir Francis Drake 1577–80 and Sir Thomas Cavendish 1586–88. Therefore, it had to have been made after 1588. The the Library of Congress, dates its copy as around 1595 ([lccn.loc.gov/92680608](https://lccn.loc.gov/92680608)). However, some authors (e.g., Wallis 1984, 145; Toppin 2013, 4) speculate that Hondius might have published some of his *Broadside* maps while he was still in England around 1590.

Daniel Crouch Rare Books dates it from 1589 to 1595 ([crouchrarebooks.com/maps/the-drake-map](http://crouchrarebooks.com/maps/the-drake-map)).

For the above reasons and also because of the QueensBanned1588, the ChileBulgeRemoved1588, and the Map-ProjectionInvented1587, we date the Hondius *Broadside* map as after 1588, with 1590 likely and 1595 a sure thing.

### DATING THE DE BRY MAP

The Theodor de Bry map was on the cover of his book *America Pars VIII*, which was published in 1599: [library.princeton.edu/visual\\_materials/maps/websites/pacific/drake/map-world-drake-1599.jpg](http://library.princeton.edu/visual_materials/maps/websites/pacific/drake/map-world-drake-1599.jpg).

### YEAR OF DISCLOSURE

Table 4 lists the C9 along with their previously proposed publication years and our new years of disclosure. For maps that were printed, this would usually be the year of publication, if this were known. For one-of-a-kind objects, like the *Whitehall* map, *Drake-Mellon* map, or the Molyneux globe, this would be the year the creator gave the object to its recipient or made it open for public view.

The *Whitehall* map was not published. Only one copy of this map was made and it was presented to Queen Elizabeth by Francis Drake in 1580.

- The *Drake-Mellon* map was not published. It was a manuscript map and most likely no copies of it were made. It was created in 1589.
- The *Silver* maps were stamped into silver disks in 1589.
- The Richard Hakluyt text was published in 1589.
- The *French-Drake* maps were first printed using engraved copper plates in 1589. Many copies were probably made.
- The *Dutch-Drake* maps were first printed using engraved copper plates in 1594. Many copies might have been made.
- The Emery Molyneux *Petworth House Globe* was unveiled in 1592.
- The Jodocius Hondius *Broadside* map was printed by 1595 and probably in 1590. Many copies were probably made.



Name	Previously estimated years of publication	Year of disclosure determined in this paper	Approximate number of existing copies
<i>Whitehall map</i>	1580	Presented in 1580	0
<i>Drake-Mellon map, Vera descriptio expeditionis nauticae . . .</i>	1587, 1588	Drawn in 1589	1
<i>Drake Silver maps</i>	1581, 1589, 1589, 1585–95, 1580–86	Stamped in 1589	9
Richard Hakluyt, “The famous voyage of Sir Francis Drake . . .” in <i>The Principall navigations . . .</i>	1589	Published in 1589	100
<i>French-Drake map, La Herdike Enterpinse . . .</i>	1580–84, 1581, 1581, 1583, 1583, before 1585, 1627, 1641, 1641	Printed in 1589	7
<i>Dutch-Drake map, La Heroike Interpinse . . .</i>	1581, 1585, 1587, after 1587, 1589, 1590	Printed in 1594	4
Emery Molyneux, <i>Petworth House Globe</i>	1592	Unveiled in 1592	2
Jodocius Hondius, <i>Vera Totius Exbitionis Nautica, (Broadside)</i>	1590, 1595	Printed in 1590 and 1595	2, Wallis (1984, 145) wrote six.
Theodor de Bry, <i>America Pars VIII</i>	1599	Published in 1599	Many

**Table 4.** Years of disclosure for the C9.

- The Theodor de Bry map was published in 1599.

While Table 4 lists the previous estimates of the year of publication of the C9, we are not in a position to specifically refute each of these. Many scholars did not give detailed reasons for their speculation about creation dates. In

any case, our fundamental guiding principle has been to use only the information on the maps themselves in making our arguments. We wanted to show that research papers could be written relying only on information available on the Internet.

## CONTINENTAL THEORY

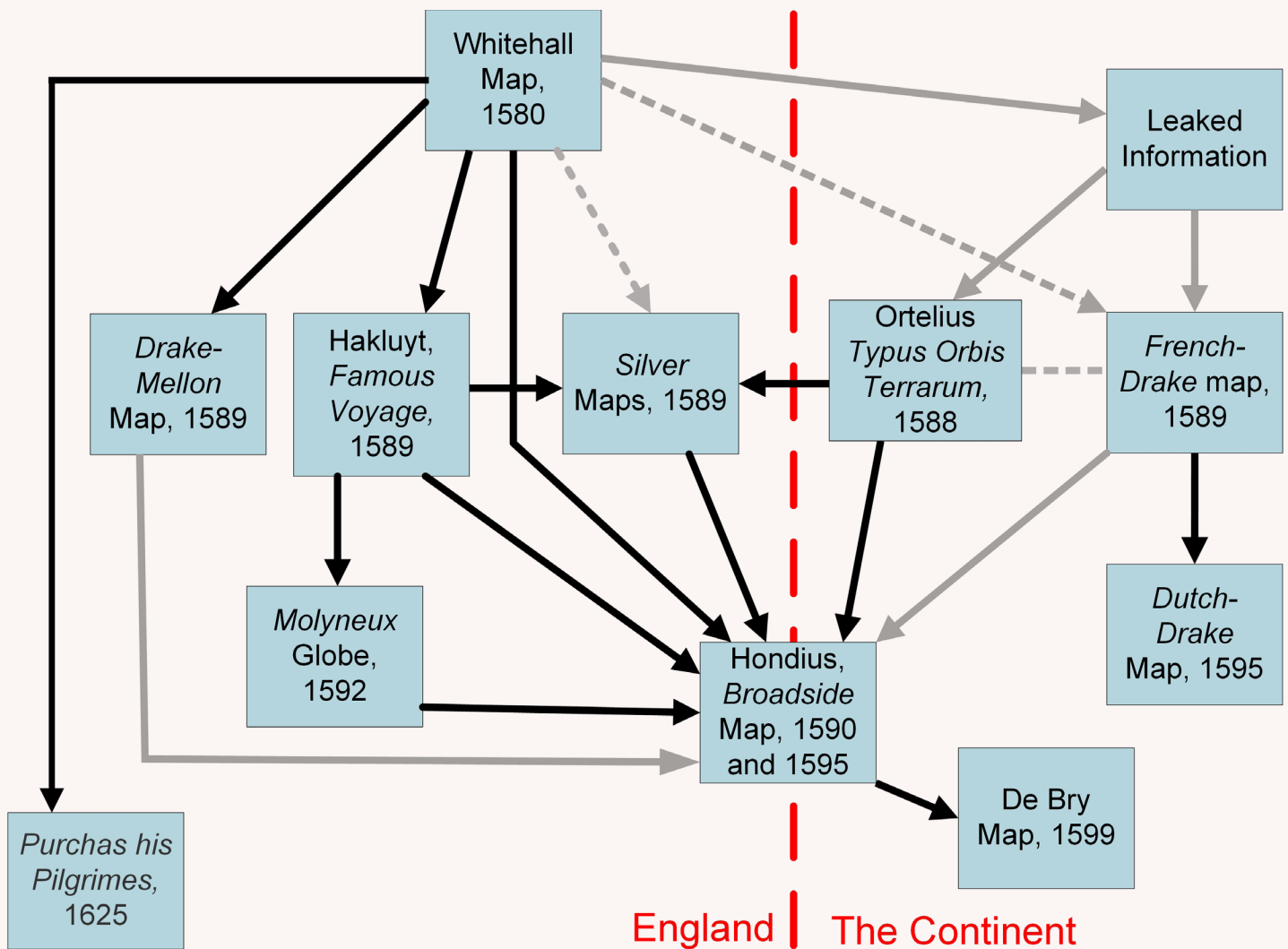
SO FAR IN THIS PAPER, MOST STATEMENTS HAVE BEEN based on the maps themselves. Now, however, in this section we switch to speculating that the *French-Drake* and *Dutch-Drake* maps were made on the European continent (Wagner 1926). This would mean that they would not have been subjected to the Queen’s prohibition on

revealing details of Drake’s voyage and they, therefore, might have been printed before her ban lapsed in 1588. But then, what would have been their source of information? Such foreigners certainly would not have had access to the *Whitehall* map in the Queen’s privy chamber. Some authors speculate that Drake might have discussed his

findings with these foreigners, given them a text with his findings, or shown (or given) them a copy of the *Whitehall* map. King Philip II's ambassador to London, Bernardino de Mendoza, wrote to his King on 20 April 1582 that Mendoza's spy, Sir James Crofts, had seen Drake's chart and discussed it with him (Wagner 1926, 89). These authors offer, as supporting evidence for a leak, speculation that Drake gave a fancy copy of this map to his friend John Foxe, the Archbishop of Canterbury (Nuttall 1914, xxvii; 357). However, John Foxe was never the Archbishop of Canterbury. Nuttall (1914, xlv) also cites a letter written in 1585 by King Henry III of Navarre (soon to become King Henry IV of France) to Sir Francis Walsingham, where he "begs the Queen to command the 'chevalier de Drac' to send him the collection [of charts?] and the discourse of

his great voyage" This means that as of 1585 King Henry still did not have a copy of the map. Therefore, it is not likely that there was a description of the *Whitehall* map that the makers of the *French-Drake* and *Dutch-Drake* maps used much before 1585.

Who made the information about Drake's circumnavigation public? Drake himself was suspected of having leaked the information to someone. Could that someone have been Nicola van Sype, whoever he was? However, there is no evidence that the Queen was angry with Drake: he made her rich, she knighted him in 1581, gave him the commission to raid the Caribbean Sea in 1585–86, and made him Vice-Admiral of the fleet that destroyed the Spanish Armada in 1588. He was in her good graces



**Figure 12.** The Continental Theory for the relationships of the sixteenth-century objects that show Drake's route of circumnavigation. Time runs roughly from the top to the bottom. The red dashed line divides maps made in England from those made on the European continent. Black arrows show information flows. Gray arrows show suspected information flows. Dashed grey arrows show ghost connections, that is, connections that may or may not have existed.



throughout the decade. Therefore, Drake was not likely to have leaked the information.

Putting together everything presented in this paper we formulate the Continental Theory shown in Figure 12.

The fact that Ortelius chopped off the Chile bulge instead of shrinking it and moving it down to the bottom of Chile suggests that he did not see the *Whitehall* map. Instead, we speculate that he heard a discussion of it. Rather than feed information *to* the C9 cartographers of Figure 12, he mostly got information *from* them. He did not have Drake's route of circumnavigation on his maps. He is in the figure because he knew everybody and everybody knew his maps.

## LIMITATIONS

THERE ARE LIMITATIONS TO USING ONLY INFORMATION on published maps in research on nautical world maps. In this paper, we necessarily supplemented the information found on maps with information from texts when the maps were insufficient. For example texts were used for the date and place of publication because these are seldom on the maps themselves. Of the C8, only the De Bry map is explicitly dated.

Likewise we used texts to understand Queen Elizabeth's ban on disclosing details of Drake's circumnavigation, the destruction of the Spanish Armada, and the Queen's subsequent ignoring of the ban; these facts were not on the maps.

The Whitehall Map has not been seen in five centuries. So, we used texts and maps to construct a textual and visual mental model of this map. We then compared this mental model to other maps. Secondly, some information was not put on maps, such as Drake's meanderings south of the Strait of Magellan. To construct the route shown in Figure 10, we used written texts. For this reason, the route shown is questionable. Thirdly, the Continental Theory posits that the French-Drake and the Dutch-Drake maps were made on the continent, not in England. Such information is not on the maps themselves.

Using only information on published maps limited our research to maps made by European cartographers in the fourteenth century and onward. In fact, the C9 were all

The theory that the *French-Drake* map was made on the continent, and out of the Queen's control, creates a puzzle as to why it sycophantically has two icons of Queen Elizabeth's coat of arms, one below South America and the other west of Nova Albion. These indicate the Queen's right of domain or authority over these regions.

The Continental Theory also requires that the Hondius 1590 and 1595 *Broadside* map be put on the dividing line between England and the Continent because much of its research and early development was done in England but it was finished and printed in Amsterdam.

made by sixteenth-century English and probably French and Dutch cartographers. We used no maps by Spanish, Portuguese, Italian, or Chinese cartographers.

We did not use manuscript maps because their dates cannot be ascertained with certainty. A manuscript map is a one-of-a-kind, hand-drawn map that was not mass-produced or published. Material can be added to an unpublished manuscript map at any later date. This is why our policy is to not use unpublished maps. Our only exception is the *Drake-Mellon* manuscript map.

We strove to have at least two sources for every fact that we presented. Often this meant using information from texts rather than from maps for our second source. The explanation of the galleon icons along Drake's route on the WHD maps fell into this category.

Finally, using only information on maps, we cannot get the opinions and feelings of people such as Queen Elizabeth. On the other hand, our database, at [sysengr.engr.arizona.edu/URLsForSixteenthCenturyMaps.xlsx](http://sysengr.engr.arizona.edu/URLsForSixteenthCenturyMaps.xlsx), makes extensive use of historical texts. It has a different purpose and a different result.

## LESSONS LEARNED

We found three things that were particularly hard to do when looking only at maps. First, unless the date was written on the map, it was difficult to determine the date

of disclosure. We think our dates, necessarily derived from information external to the map content, are correct to within plus or minus one year. Second, we found that it is difficult to translate from one language to another, especially for text that is five centuries old. Synonyms and archaic grammar can make each translation different. There is no one correct translation—a fact which is true even when converting between present day texts. Finally, it was

hard to determine which map projection the cartographer used, unless he told us, which they never did.

One of the main purposes of this paper is to introduce a new genre of research papers about sixteenth-century nautical charts. With the exceptions listed above, these papers are based only on material contained on sixteenth-century nautical maps and charts and not modern interpretations of them.

## DISCUSSION

WE WILL NOW LIST MILESTONES IN THE STUDY OF world maps. In the second century CE, Ptolemy wrote his books and created his world maps. A researcher could consult these on a quick trip to Alexandria. A millennium later, in the fourteenth century, the creation of portolan charts revolutionized the appearance and content of large-scale maps. A century later, Ptolemy's book *Geographica* was translated from Greek to Latin and then into other common languages. This revolutionized the world's view of the world. Also, in the fifteenth century, Gutenberg's invention of the moveable-type printing press greatly accelerated the printing of books and maps. Although woodblock printing had been used for a millennium in China it was first used in Europe for printing maps in the fifteenth century. Woodblock printing allowed multiple copies of maps to be made cheaply. The sixteenth-century invention of copperplate engraving allowed fine detail on multiple copies. This leads us up to the late sixteenth century and the events of this paper.

In 1570 Ortelius invented the atlas, which was a collection of maps with extensive text discussing those maps. The maps and text were arranged geographically, not chronologically. Atlases allowed a researcher to study scores of maps in one setting.

In the sixteenth century, for expansion and political control, many countries closely guarded their maps. The Spanish kept them in the *Padrón Real*. The Portuguese kept them in the *Padrão Real*. And the English kept them in the privy chamber in the Queen's palace. These were usually manuscript maps: meaning only one hand-made copy was produced. They contained the best geographical knowledge at the time. But only the crown and the trading companies could benefit from this valuable secret intelligence. Publicly accessible printed maps lacked detail

and accuracy. Crown officials were the most common patrons of cartographers. Therefore, these public maps were laden with political and ideological messages. To get correct geographic information, cartographers had to compare several maps and filter out the propaganda.

From the seventeenth to the twentieth century research like that exhibited in this paper was done by researchers who visited libraries and other repositories of maps and charts. The researcher would spend days or weeks extracting all the knowledge he could and then he moved on to another repository.

In the twentieth century books about nautical maps appeared. They often gave great detail for one or a few maps. Atlases such as Shirley (1983) displayed hundreds of maps from a given period of time. And dozens of professional research journals published research papers about maps. In the last decades of the twentieth century the Internet evolved. Specific libraries opened their collections to online browsers, these libraries included those at the British Museum, Bibliothèque nationale de France (BnF), the Library of Congress, Brown University, Yale University, and Stanford University. This is the era in which this paper was researched and written.

This is also the era where authors tried to interpret maps as vehicles for the exercise of power and to effect social-political ends. They tried to analyze what the cartographers were thinking or what their motives were. Such speculation introduced intentional and unintentional human biases (Smith et al. 2007). We strictly avoided such papers. We shunned them like the plague.

This paper is an experiment. We wanted to show that research papers like this could be written based solely on

information shown on charts and maps that are freely available via the Internet.

After we wrote this paper, we discovered the David Rumsey Map Center at Stanford University [www.davidrumsey.com/luna/servlet/s/3aq715](http://www.davidrumsey.com/luna/servlet/s/3aq715). It is the perfect solution for our problem. It contains over 125,000 maps and related images dating from the sixteenth to the twenty-first century. This online digital database was designed so that it could be read by anyone, anywhere. Rumsey said that he wanted to provide “open access to all art . . . freely available via the Internet (Hessler 2023).” The David Rumsey Map Collection “. . . allows searching maps by toponyms and text on the maps (Hessler 2023).” This database should offer a whole new genre for researching sixteenth-century nautical maps.

Present artificial intelligence (AI) systems are built upon huge libraries of text and digital data. Soon they will store maps. Using AI systems may soon be the first step in a preliminary literature review for a new study. Is this then the future of cartographic research? No. Not yet. While AI is becoming useful, these systems are built not so much with a mind toward collecting quality literature as collecting as vast a quantity of text as possible. These documents are not corrected for factual and grammatical errors. These systems lack validation. They are inherently racially biased because, for example, Black writers have historically not contributed the same quantity of classical English literature as white writers have.

## SUMMARY

FROM 1577 TO 1580, CAPTAIN FRANCIS DRAKE AND his men circumnavigated the world in the *Golden Hind*. When he returned to England, he presented Queen Elizabeth with a map containing the route of his journey. She hung it on a wall of her Whitehall palace. Thus, it is called the *Whitehall* map. But, because she feared and loathed the Spanish, she did not want them to learn anything about Drake’s voyage. Therefore, she forbade her subjects from disclosing any details under pain of death. Finally, after about eight years, after the defeat of the Spanish Armada and thus the Spanish threat to England, the ban faded away. Then (i.e., from 1588) a series of maps, texts, and globes were made showing Drake’s route, which are described in this paper:

At present you must already have maps to evaluate the opinions of an AI system. If you already know the answer to a question, then it is acceptable to ask an AI system the question. For then you will be able to tell when it has made a mistake. But, if you do not know the answer beforehand, then you had better not trust an AI system. They lack validation. An AI system does not know what it does not know.

Now, to conclude this section, was our novel experiment a success? We wanted to show that research papers like this could be written based *solely* on information shown on charts and maps that are currently available via the Internet. We think that we were successful, except that there were certain specific facts that we had to gather from texts.

We suggest that other authors adopt this unique approach. It eliminates intentional and unintentional human biases introduced by recent authors who tried to interpret maps as vehicles to exercise power and affect social-political ends, authors who tried to analyze what the cartographers were thinking or guess what their motives were.

Our approach was revolutionary for its time. However, it should become common now that the David Rumsey Map Center at Stanford University has greatly increased the power of using the internet. Furthermore, AI developers might invent methods for validating their systems and then they might contain the necessary power to further develop studies of sixteenth century nautical maps.

- *Whitehall* 1580 map,
- *Drake-Mellon* 1589 map, *Vera descriptio expeditionis nauticae . . .*,
- *Silver* 1589 maps, stamped into silver medallions,
- Richard Hakluyt 1589 text, “The famous voyage of Sir Francis Drake . . .”
- *French-Drake* 1589 map, *La Herdike Enterprinse . . .*,
- *Dutch-Drake* 1594 map, *La Heroike Interprinse . . .*,
- Emery Molyneux 1592 *Petworth House Globe*,
- Jodocius Hondius 1590 and 1595 map, *Vera Totius Exbitionis Nautica, (Broadside)*, and



- Theodor de Bry 1599 map, *America Pars VIII*.

These nine artifacts are called the C9. The C9 without the *Whitehall* map are called the C8.

Using the C8 and the Purchas first-hand textual description, we have surmised what the *Whitehall* map must have looked like. It would have

- shown Drake's route of circumnavigation;
- contained several cartouches with text and drawings of the *Golden Hind*;
- displayed a statement in Latin relayed by Purchas, which translates as, "Since almost all think that south of this part is a continent . . .";
- revealed that there was not a continent south of the Magellan Straits, but, rather, there were many islands;
- featured the name Elizabeth in gold letters, and contained Queen Elizabeth's coat of arms encircled with a garter belt and topped with a crown;
- included galleon icons showing the number of major ships in Drake's fleet at that location;
- been rectangular with a landscape orientation;
- used an equirectangular map projection, centered on the equator;
- incorporated a prominent equator and a *linearly* numbered central meridian consistent with an equirectangular map projection;
- displayed an immense Rio de la Plata;
- indicated that Drake had reached 55° to 57° S latitude, southeast of the western mouth of the Strait of Magellan;
- had a small protrusion on the coast of Chile around 49° S latitude and no large bulge north of it;
- allowed room for the Drake Passage below Terra del Fuego;
- showed the Pacific coast of North America; and
- been written entirely in Latin.

The *Drake-Mellon*, *French-Drake*, and *Dutch-Drake* maps also had all of these features, except for the language. The *Whitehall* map might have been hand-drawn or Drake's route and important toponyms could have been drawn on a previously printed, copper plate engraved map.

The strongest evidence for concluding that the *Drake-Mellon* map 1589, the *French-Drake* map 1589, the *Dutch-Drake* map 1594, and the Hondius 1590 and 1595 *Broadside* maps were derived from the *Whitehall* map, is the similarity of the content of the cartouches. In particular, their bottom center cartouches that state:

Since almost everyone thinks that south of the strait [of Magellan] is a Continent, let them know for certain that these are islands that are passable by sailors, and that the southernmost of them is named ELIZABETH by its discoverer Francis the Dragon.

Drake's navigation was a magnificent feat. But he could not brag about it because the Queen forbade Drake and his crew from disclosing any details, due to rivalry with the Spanish. Finally, eight years later, after the defeat of the Armada, she relented. In late 1588, we conjecture that Drake commissioned a fantastic silver medallion with his route of circumnavigation engraved upon it. The result was the nine extant Drake *Silver* medallions and probably many others. At about this same time the *Drake-Mellon* map, Hakluyt's book, and the *French-Drake* map appeared showing Drake's route of circumnavigation. The Queen's secret was no secret anymore.

Most nautical world maps published between 1561 and 1588 have an enormous bulge on the western coast of Chile as shown in Figure 9 (left) (Bahill 2022a). This mistake in the coastline of Chile seems to have caused Drake difficulty in navigating around Cape Horn. After he returned to England cartographers were probably impatient to correct this error, but for eight years the Queen's edict of secrecy prevented them from doing so. After the English defeated the Spanish Armada and her shroud of secrecy dissolved, there was a flurry of activity to change the coast of Chile on maps. One group led by Ortelius simply omitted the bulge. A second group, including our C9 (except for the *Silver* maps), shrunk it and moved it down to the southern tip of Chile. As noted earlier, a third group, the outsiders who did not get the word, continued with the bulge all the way up to 1600.

The 1589 *Silver* maps, the 1590 and 1595 Jodocius Hondius *Broadside* map, and the 1599 Theodor de Bry map used a Mercator double-hemisphere equatorial stereographic projection, developed by Rumold Mercator and

first published in 1587. This fixes the earliest reasonable year of disclosure for these three maps as 1589.

The strongest evidence for the years of disclosure of the C8 is the use of the Mercator double-hemisphere equatorial stereographic projection starting in 1589 and the destruction of the Spanish Armada in 1588 causing the demise of Queen Elizabeth's ban on disclosing Drake's route of circumnavigation.

In the sixteenth century, Sir Francis Drake circumnavigated the world. When he returned to England in 1580, he presented a map containing the route of his journey

to Queen Elizabeth. The Queen forbade publication of details of his journey with an edict that lasted for eight years. Thereafter, the C8 were published in a narrow time window, in the last decade of the sixteenth century. They were, plus the *Whitehall* map, the only sixteenth-century maps (etc.) to show Drake's route of circumnavigation of the world. They were also the only maps to reduce the size of the bulge on the coast of Chile and move it a thousand miles down the coast. No other maps did this. In this paper we have revealed the intricate set of relationships between each of these artifacts. The C8 is a remarkable collection of maps, representing a remarkable journey.

## ACKNOWLEDGMENTS

We thank Mike Horner for the French-to-English translations. We congratulate the *Cartographic Perspectives* journal and its editor: that was the most thorough pair of reviews we have ever had.

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We have provided a list of Internet sources for the maps mentioned in this paper. This list/database is located at [syngen.engr.arizona.edu/URLsForSixteenthCenturyMaps.xlsx](https://syngen.engr.arizona.edu/URLsForSixteenthCenturyMaps.xlsx).

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