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Analysis of Geometrical Properties and Content of Old Maps – an Example of Map of the Croatian Cartographer Fernando Consag – Croata Varasdinensis

Summary: Fernando Consag – Croata Varasdinensis is a Croatian cartographer, missionary, Jesuit and the founder of Lower California (Baja California). The result of his three expeditions in 1746, 1751 and 1753 were several maps of Lower California and the Bay of California and the diaries of the first and the second expedition. The map of California and Consag’s diary of the first expedition were published in Madrid in 1757 and then presented to King’s advisors. After many confrontations, King of Spain officially recognized that Lower California is a peninsula, not an island, on the basis of Consag’s map and diary of his first expedition in 1746. This paper analyzes geometrical properties and the content of Consag’s map taking into account latitude-measuring methods, graphic map scale, geographical coordinates assigned at the map border and other map characteristics. There are some suggestions for map georeferencing into contemporary cartographic model.

Keywords: Fernando Consag – Croata Varasdinensis, Lower California (Baja California), map, diary, longitude, graphic map scale, georeferencing.

Introduction

The paper gives a short biography of Fernando Consag (1703-1759) mostly using Muljević (1991) and Zorić (2002). Zorić (2002) collected the most references about Ferdinand Konšćak (hispanized and better known as Fernando Consag) Croatian cartographer, Jesuit, missionary, explorer, and the founder of Lower (Baja) California. Consag led three expeditions in 1746, 1751 and 1753, described very shortly in the second part of the paper (Muljević 1996, 1998). Consag’s diaries from the first and second expeditions, his maps of California and the Bay of California and his work ‘Description of California’ are found all around the world. Here is a short list of his works and where they can be found. At the end of the paper there are Consag’s maps from available references. I described the available parameters of the map that could be used for geometrical analysis of the Consag’s maps.

Biography

Ferdinand Konšćak (Fernando Consag) (Varaždin, Croatia 3rd of December 1703 – San Ignacio, Mexico 10th of September 1759) is a Croatian cartographer, missionary, Jesuit and the founder of Lower California (Baja California).

He was a student at the Jesuit’s Grammar School in Varaždin (1713-1719) where he became a so-called ‘retor’. Then on 21st October 1719 he entered Jesuit Order in Trenčín, Slovakia till 1721. He learned classics, stylistics and rethorics, Leoben, Austria (Styria) in 1721/1722. Then he studied philosophy and theology in Graz: in 1722/1723 he was a ‘logicus’ in 1st class, in 1723/1724 he was a ‘physicus’ in the 2nd class, and in 1724/1725 he was a ‘metaphysicus’ in the 3rd class. In 1725/1726 at Jesuit’s College (collegium) in Zagreb had a title ‘magister Konšćak Parvista’ and he taught elements of grammar; in 1726/1727 in Buda, Hungary at the 3rd and the 4th grade of Grammar School he taught ‘humaniora studia’; in 1727/1728 and 1728/1729 at University of Graz he studied theology.

Consag wanted to go to missions, therefore he wrote four letters to the Jesuit General in Rome, Michelangelo Tamburini (1648-1730) and asked to be sent to missions in India or Japan:

1. the first one on 21st December 1722 from Graz;
2. the second on 3rd December 1726 from Buda;
3. the third on 21st December 1727 from Graz and

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4. the fourth on 15th November 1728 again from Graz. Finally, after the fourth letter his application was accepted for a Native mission in Mexico and in 1730 he was put at the list of Jesuit Order ‘In missionibus Indicis’.

At the end of 1729 Consag traveled to Cadiz, Spain where he missed a ship for America and there he waited for the next ship for a year. Meanwhile, he learned Spanish and went to the 3rd class of Jesuit Collegium in Cadiz. He was ordained in 1730. In April 1732 he was in Havana, Cuba, where he was present at the funeral of Father Johann Klesinger. On 10th April 1731 he traveled from Havana to Vera Cruz where he arrived on 19th April 1731. There, at a very small Jesuit’s Collegium Consag finished the 4th class of theology. Consag went from Mexico to San Ignacio, Lower California probably in 1732, a 2000-kilometers-long journey.

In San Ignacio Consag lived and worked as a missionary, Jesuit but also as an explorer of Lower California. At the beginning he was an assistant to Brother Segismundo Taraval (1700-1763) in San Ignacio but he was promoted all the way to head of all Californian missions. He died in San Ignacio on 10th of September 1759.

**Expeditions of Fernando Consag 1746, 1751 and 1753**

The Spanish Crown wanted to make California their own territory. Jesuits as missionaries and highly educated people were in the service of the Spanish Crown in order to explore new territories, especially drinking-water springs, mainland and sea routes to existing and new mission sites, and appropriate locations for seaports. Following the demands of the Spanish Crown, Fernando Consag organized, led and took part in three exploratory expeditions to the northern regions of Lower California in 1746, 1751 and 1753 (Figure 1).

*The first expedition 9th June – 25th July 1746*

9th June – 25th July 1751 Fernando Consag in his first expedition with boats along the east coast from Loreto to the mouth of the river Colorado should explore whether Baja California is a peninsula or an island. The result of the expedition will help the Spanish Crown to conquer northern parts of California. As the result of the first expedition there is a diary and a map of California that were used as the evidence for official recognition that Lower California is a peninsula, not an island (Husak 2007:35). The expedition was described in ‘Noticia de la California’ published in Madrid in 1757. The diary of the first expedition, originally written in Spanish, was published in English (Krmpotić 1923) and in Croatian (Muljević 1996).

*The second expedition 22nd May – 8th July 1751*

The second expedition of 22nd May – 8th July 1751 explored the western part of the Sierra Madre and the coast of Pacific Ocean. There is also a Consag’s diary with his notes about the expedition written in Spanish, published in Barcelona 1754, as an English translation (Krmpotić 1923) and as a Croatian translation (Muljević 1998).

*The third expedition June and July 1753*

The third expedition in June and July 1753 explored the Californian peninsula up to the 31st parallel. It is possible that a diary of the third expedition exists, but has not been found yet. Diaries are supplemented with the maps, some of which have been saved in archives and libraries. In this paper Consag’s maps will be listed and one of them cartographically analyzed.

**Consag’s works**

Ferdinand Consag was a Jesuit, missionary, explorer and, last but not least, cartographer. As explorer he wrote:

The diary of the first expedition 1746,
The diary from the second expedition 1751,
Necrology of Tempis, and
‘Description of California’.
As a cartographer he made several maps and charts of the Bay of California and the Californian peninsula.

Figure 1: Contemporary map of Lower California with the routes of Consag’s expeditions 1746, 1751 and 1753 (Muljević 1991: 32).
The Diary from the first expedition 1746

The diary from the first expedition 1746 has the full title:
‘Derrotero del viaje, que en descubrimiento de la costa oriental de Californias, hasta el Rio Colorado, en donde se acaba su estrecho, hizo el Padre Fernando Consag, de la Compania de Jesus, misionero de Californias, por orden del Padre Cristobal de Escobar y Llamas, Provincial de Nueva-España, de la Compania de Jesus. Ano 1746.’
and it is the part of the following works:
José Antonio de Villa-Senor Sanchez (1748): ‘Theatro Americano, Description general de los Reynos, y Provincias de al Nueva-Espana, y sus jurisdicciones, Segunda parte, Mexico’. It was published again in 500 collector’s copies in Mexico in 1952. As we know, this is the first published work about Consag’s 1746 explorations. The diary in this work isn’t complete. This work was translated into English and published in London in 1748 with a title: ‘The Statistical Account of Mexico’.
Burriel-M. Veneas (1756/7): ‘Noticia de la Calif ornia y de su conquista Temporal, y Espiritual Hasta el Tiempo presente. Tomo Tercero, Madrid 1757, Apendice III’. In this work the first diary was published for the first time in full. This work was published again in Mexico in 1943-1944 and Consag’s diary is to be found on pages 91-120. In 1759 this work was translated into English, into Dutch in 1761-1762, into French in 1766-1767, into German (with a somewhat altered title) in 1769-1770.
Don Pedro Alonso O’Crouley (1774): ‘Idea Compendiosa del Reyno de Nueva Espana’, contains a chapter with Consag’s first diary (partly related) with the title: ‘Viaje a las costas de California, por el Padre Fernando Consag’.

The Diary from the second expedition 1751

The Diary from the second expedition 1751 has the full title:
‘Diario del viaje, que hizo el Padre Fernando Consag de la Compania de Jesus en la California desde 27 grados, y 2 tercios azia el Norte entre la Sierra Madre y el Oceano.’
and it was published in Barcelona in 1754 in ‘Apostolicos afanes de la Compania de Jesus’ in the third part, chapters IX-XI. It was published again in Mexico in 1887: ‘Historia del Nayarit, Sonora, sinaloa y Ambas Californias’, the author was mentioned in preface: José Ortega, and this is only partly correct. The authors were Juan Antonio Balthasar and José Ortega. The second diary was published again as ‘Apostolicos afanes’ in Mexico in 1944, with the title P. José Ortega S. J., ‘Meravillosa reduccion y conquista de la provincia de S. Joseph del Gran Nayar’. The second diary is to be found in the third part at pages 387-422.

Necrology of Tempis

1st October 1748 Consag finished necrology (or biography) of Jesuit Brother Antonio Tempis, a Bohemian missionary who died on 6th July 1746 after ten years of work in missions. The necrology is actually a biography that should educate brothers Jesuits and based on the lives and experiences of other Jesuit brothers. It is remarkable that Consag also had a necrology written by Zevallos with many useful data about Consag’s life and work.

Manuscripts and issues of ‘Description of California’

The British Museum in London has:
1. Summarized description of the people and country of Lower California with the title:
‘Descripcion compendiosa de lo descubierto y conocido de la California por P.e Fernando Consag de la Compania de Jesus’ (Summarized description of the revealed and known about California by father Fernando Consag from Society of Jesus).
2. The extension or addition with the title:
‘Addiciones à las noticias contenidas en la Descripción compendiosa de lo descubierto, y conocido de la California’ (Additions to reports contained in the Summarized description of the revealed and known about California).

At the end of the extension it is written: ‘Rewritten in Mexico, in March 1791’.

The National Library in Madrid owns a manuscript with the title:
‘Descripción de la California, a chapter in Ydea compendiosa del Reyno de Nueva España’ by author don Pedro Alonso O’Crouley from 1774. This work was published in Mexico in 1975. In the introduction is mentioned that the chapter about California was written in 1765 by Jesuit Norbert Ducrue who had lived there for 28 years. It contains only the first part, but it is more complete than the manuscript saved in the British Museum where descriptions of nature and customs of the Natives are missing. O’Crouley added two short notes about the Jesuit missions’ beginnings and expulsion of Jesuits from California.

The Huntington Library in San Marino has ‘Addiciones’ that contains several cactus drawings that are not in the ‘Addiciones’ from the British Museum. This work contains three maps of some parts of the southern part of the peninsula.

Figure 2: Pacific coast opposite Purisima mission, Zorić 2002:108, who took from Aschmann (1966).

The Bancroft Library in Berkeley has a copy with the title:
‘Descripción física de las costas de la California’ – it is a rewritten work that is stored in Deposito Hidrografico in Madrid (Letra e5a).

The Deposito Hidrografico in Madrid (Letra e5a) owns four manuscripts with the title:
‘Descripción de la California’.

London and San Marino manuscripts have an additional note about Consag written in the third person and mentions that he is the author of ‘Descripción’. The note was possibly written by Georg Retz or Wenceslav Linck.

This translation contains ‘Descripción’ and ‘Addiciones’ with drawings. Aschmann concludes that according to the style and way of narration ‘Descripción’ was written by Ducrue and ‘Addiciones’ by Consag.

Figure 3: Coast of the bay near Loreto, Zorić 2002:90, who took from Aschmann (1966).

Maps

Ernest J. Burrus was the researcher who has so far best explored Consag’s maps. On basis of explorations at the first expedition Consag made a map and it has the full title: ‘Seno de la Californias y costa oriental nuevamente descubierta y registrada el cabo de las Virgenes hasta su termino que es el Rio Colorado. Por el P. Fernando Consag de la Compania de Jesus, missionero de la California, ano de MDCCXLVI.’
The title is the same for two different maps:

1. The first map (map A) shows the area described in the title, the bay and the eastern coast from Cabo de la Virgenes to Rio Colorado from 27° to 33°20’ northern latitude.

2. The second map (map B) shows the whole (explored) Californian peninsula and the western coast from 21° to 34° northern latitude.
Both maps have a graphic map scale of Spanish and French Leguas\(^1\) and without marked geographical longitude. Burrus called the map A the first map and the second map the map B. Burrus found only one original of Consag’s map A, 14cm×21cm that Consag sent to his provincial with the report.

The real base for Consag’s later maps was made by Jesuit and Californian missionary Pedro Maria Nascimben (1703-1754) from Venice. He made the map A according to Consag’s drawing that was saved with his signature and it is in the Huntington Library in San Marino. Nascimben also made (according to Burrus) the map B of the bay and the peninsula using Consag’s base and other earlier maps (especially Kino’s maps).

Burriel made many copies of the map of the bay according to Nascimben, he put the same title, but the year 1747. The peninsula map has the title: ‘Mapa de la California su Golfo y Provincias, fronteras en el Continente de Nueva España’. 1754. Burrus called the first map C, and the second map D.

There are many copies of these maps. Jakob Baegert for the memoirs from California ‘Nachrichten von Amerikanischen Halbinsel Californien (Mannheim 1772) published the map with the title ‘California per P. Ferdinandum Consak S. I. et alios’ (Figure 5).

Mujvević (2007) made list of Consag’s maps of Lower California.

The Geographic map that Consag made after his first expedition: ‘Seño de California y su costa oriental nuevamente descubierta de las Virgenes, hasta su terminos, que es el Rio Colorado, ano de 1746. pore l Pe. Ferdinando Consag de la Campa. de IHS Missionero, en la California. This map is in the Library of Congress in Washington D.C. and a copy of this geographic map is in the British Museum, London and in the Archives of Spain.

In Burriel–M. Venegas (1756/7): Noticia de la California, Madrid, was published Consag’s geographic map: ‘Mapa de la California: su golfo y provincias fronteras en el Continente de Nueva Espana’.

In the famous French ‘Encyclopédie’ (Supplément 5e Cartes), published in Paris 1751-1780, Denis Diderot (1713–1784) the philosopher and Jean Lerond D’Alembert (1717–1783) the philosopher and mathematician took Consag’s geographical map. In the process of map reproduction the publishers of the ‘Encyclopédie’ made a mistake and wrote Father Gonsaquen as the author. This map was published again in Los Angeles in 1962 at the beginning of the ‘Encyclopédie’ volume. Perić (2004) wrote that Consag’s map of the Lower California is in the Diderot and D’Alembert encyclopedia and many names of plants and places in Lower California were provided by Consag himself.

In Baegert ‘Nachrichten von der Amerikanischen Halbinsel Californien’ published in Mannheim 1772 and 1773 is geographic map of Lower California with the name Gonsag.

Burrus said of Consag’s geographic map in 1967: ‘There are few Mexican maps that were copied or reproduced so many times as the ones of Fernando Consag’s with the same title but different form.’

Consag’s geographic map was the base for others and future maps of the California Bay from then to mid-19th century. There are many maps of Lower California drawn using these geographic maps.

A map like ones described before was published by Krmpotić in the book ‘Life and Work of Reverend Ferdinand Konščak, S. J. (1703.-1759.) an Early Missionary of California’. The title of the

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\(^1\) 1 Legua = 3 English miles = 4.83 km (land) or 5.56 km (sea mile).
map is ‘California per P. Ferdinandum Consak et per alios’, text in Latin may presume that it was redrawn in cooperation with Society of Jesus.

Figure 5: Jakob Baegert: ‘California Nachrichten von Amerikanischen Halbinsel Californien’ (Manheim 1772) published map with the title ‘California per P. Ferdinandum Consak S. I. et alios’.

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Map Analysis - an Example

The exhibition catalogue Jesuits’ heritage in Croatia (Isusovačka baština u Hrvata) (Korade 1993:31) has the best reproduced map of Consag found in available sources in Croatian. The full title of the map is already mentioned, it is written in the upper, right part of the map:

‘Señor de California y su costa oriental nuevamente descubierta de las Virgenes, hasta su terminos, que es el Río Colorado, ano de 1746. pore l Pe. Ferdinando Consag de la Campa. de IHS Missionero, en la California.’

Consag made this geographic map after his first expedition (Figure 6).

![Geographic map Consag made after the first expedition.

Description of the Consag’s geographic map

In the catalogue this Consag’s map looks clear and bright, very promising for digital processing. This reproduction is scanned in grayscale 600 dpi. The big zoom of the map shows a pattern made for catalogue print process (Figure 7).
Anyway, this map picture is analyzed like a analogue or digital copy of this map. The map has a double frame around the area the map shows. Its content is oriented as usual: up is north, down is south and so on. The frame has the whole degrees of the northern latitude drawn and written at the left and right from 28 to 33 degrees, outside the frame. The shown area is bigger approximately a half degree to the south and a half of degree to the north. Longitude degrees are neither drawn nor written in the map.

The map does not have a relatively big map scale because it shows approximately 6 degrees, and east-west 90 Leagues using graphic map scale from the map. According to Muljević (1996:49) 1 League = 3 English miles = 4.83 km (land) or 5.56km (sea mile).

Map Analysis

Putting raster image of the map into CAD system, the map looks very neat and good. Geometrical properties of the map are defined with

1. graphic map scale, and
2. geographic coordinates.

The map has graphic map scale (Escala de leguas Españolas – Scale in Spanish Leagues) and has not numeric map scale. Over Consag’s map graphic map scale is drawn ideal graphic map scale across its length of 27 Leagues in red. The graphic map scale is only approximately linear. There are residuals between the graphic map scale and constructed map scale in red (Figure 8).

The double-line map frame is drawn in blue. It is obvious that Consag map frame has not straight lines (Figure 6).

Geographic coordinates on this map are only latitudes. Straight lines between the same degrees of latitude are drawn in green, suggesting the parallels of latitude. The middle line in green is middle...
meridian rectangular to parallels. Mentioned characteristic has a graticule of pseudocylindrical projection that consists of: parallels that are parallel among themselves, rectangular to middle meridian, and meridians that are symmetrical to middle meridian (Frančula 2004:211).

<table>
<thead>
<tr>
<th>Values of latitude</th>
<th>Angle between the neighboring parallels</th>
<th>Distance between whole values of degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>(in degrees)</td>
<td>(in degrees)</td>
<td>left side (in Leagues)</td>
</tr>
<tr>
<td>33°</td>
<td>0.5350°</td>
<td>L1=161.07</td>
</tr>
<tr>
<td>32°</td>
<td>0.0945°</td>
<td>L2=172.20</td>
</tr>
<tr>
<td>31°</td>
<td>0.1195°</td>
<td>L3=168.01</td>
</tr>
<tr>
<td>30°</td>
<td>0.0526°</td>
<td>L4=161.97</td>
</tr>
<tr>
<td>29°</td>
<td>0.0813°</td>
<td>L5=167.66</td>
</tr>
<tr>
<td>28°</td>
<td>∆α=α_{max}-α_{min}=0.4824°</td>
<td>∆L=L_{max}-L_{min}=11.13</td>
</tr>
</tbody>
</table>

Table 1: Angles between connection lines and sizes of degrees of the latitude on the left and right border of the map.

Distances between whole values of degrees and angles between neighboring parallels are measured by tools in CAD software (Table 1).

**Conclusion**

For preliminary research on geometrical properties was used Consag map reproduction (Korade 1993:31) scanned in high resolution. Over Consag map frames, straight lines are drawn in blue. ‘Straight’ lines on Consag map are not straight lines. Parallels of latitude (in green) are only approximately parallel inside 0.54° and distances between whole values of degrees (in green) are evidently different: ∆L/L_{average}=6.70%, ∆R/R_{average}=4.71%. Suggesting the pseudocylindrical projection this reproduction of Consag map from Korade (1993:31) is deformed substantially.

Taking into account all these facts, the Consag map used in this preliminary research give us unreliable results for estimating map deformations. Scientific approach needs to do research with originals or reliable contact copies or scanned pictures in high resolution obtained from the map owner. The next step is to obtain reliable Consag map and to do similar research again.

Consag determined latitude for some named sites mentioned in his diaries. They could be used as additional parameters for analysis of geometrical properties of Consag maps.

**References**


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