

# Tectonics of cartography

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**Abstract:** Probably by dint of seductive appearances and overflowing passion for cartography, by dint of instant accessibility to all kind of maps and any graphic representations commonly called ‘maps’ and finally by dint of confusions between what is an IMAGE and what is a DATA, everyone forgets that, at the dawn of a cartographic project, ‘THE MAP STILL DOESN’T EXIST’. For it to exist, a scope of collective work and essential skills are necessary. First of all, the aim of a mapping project must be identified. Its specifications, statement of requirements, its schedule of conditions must be sealed by a contract between an orderer and a cartographer.

The objective of this presentation is to recall how a keyboard is neither a magic thought nor a magic wand. Clicking on it will never finalize our work without us, cartographers, but engages us to follow series of timeless execution process over the entire duration of the cartographic production, in anticipating each action.

Our work consists in making every effort, by all the necessary technical and human means, to gather the knowledge of a subject (or several) to ‘Map-draw’ with the ultimate goal of returning this acquired knowledge to the readers. Their eye has to find at first glance the information sought. Indeed, the more beautiful and easier to grasp the map is, the more it will be consulted with pleasure.

Through a range of cartographic memories, the following characteristic examples of out-of-standard cartographic productions will detail the pertinence of this meticulous cartographical articulation.

**Keywords:** Topographic maps, Thematic maps, Atlas, Map-drawing, Graphic design

## 1. Introduction

Geolocations define the framework of the project through analysis, prioritizing each data that will compose it through reports of measurements in an appropriate projection, a scale making the accuracy of the map readable, the mentioned scope of work calling on other trades associated with those of the cartographer, until the publication bring the map between its user’s hands.

From drawing to engraving, from our light tables to our digital tools and systems, from the photographic laboratory of yesterday to our calibrated screens and prints of today, the preparations for our work remain manual.

On closer observation, our profession has not changed so much. Our vocation remains the same: our mission is to inform with rigor and precision the map’s users. Whatever the time and whatever the tools used to produce our thematic maps and atlas, our mapping professions determine a full medium-purpose discipline, thinking of itself as a way to ‘inform’.

The cartographer is trained to produce the most rigorous tools to represent the amount of geolocated data necessary to achieve, in fine, what is not an ordinary image. ‘Map-Drawing’ supposes to find the best answers to the questions the map is supposed to fix, restoring unequivocally the coherence of an information going to be disseminated, clearly referenced in its keybox.

The creation of a map requires processes dedicated to the security of each step of a work consisting in managing complex and heavy files to be archived with care along the way for weeks or even years. The slightest displacement of a selected anchor point of our plots depends on the previous gesture and induced the following one. Layer by layer of information, zone by zone, enlarged in readable format adapted to our screens by zooming, in a logical and precise order, the map reveals itself along with our work.

Any dive into our sophisticated cartographic systems requires total concentration, serenity to any test, commitment to never make a random move in our execution files, working progressively in complete security. Execution and recording time of each gesture is incompressible in cartography.

This submission aims to stress what “mapping” means, to share the knowledge and its pedagogy. This requirement indicates the indispensable thread to follow in order to obtain the expected result that will appear only at the end of many collective efforts, when it is laid out. There, other trades must enter the scene in order to ensure that the work produced can be published and disseminated.

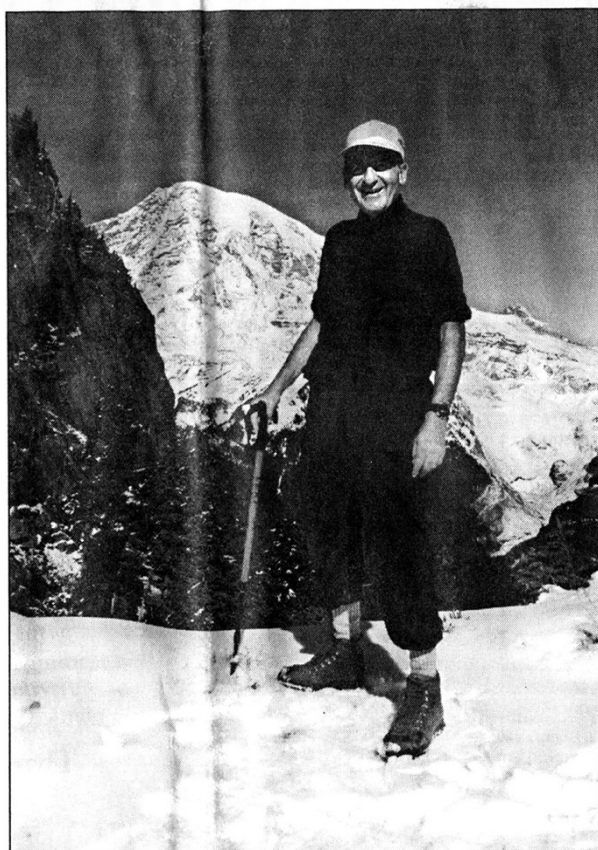
Through the three following examples of monumental maps produced since 1997, this contribution invites to embrace sequences of cartographic processes.

### 1.1 A life in cartography, the choice to learn in order to understand and to share it

Maps are travel companions, artistic universe of evasion and dreams, technical support of our scientific knowledge, thanks to which the maps are also our tools to help to fix our collective decisions. The maps remain unbreakable links between our living spaces, the organization of our societies, our imaginations... Wandering by necessity or desire, the maps crystallize our itineraries through our projections, our living dreams in spaces that we inhabit together.

## 2. A map of Mount Rainier National Park, USA. A tribute to Stanley Friedman, improvised publisher from Seattle, and to Jean-Claude Dupuis, France Map Library Dir., National Geographic Institute (IGN, Paris 1997)

Most often, a project in mapping starts by an encounter between an orderer and a cartographer. Here, all started by a dream shared in a call from Stanley Friedman, Seattle, to Jean-Claude Dupuis, Paris.



**Stanley Friedman** of Mercer Island has just published a map of Mount Rainier National Park. COURTESY OF STANLEY FRIEDMAN

Figure 1. Stanley Friedman, provider and finally publisher of The Topographic Map of Mount Rainier National Park, Centennial Edition (Stanley Maps, US 2000)

The aim of this call was to suggest to the National Geographic Institute to produce, from France, an updated topographic map of the Mount Rainier National Park. ‘Tahoma’ active stratovolcano, world most prominent peak (4392 m), Northwest Pacific in the Cascade Range, Washington State, US, where the last available maps dated from 1945.

S. Friedman was a frustrated climbing hiker enjoying wilderness (Fig. 1), dreaming about an updated map offering the characteristics and accuracies of our 1:25 000, the blue series topo-maps recovering the French territory produced by our civilian mapping institution.

### 2.1 A first approach “I’m just wandering around”

Meeting with a very unusual character, a wonderful human being talking about maps, S. Friedman made by my side his last deal at 73 years old: “I’ve done lots of things, none of which I had any background in”, the mild-mannered Friedman said with a smile, “I’m just wandering around.”<sup>1</sup>

All started a little later for me, French cartographer called to the rescue, by our encounter in the office of J.-C. Dupuis, Saint-Mandé, at the French Map Library (that place even doesn’t exist anymore today). First, M. Friedman explained his project, his dream and its frame. He wanted me to be connected with an American publisher (‘GREEN TRAIL’, Seattle) in order to create this big map together.

The death of the Green Trail Founder in the meantime moved the project directly in Stanley’s hands a year later.

So, in order to keep our work possible, S. Friedman founded his own publishing company he called: ‘STANLEY MAPS’.

To make a map to exist, it needs the appropriated conditions.

After different exchanges during our preparations, we have been joined by Chuck Kitterman, cartographer from Bellingham used to work for Green Trail, in order to manage together our process to produce this monumental topographic map. My responsibility was specifically to give the map its scientific topographic accuracy and artistic aspects. C. Kitterman had particularly in charge to coordinate our amounts of works with our different interlocutors from the US Geological Survey to the management of the Mount Rainier National Park and its rangers on site.

### 2.2 Learning how to map ‘Tahoma’ authenticity. Preparations, USGS aerial coverage photography

Time had to be spent on the spot, in the Park as in S. Friedman’s office on Mercer Island, closed to Seattle, with no moment to rest. Days and nights, through its own pictures in support, Friedman never stopped explaining every trail, every fault, every glacier, each place and each name and its meaning to the local Native Indians who respected this magical place, ‘TAHOMA’, shrouded in clouds, majestically placed on the lines of time, above the World.

<sup>1</sup> The Seattle Times, Monday, September 2000 by Ian Ith



The story of a map is always full of so many stories that the map itself cannot show... notes had to be taken on the back of the photographs to be spotted in detail later.

The USGS 1996 aerial photo revision coverage was available, in color, in 1997. We had at our disposal the series of USGS contours that we combined in order to fix our new map at the scale 1:30 000, in Lambert Conformé Conic Projection.

In the rules-of-art of photo-identification, each parcel of this territory and its surroundings has been observed and reported in order to update and rectify as much as accurately each of its representation (Fig. 2, 3).

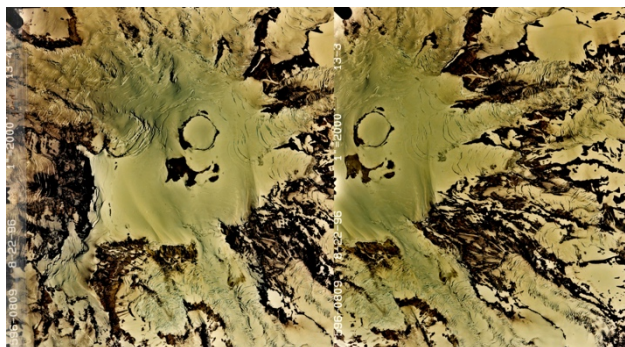


Figure 2. “Tahoma” Stereoscopic study, USGS Aerial Photography Coverage, 1996.



Figure 3. “Tahoma” Stereoscopic study: first drawings of terrain features, J. D. Salachas, cartographer.

From its manual studied preparations to the digital reports, the big map started to be created layer by layer in @Illustrator.7 at the time (Fig. 4).

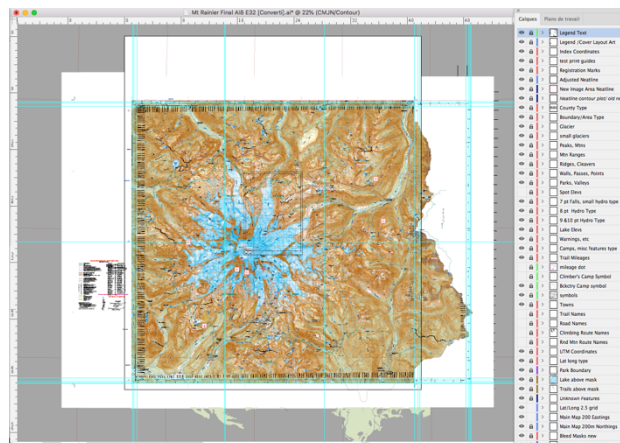


Figure 4. General overview of the Mount Rainier National Park Topographic Map Centennial Edition in @Illustrator 7, 1999.



Figure 5. “Tahoma” cartographic aspect of the Mount Rainier National Park Topographic Map, abstract (Stanley Maps, 2000)

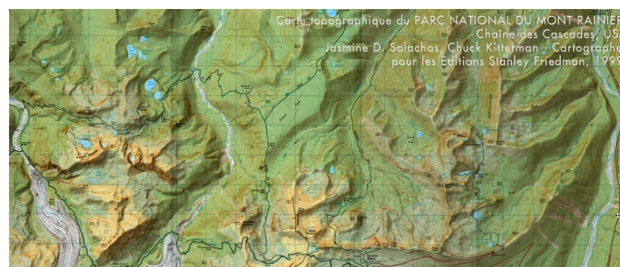


Figure 6. “Tahoma” North-East, abstract (Stanley Maps, 2000)

### 2.3 A remarkable artistic dimension: Between geodesy and art, the civilian cartography at the service of the public

*“Until now, it was claimed that American maps, with a few exceptions, met the practical requirements of the New World, which did not bother with aesthetic considerations of old Europe. The “Mt Rainier National Park” map recently published by Stanley Maps is a brilliant denial.*

*I had the chance to connect Stanley Friedman and Jasmine Desclaux-Salachas, cartographer, one in Seattle, the other*



in Paris. Two amazing characters, willing and passionate about beautiful cards.

Despite the distance, they managed to overcome all difficulties. It is remarkable that the processes used have involved both the most traditional pen drawing and the most modern automated mapping from USGS files.

The manual drawing of rocks, glacial moraines and scree, are no longer practiced. J. D.-Salachas, assisted by J.-L. Pottier, both students of the National School of Geographical Sciences were able to take up feathers and stereoscopes as they had learned 20 years earlier.

The printing of colors has been treated. The graduation of the tints and the blending is soft and harmonious, especially the yellow of the meadows that comes to brighten the sides of the mountains under the sparkling bluish of the glaciers. The artistic dimension of the map has been well taken into account. It speaks to us and invites us to travel, the success is total. The Mount Rainier of Stanley Maps has found its place among the works of quality, following the Swiss Alps of the Federal Office of Topography and the Massif du Mont Blanc of the IGN.”

J.-C. Dupuis, IGN, France Map Library Dir., March 2000.



Figure 7. Topographic Map of Mount Rainier National Park, Centennial Edition (Stanley Maps, USA 2000)

Mapping implies using many techniques and skills to express what must be said about a specific place and the issues that intertwine, where everything must be measured, defined and prioritized. All cartography begins with a research work where each plot must be staged as it exists in reality. Each of the plots on the map is seen in its drawing as it is seen in the landscape, in its own place and in its own environment.

To map is to think of the construction of a structured and spontaneously accessible visual language, aiming at a coherent and memorable interpretation of reality. The map must account for the real. Whatever the scale to reproduce it, mapping is not reinventing reality but rather proposing modes of representation to account for it.

### 3. The different stages of making a perfect sphere, a giant work in standby since 2017

The meeting to embody the frame of this new monumental map started in 2016, at the National Geographic Institute.

#### 3.1 From an approximation of a Earth globe to the mapping of Earth in details

The challenge, here, was to (re)draw the world without any model, from the geographic geolocation of each point exactly located on its latitude and longitude, following the grid made up of meridians and parallels, joining points until lines creating the conform surfaces (Fig. 8, 9).

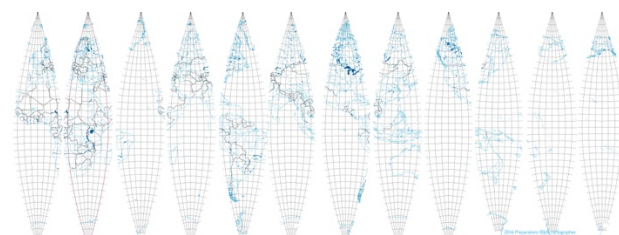


Figure 8. First preparations to map a giant globe in standby, 2016 (J. D.-Salachas, Giant Earth Globe, 2016-2017)

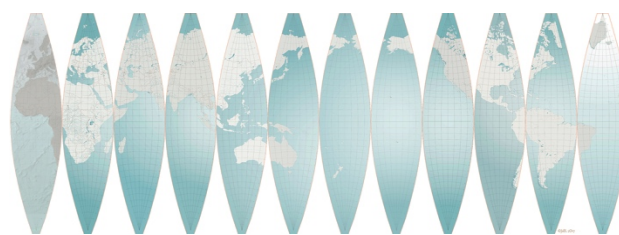


Figure 9. Redrawing the world for a giant globe, a complete creation in standby (J. D.-Salachas, Giant Earth Globe, 2016-2017)

Drawing the world as it exists: create a map that did not exist... redraw the entire Earth on a giant globe, point to point in longitude and latitude, from the Poles to Ecuador, from East to West, reviewed from North to South, from its torn coasts, its cliffs, its long pebble and fine sand beaches, its capes and lagoons, its peninsula islands, its rivers flowing into its rivers from their sources, shaping its forms, its plains, its mountains, its borders... since its generalization to the tightening of its plots in the greatest precision (Fig. 10)

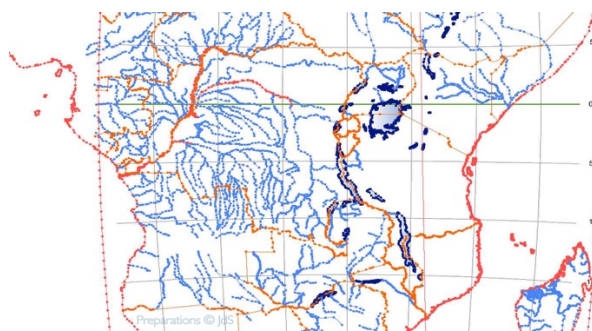


Figure 10. The Earth at 1/15 000 000e as it exists, scale of representation as consistent as possible, relatively fair in its angles and its surfaces to Ecuador (J. D.-Salachas, Giant Earth Globe, 2016-2017)



Endless hours of clear reading in @Illustrator! From the rough way to lock onto it relatively, to the accuracy of the representations to account for the beauty of the real that Nature offers us (Fig. 11, 12)

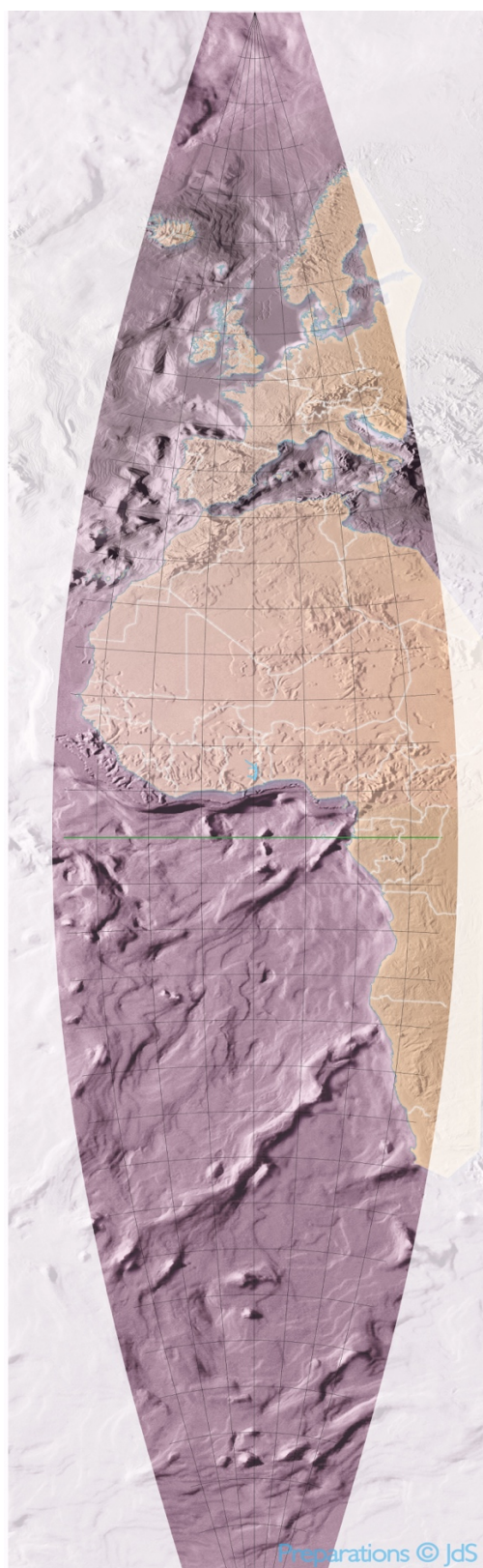


Figure 11. The Earth Globe and its reliefs, first testing (J. D.-Salachas, Giant Earth Globe, 2016-2017)

In August 2016, started an embarkment on a recreational dive of this empirical work, without a precise contract, open to create what did not exist: a new map without model, without benchmark, without rigid deadlines since it was necessary to adapt day by day to the gestures, calculated certainly, but subject to unforeseen circumstances. Earth mapping has been built from the meridians and parallels lines, plotted in the scale of this giant globe.

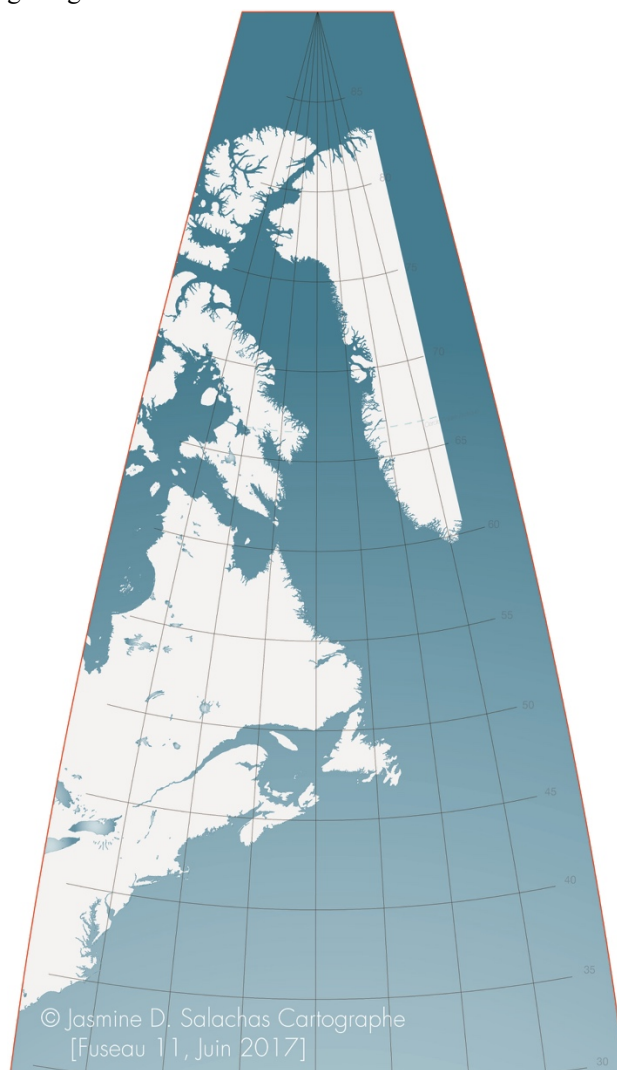


Figure 12. Earth mapping and its accuracy, giant files managed in @Illustrator (J. D.-Salachas, Giant Earth Globe, 2016-2017)

### 3.2 Imagination at the service of the working hand, of the eye that never leaves its drawing

To map in two dimensions a gigantic three-dimensional sphere forces one to constantly imagine its invisible volume.

Whatever our production tools are, we always start from the detail of a map called “BASIC MAP”, to extract the essential by ‘GENERALIZATION’ and keep on the map in progress only the information related to its subject.

A new challenge for an experimental construction that will be decrypted in Florence, ICC-2021.

#### 4. Treasures of Humanity and public information, a Museum of Human new cartographic adventure, 2021

There are strict rules to carry out this patient, tedious work, rules that one must constantly know how to transgress according to the scale, the projection, the characteristics of the ground studied... if it is a town center, a mountainous massif, a vast plain, an edge of the coast torn away by erosion or long beaches of fine sand: nothing is thought of in the same way when we map.

To map doesn't consist to copy/past an image as it seems always more and more to be printed in minds. Each plot in the map must be referenced, and georeferenced when the information is related to spatial databases. each information must be sourced in order to be mapped. Cartographers must offer to all the most rational and pleasant tool to read a reality through its higher likely, realistic, representation. Any return of information must remain, as fair as possible, "honest" to the citizen who must be thoroughly informed. The cartographer does not map for himself, but rather to inform users of the maps he/she is making

##### 4.1 Users of our maps determine the nature and the construction of our works according to their uses

Achieving the best objectives, when designing maps requires cartographers to know their readers and the conditions of use of the maps to be produced beforehand. It is the users themselves and what characterizes their use of maps that determine the elements that must be built to inform them: on what scale of reproduction and on what type of projection adapted to allow the readability of the data? For which level of detail of information to propose? How to direct the research in graphic semiology to develop the best language of visual expression according to the mode of editing of the final document ?

Throughout the process of making a map, it is necessary to be able to define which information must remain priority, which other must be discarded, reduced or erased. Adapting the 1:1 reality to a given scale on the page format requires abstracting what is too small or unreadable. It will be necessary to « generalize » each data in order to find the most correct carto-graphic language, the most adapted to the subject and the conditions of its reading where everything must make sense at first glance.

##### 4.2 The beginning of a project in cartography is a contract and its terms of reference

At first, all started through the monumental project of one map featuring the European Continent until the Black Sea, 40 000 years ago (Fig. 13, 14).

Mezzanine novembre 2020.  
Entrée : Cadre doré et écran  
Box 1 : film art pariétal avec menu

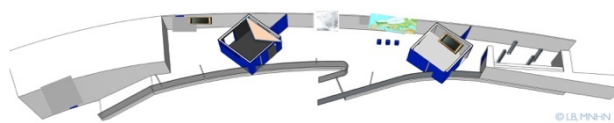


Figure 13. *Mezzanine des Trésors de l'Humanité*, general public frame (MNHN, 2020)



Figure 14. First preparation: Europe until the Black Sea, J. D.-Salachas, cartographer (MNHN, 2020)

##### 4.3 Behind a map, an accurate accumulation of knowledge represented by a cartographer in order to answer its users

The transformation of the cartography from Azov to Irkutsk extended the initial project until the representation of Nepal, until the south of Persian Gulf, a part of India... embracing the rotations of each drawing inside the general layout (Fig. 15, 16, 17).



Figure 15. Second preparation including the Magdalenian continent: extension beyond the Azov Sea, J. D.-Salachas — Cartography of the Magdalenian continent is here based on Anthony Sécher's research on Europe in the Ice Age, Doctor in Prehistory (MNHN, 2020)





Figure 16. Magdalenian Europe beyond the Azov Sea, including its Inlandsis (J. D.-Salachas, MNHN, 2020)



Figure 17. Third reconstruction of the map in order to extend our presentations until Irkutsk, Lake Baikal, Eastern Siberia (J. D.-Salachas, MNHN, 2021)

Hydrographic systems and watersheds benchmarking the borders, each point had to meet the other, layer by layer, tens of millimeter to tens of millimeter, in order to produce the right line, so that each information can be reached without error, at its right place (Fig. 18).



Figure 18. A giant mapping system thought to be printed on 2m50 height, 15 m width, and finally organized to produce 4 thematic other presentations locating the Treasures of Humanity until Eastern Siberia (J. D.-Salachas, MNHN, 2021)

After inevitable multiple validations of this specific cartographic background adapted to the set of presentations, geolocations procedure in 3 available dynamic geolocation systems completed the Excel data bases of the prehistoric sites presented to public (P. Paillet,

Prehistorian and É. Robert, Prehistorian-Anthropologist, MNHN). Focus for the French prehistoric sites mentioned (Fig. 19, 20, 21, 22)



Figure 19. French prehistoric sites geolocations/IGN, by S. Seyer, Cartographer and S. Boullier, Engineer-Topographer (J. D.-Salachas, MNHN, 2021)

[https://www.geoportail.gouv.fr/carte?c=-2.1729973609767153,47.30868326910556&z=5&l0=GEOGRAPHICALGRIDSYSYSTEMS.MAPS.SCAN25TOUR.CV::GEOPORTAIL:OGC:WMTS\(1:h\)&l1=GEOGRAPHICALGRIDSYSYSTEMS.MAPS::GEOPORTAIL:OGC:WMTS\(1\)&l2=GEOGRAPHICALGRIDSYSYSTEMS.MAPS.SCAN50.1950::GEOPORTAIL:OGC:WMTS\(1:h\)&d3=3126095\(1\)&permalink=yes](https://www.geoportail.gouv.fr/carte?c=-2.1729973609767153,47.30868326910556&z=5&l0=GEOGRAPHICALGRIDSYSYSTEMS.MAPS.SCAN25TOUR.CV::GEOPORTAIL:OGC:WMTS(1:h)&l1=GEOGRAPHICALGRIDSYSYSTEMS.MAPS::GEOPORTAIL:OGC:WMTS(1)&l2=GEOGRAPHICALGRIDSYSYSTEMS.MAPS.SCAN50.1950::GEOPORTAIL:OGC:WMTS(1:h)&d3=3126095(1)&permalink=yes)

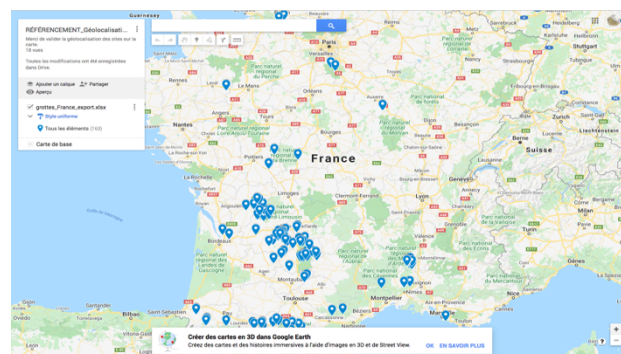


Figure 20. French prehistoric sites geolocations/in Google.MyMaps, S. Seyer and S. Boullier (J. D.-Salachas, MNHN, 2021)

<https://www.google.com/maps/d/u/0/edit?mid=1qxJt3bacjtlJamMRkfoDny3KeEHqU500&usp=sharing>

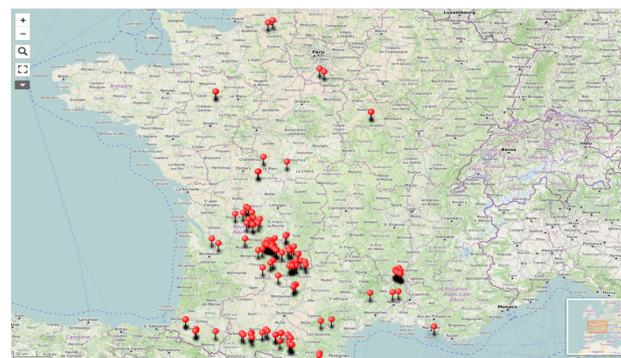


Figure 21. French prehistoric sites geolocations/In OSM S. Seyer and S. Boullier (J. D.-Salachas, MNHN, 2021)

[http://umap.openstreetmap.fr/fr/map/sites\\_553523#6/47.525/2.813](http://umap.openstreetmap.fr/fr/map/sites_553523#6/47.525/2.813)



Figure 22. *Trésors de l'Humanité, French prehistoric sites geolocated* (L. Bataille, J. D.-Salachas, MNHN, 2021)

While being managed, these sophisticated carto-graphic systems require a strict concentration. Cartography permanently demands a complete serenity, an obligation to not commit any outward in order to protect the files from any corruption, with incompressible recording times, whatever it takes to guarantee no risk on the final quality for the final files to be easily edited (Fig. 18).

#### 4.4 Cartography is thought to talking to its audience

Graphic design offers to capture information outside the map itself, to manage it in a visual frame aiming to talk to the audience. Through an act of revelation, the graphic designer switches and oscillates between two visual requirements: the staging of a content, its narrative, and the invisibility of the device allowing the transmission of knowledge (Fig. 23, 24, 25).

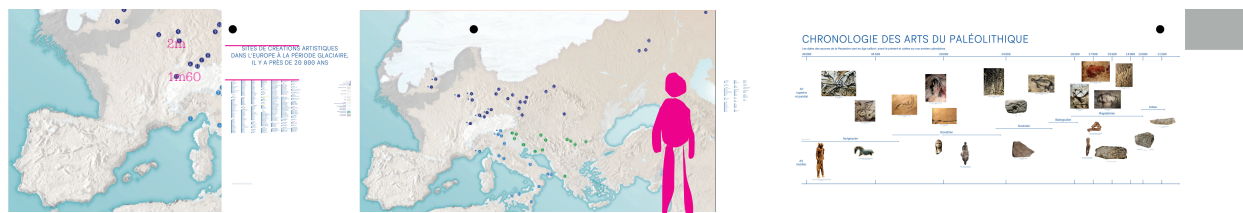


Figure 23. A first graphic approach about the relation between the maps, the prehistoric chronology and the public (L. Bataille, Graphic Designer, MNHN, 2021)



Figure 24. *Trésors de l'Humanité, MNHN, 2021*. Printed by Studio LUDO, France. Courtesy of Studio LUDO and L. Bataille.

## 5. Conclusion

The work behind a map is tedious and not exciting. But this is the thread to follow to get the result expected. Passion may start later, on the other side of the cartographer, at the end of its collegial work produced to inform the public about the results of the research that maps highlight. While considering the number of these necessary steps to reach the map users wait for, the visual science, from the beginning of a project until its possible uses, the passion remains on hold until the end of our collegial works produced to inform. In few words, mapping is a discipline that allows us to remain accurately realistic. Passion in cartography, then, can start when the work finished can be shared.



Figure 25. *Trésors de l'Humanité, Meeting with the public, MNHN, 2021*. Courtesy of M. Tazaïrt .

## 6. References

- Desclaux-Salachas, J. and Kitterman, C. (2000). Mount Rainier National Park Topographic Map, Centennial Edition, Stanley Maps. Seattle, USA.
- MNHN, *Salle des Trésors*, 17, Place du Trocadéro, 75016 Paris, France.
- Bataille, L. (2021). ÉSAD Valenciennes, *Structure Bâtons* <https://www.b.a.t.o.n.s.fr>, Valenciennes, France.
- Desclaux-Salachas, J. *les Cafés-cartographiques*, Paris, France.
- Sécher A., research on Europe in the Ice Age, Doctor in Prehistory (2017), <https://asecher.wordpress.com>, Paris, France.