

RETOUR D'EXPÉRIENCE : L'USAGE DU RIPOLIN DANS LES PEINTURES DE LA COLLECTION DU MUSÉE PICASSO D'ANTIBES

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« Quand nous avons commencé, on ne savait pas ce qu'on faisait. Si vous m'avez dit : Voilà un atelier ! Vous-même, vous ne saviez pas ce que vous vouliez faire. C'est pour ça que ça a réussi, parce que vous n'avez pas imité un musée. »
Picasso à Romuald Dor de La Souchère

Sometimes destiny has a way of playing with people's lives. It wasn't really a chance encounter that brought Picasso and Dor de La Souchère together on the beach in Antibes just after the war. De La Souchère, a curator, had a museum full of antiquities, with a top floor used for storage. Picasso, in an effort to escape the somber atmosphere of Paris; was spending the summer in Antibes, as he had done many times before. In fact, it was Michel Sima who brokered the meeting. Nonetheless, had it not been for that encounter, today the city of Antibes would not carry the distinction of having the first Picasso Museum ever established and eventually baptized with this name in 1966.

Trained as a sculptor and later taking on photography, Michel Sima had experienced the creative milieu of pre-war Paris, where he first met Picasso. At 34, he had just returned to the South of France after internment in one of Hitler's concentration camps (or: "after internment in a concentration camp"). He was the first occupant of Dor de La Souchère's "atelier in the attic" and was quickly adopted by Picasso as an "archetypical harlequin" to provide him with materials, ideas and entertainment. It is to Sima that we owe the detailed photo-documentation of that fertile, enormously creative period of revival for Picasso that unfolded between September and November 1946 on the French Riviera.

Illuminated by the large studio projectors that Sima had sourced from the Studios de la Victorine in Nice, the painter, his young companion Françoise Gilot and the photographer worked feverishly every afternoon well into the night. In the highly contrasted black and white photographs we see the artist at work, at rest, posing with occasional visitors, in contemplation of his work, in action, painting on plywood panels propped up on easels or laying down on the ground. What strikes us is the multitude of cans and brushes scattered among charcoal smudges all over the floor, and the sporadic appearance of a rolled up tube and crumpled rag. The glistening of the enamel is palpable under the strong light in the darkness of the studio, and drips of paint, decorating the bottom lip of easels, are evident in many of the images. Sima would leave us more than 400 snapshots of that creative season.

« Et puis, se forcer à utiliser de moyens limités est une contrainte qui libère l'invention. Cela oblige à progresser d'une manière qu'on ne peut pas imaginer a priori. »

Picasso à Françoise Gilot

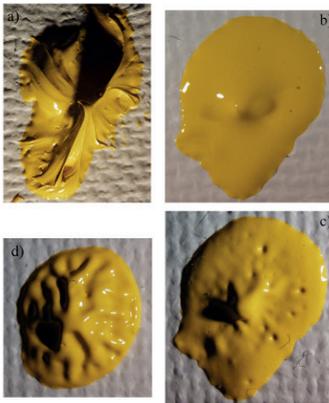
No sooner had Picasso left the Château Grimaldi in the second part of November, carrying with him only those drawings, sketches, gouaches and paintings whose small dimensions allowed to be comfortably packed in his car, than the mythos of Ripolin began for the Antibes cycle. The artist left behind 23 paintings and 44 works on paper: Dor de La Souchère in 1960 and Danièle Giraudy in 1982, both chief curators of the Museum at the time, promptly attached a Ripolin label to the media of this corpus.

It was Françoise Gilot who first elaborated on Picasso's desire to work with materials sourced locally, even though he could realistically have sent for his fine artists' paints stashed in the studio of the Rue des Grands Augustins in Paris. Boat paints, or "ripolin" paints, were chosen instead, she added, because of the belief that such materials would better withstand the ravages of the harsh marine environment to which the paintings would be exposed. And it was the resourceful Sima who was dispatched with Picasso to the harbor's shops, including la Droguerie de la Marine, to get boat paint and plywood supports. The large fibrocement panels used for such iconic works as *La Joie de Vivre*, and the triptych *Satyre, faune et centaure au trident*, would be acquired from the Société Cannoise de matériaux on September 17, 1946.



1. Selected examples of surface characteristics typically associated with enamel paints, as captured on the surfaces of the Antibes paintings. From top left, clockwise: fluidity of paint; drips; marbling and incorporation of dried bits of paints; wrinkling. Details taken from, top left: *Nature morte aux volets noirs*; top and bottom right: *La Joie de Vivre*; bottom left: *Ulysse et les sirènes*

Close observation of the surfaces of the paintings in Antibes certainly reveals all the characteristics usually associated with enamel paints: a smooth, often brushless surface, high gloss; leveling, smooth edges, presence of pin-holes, incorporation of dried bits of paints collected from the rim of a can left opened for a few days, wrinkling; drips and marbling (fig. 1). Caution should be exercised, however, in presuming the presence of Ripolin based on visual clues alone, since scientific analysis of Picasso paintings as well as modern reconstructions using combinations of oil-based tube paints and siccatives have demonstrated that the surface effects of enamel paints could be easily replicated with traditional materials. Picasso wasn't shy of using this expedient, perhaps when he did not have any paint cans handy, but still wanted to achieve the formal and aesthetic effects of a "Ripolin look" (fig. 2).



2. Paint reconstructions, to mimic the look of enamel paints using mixtures of artists' oil paint and copal painting mediums.

- a) Old Holland oil paint;
- b) paint a mixed with 26% w/w Studio Products Congo Copal showing the complete loss of brushmarks and smooth, enamel-like look;
- c) paint mixture portrayed in b after 2 months, showing pin-holes;
- d) paint a mixed with 45% w/w Studio Products Congo Copal after 2 months of aging, showing wrinkling effects

Average size of paint daubs is between 0.5 and 1.0 cm

Of course, the legend of Ripolin and Picasso goes back much farther than the artist's Mediterranean years. Although he methodically kept even the smallest record, scrap of paper, used ticket and the myriad of other memorabilia accumulated during an incredibly full life, only one receipt for a purchase of Ripolin "blanc de neige," and a note to Marcel to purchase black and white Ripolin, both undated, are known to exist in the Archives of the Musée national Picasso-Paris. Yet we know Picasso used Ripolin from his letters of 1912 to Daniel-Henry Kahnweiler, the comments and correspondence of visitors to his studio such as the artist Gino Severini and the Czech collector Vincenc Kramár, the accounts of Gertrude Stein and Roland Penrose, media entries in early exhibition catalogs that would have likely been written based on first-hand information from the artist, and physical evidence incorporated in some of his works (a Ripolin lid forms the head of the Art Institute of Chicago's *Figure*, from 1935). After the Second World War, additional types of enamel paint entered

the painting vocabulary of the artist, including brands such as Valentine, Triton, and Avi, whose cans can be seen in the many photographs of Picasso's homes of the South. Some examples of actual cans—the paint sometimes still viscous to this day, pulsating with its endless possibilities—remained in Picasso's many studios and are in the possession of the family, with one specimen of black Triton and one of Ripolin *blanc de neige* currently on display in the reopened Musée national Picasso-Paris (fig. 3).



3. Detail of a chair with paint material from one of Picasso's studios in the South of France showing a can of black Triton paint and a can of Ripolin blanc de neige
© Succession Picasso, 2016

Despite the artist's use of many different brands of enamel paint after the war, Ripolin has risen to iconic status because it was one of the first ready-made, non-artist material, technical innovations adopted in Picasso's avant-gardist exploration of modernity. Ripolin, in short, represented a formal and material rupture with the artistic means of the past and, as such, is the only paint that is still identified by its brand name in museum labels, a distinction only afforded to Roy Lichtenstein's (1993-1927) use of Magna, David Alfaro Siqueiros' (1896 – 1974) of Duco and a few others.

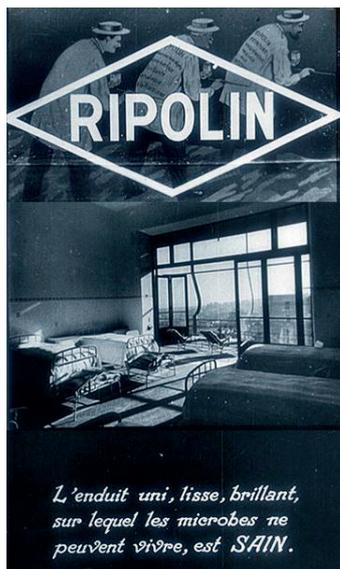
Le Ripolin, "société anonyme française de peintures, laques et d'enduits sous-marins" was established in 1897 as a partnership between the French Lefranc and the Dutch company Briegleb, who owned the technology developed by Carl Julius Ferdinand Riep. A pavilion exclusively dedicated to the production of Ripolin was erected on the site of the Lefranc Factory at Issy les Moulineaux. In the beginning, this was the only place where Ripolin was produced for many years, until the establishment of production and distribution centers elsewhere in France, as well as in England, Spain, and eventually the United States (under the auspices of Glidden). Recent research has disclosed that Lefranc provided Ripolin with the base medium for enamel paints, while the Ripolin end of the production was dedicated to grinding the pigment mass into the medium and conditioning and packaging the product. The Lefranc family acquired all the patents from

Mr Briegleb. So close were the two enterprises that even after the public offering of the Ripolin company on the stock market, members of the Lefranc family continued to sit on its board.

The incredible prominence of Ripolin paints in the first half of the 20th century was undoubtedly due, not only to the superior quality of its paints (as has been confirmed by scientific analysis) and to its role of trail-blazer in the household paint market, but also to its savvy marketing strategies. Thanks in part to the clever design of its advertising, Ripolin was quickly celebrated as a symbol of modernity and was heralded as sanitary because it formed a continuous, impenetrable film that could fill all imperfections of walls in which microbes and dust could otherwise collect, and was easy to clean, hence its popularity in hospitals. One cannot help but wonder whether Picasso's remark that Ripolin represented "la santé des couleurs," as reported by Gertrude Stein, may have been subliminally influenced by such advertising (fig. 4).

Despite its incredible fame and its solid position in the socio-political and artistic scene of early 20th century France and beyond, the precise identification of Ripolin beyond visual perception has remained elusive. Picasso's own mention of the fact that "the Ripolin enamel paintings, or Ripolin-like paintings, are the best ones" should sound like a warning: not all that looks glossy and enamel-like is necessarily Ripolin.

Scientific analysis can assist the art historian and conservator in making accurate determinations of where Picasso actually employed Ripolin paints. It is only with the solid foundation of this material knowledge that the journey to attribute meaning to the artist's specific choice of materials can begin.



4. Screen captures of an undated commercial video for Ripolin paints (c. 1950) promoting its sanitary character
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« Les œuvres naissent selon les moments, les lieux, les circonstances. Au fond on interprète toujours le réel et tout est bon pour l'artiste. Tout est point de départ. »

Pablo Picasso

As we are trying to answer the question of whether Ripolin was indeed the medium of choice for Picasso's oeuvre in Antibes, it should be underscored that, for a collection not even seen outside of the Château Grimaldi until the early 1980s, the materials of this collection have been the subject of unique, in-depth scientific scrutiny. This is even more remarkable in light of the still relatively scarce number of published technical studies of the works of Pablo Picasso. The first scientific exploration of the collection by the researchers of the Laboratoire de Recherche des Musées de France dates back to 1982, shedding important light on the process of creation of this extraordinary corpus. 27 years later, a new analytical campaign led by the Art Institute of Chicago has confirmed and refined those results.

Scientifically identifying oil-based Ripolin is challenging. To solve this problem, The Art Institute of Chicago has amassed what is perhaps the largest collection of historical Ripolin samples. A multi-technique analysis of this material has allowed us to drill down to the DNA of the paint, unraveling every detail of the composition of its pigments and extenders, measuring the particle size of the pigment mass, scrutinizing in detail the binding media and interpreting all these results in light of existing technical literature. Our research uncovered that Ripolin paint was based exclusively on the finest grade of zinc white, free from most impurities, ground to a very small and reproducible particle size. The pigments used were mostly inorganic colors with a few synthetic organic pigments (hence the good light-fastness of these paints), used pure, with only slight traces of extenders, and blended with a binding medium made of heat-treated linseed oil (stand oil) mixed with varying amounts of Pinaceae resin depending on the final hue of the paint. This paint formulation was kept strictly secret and changed relatively little in the 60 years of (French) production that we have studied.

This profound knowledge-base allows us to compare, side by side, the composition of the Antibes paints and the specific composition of the "13 colors of Ripolin" as published by Giraudy in 1982. Although the visual appearance of the paints resembles very closely the hues available on contemporary Ripolin brochures, our recent study confirms that while Picasso undoubtedly used enamel and "boat" paints at the Château Grimaldi, the majority of them do not match the composition of the paints produced by Ripolin (table 1). These findings are supported also by historical evidence: receipts in the Musée Picasso Antibes archives only include notations for *peinture blanche*, *zincolac* or *Peinture droguerie*, with no specific mention of Ripolin. Similarly, in Sima's photo-documentation, only cans with the Droguerie de la Marine and Valentine labels are clearly legible. Thus, while Françoise Gilot wasn't in error calling them ripolin paints with small caps to signify generic enamel paints, with the scientific knowledge we have today, it would be inaccurate to label the paints used in Antibes as Ripolin with a capital R.

The significance of the new research, besides resolving once and for all longstanding ambiguities about the specific paints used in Antibes, also resides in its ability to open new

paths of inquiry into Picasso’s work, enabling new discoveries within the collection.

Because the paints are brushed in flat application with minimal mixing (only charcoal is found in some colors and white paint mixed wet into wet for some specific passages) the same tints reverberate from one work to the other, creating a musical echo on the walls of the museum, where we find a recurrence of the same ochre yellows, piercing turquoise blues and deep maroons in many different paintings.

As a result, Picasso’s practice in Antibes allows us to add new information to the genesis and gestation of his most iconic work: *La Joie de Vivre*.

« Il serait très curieux de fixer photographiquement non pas les étapes d’un tableau, mais ses métamorphoses. On s’apercevrait peut-être par quel cheminement un cerveau s’achemine vers la concrétisation de son rêve. »

Picasso, 1935

It all started with close observation of the surface to discern underlying colors, which only peeked through at the edges of existing forms. Then we augmented this knowledge with information on the colors gleaned from the complex stratigraphy of four existing cross sections of samples taken in the 1980s. Finally, a custom-designed algorithm guided the computer-controlled spreading of this sparse color information on a digital image of the black and white Sima photographs documenting the metamorphoses of *La Joie de Vivre* from one state to the other. Through the computational solution of complex equations, color was spread from one pixel to the other based on the localized color information and the grayscale intensities of the black and white historical photographs. Because Picasso always used the same set of tints, we can be certain of the value of each color in our new colorized visualization, based on what is visible on the surface of other paintings. The result is able to preserve

the artist’s brushwork and shading like never before and, by virtually turning back time, gives a richer context to the narrative that saw Picasso labor on this painting more than any other in Antibes (fig. 5).

Similarly to the journey back in time afforded by the newly colored states of *La Joie de Vivre*, the recent campaign of scientific analysis also pulled the lid over another aspect of Picasso’s practice in Antibes. We discovered that the specific composition of the white paints that the artist used encoded a clear indication of the period in which the works were painted. As a result, a new date of September 1946 has been proposed for the *Nu assis sur fond vert* based on the use of a white paint containing zinc white with trace amounts of barium sulfate that Picasso used only in September, and new dates of October 1946 have been proposed for *La Chèvre* and *Satyre, faune et centaure au trident* based on the identification of a white paint made of zinc white with significant amounts of lithopone, which was only used for paintings dated by the artist to October of that year. A critical reevaluation of Sima’s photographs supports the new dates.

CONCLUSIONS

In recent years materials and “materiality” have emerged as critical elements in the interpretation of modern art. If the technical means used to realize an artist’s vision have agency, could materiality then offer a new perspective on modernism?

In his book *Picasso and the Environs (Picasso i okrestnosti)*, published in 1917, the Russian critic Ivan Aksenov interpreted the use of enamel paint in cubist paintings in terms of the materials’ radical nature: “If an artist doesn’t use lettering and collages in his works, and doesn’t paint with enamel paints, he cannot consider himself as a modernist...”. And, he concluded: “Art is drowning in oil medium as music drowns itself in the twelve notes of the musical structure. Picasso is the only one who could surpass all painting techniques which are dying, and create a new art using all possible new materials.”

In the end, the explosive formal and ideological innovation of using enamel paints does not rest on it being Ripolin with a capital “R” or a generic version, with small caps. Scientific research can provide important answers to the art historical questions of where and when Picasso made use of non-artist paints. If materials make meanings, together art historians and scientists can start to write these new chapters in art history where the two disciplines go hand in hand in the search for new discoveries and a new framework of understanding Pablo Picasso’s work.



5. Left: 1946 photographs by Michel Sima illustrating the central areas of the 1st, 2nd and 3rd state of *La Joie de Vivre*. On the right hand-side: results of colorization for each corresponding image
 © Succession Picasso, 2016
 © Michel Sima héritiers
 © Sotirios Tsaftaris and Francesca Casadio

Ripolin paint name (swatch number)	Ripolin: Pigment identification	Antibes paints, pigment identification
Blanc Ivoire (53)	Zinc white, lead chromate (barium sulfate traces)	4 different types of white : Zinc white with minor amounts of barium sulfate; Zinc white with significant amounts of lithopone; Zinc white with no extenders; Zinc white with significant amounts of titanium white (anatase)
Jaune Clair (4)	Lead chromate, lead sulfate	A small amount of finely dispersed chrome yellow with barium sulfate and zinc white
Bleu Azur Foncé (17)	Zinc white, Prussian blue (barium sulfate traces)	High amounts of Prussian blue with very little barium sulfate and zinc white
Bleu Azur Moyen (18)	Zinc white, chromium oxide green (barium sulfate traces)	Prussian blue with significant amounts of barium sulfate extender and zinc white
Noir d'ivoire (5)	Carbon black (barium sulfate traces)	Asphalt, iron based black, carbon blacks have all been detected, either used together or individually
Mine Orange (19)	Basic lead chromate	Red lead (lead tetroxide) with traces of lead white
Rose Clair (12)	Zinc white, little lead chromate, alizarin crimson (PR 83)	
Vert Bronze Clair (87)	Lead chromate, Prussian blue, barium sulfate	A little Prussian blue and finely dispersed chrome yellow with barium sulfate, and zinc white
Vert Irlandais Clair (29)	Lead sulfochromate, Prussian blue, hydrocerussite	Prussian blue with barium sulfate and yellow ochre with kaolinite clay
Chamois Clair (31)	Zinc white, lead chromate, iron oxide, Barium sulfate	
Ocre Rouge (23)	Iron oxide	Red ochre with little burnt umber, zinc white, gypsum and quartz, kaolin and other clays
Gris Rose Foncé (51)	Zinc white, a little carbon black (barium sulfate traces)	Carbon black and zinc white with a small amount of iron based blackb
Gris Rose Pâle (52)	Zinc white, carbon black and possibly some lead chromate	White paint (of any type listed above) and crushed charcoal

Table 1. Composition of the hues of Ripolin that were identified in Giraudy, 1984, vol. 4 as the 13 colors used in Antibes. Their composition is contrasted with the composition of the various tints recently analyzed in Antibes to highlight compositional differences and similarities. The composition of paint swatches was scientifically determined from a Ripolin® brochure that can be dated to the period 1929 - 1946 (AIC ref. B02).

The ideas and opinions expressed in the videos and publications of this seminar are those of their authors and do not necessarily reflect the opinion or position of the Musée national Picasso-Paris, nor does the Musée national Picasso-Paris assume any responsibility for them.

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1. Jules-César Romuald Dor de La Souchère, *Picasso in Antibes*, Lund, Humphries & Company Ltd, London, 1960

2. F. Gilot in Richardson, John, Pablo Picasso, Françoise Gilot, Carlton Lake, and Jaime Sabartés. 2012. *Picasso and Françoise Gilot: Paris-Vallauris, 1943-1953*. New York: Gagosian Gallery, p.20.

3. *L'Atelier des combles*, photographs by Michel Sima, text by Anne de Staël, postface by Jean-Louis Andral, Hazan, Vanves, 2009.

4. Cited in Françoise Gilot and Carlton Lake, *Life with Picasso*, McGraw Hill, New York, 1964 p. 59.

5. Jean-Louis Andral, *Musée Picasso Antibes - Un guide des collections*, Paris et Antibes, 2012.

6. Jules-César Romuald Dor de La Souchère, 1960 cited in note 1.

7. Danièle Giraudy, *L'Œuvre de Picasso à Antibes*, catalogues Vol. 1, 2, 3, 4, *Catalogue Raisonné du Musée*, Antibes: Musée Picasso/Château Grimaldi, 1981-2.

8. Note the small caps use of the name "ripolin," which soon became a common term to indicate enamel paints in general, independently of its manufacturer; a quick adaptation of the language

to contemporary uses, much as we use the verb "to google" today to indicate an online search, independently of the search engine actually used.

9. Françoise Gilot will make reference to this multiple times: « À cause des embruns salés qui étaient à craindre et de leur effet corrosif sur la peinture à l'huile, les tableaux de Picasso destinés au musée d'Antibes furent peints avec de la peinture pour bateaux ou du ripolin jugés plus résistants » [...] « Mais l'idée était de créer à Antibes avec des matériaux venus d'Antibes : de la peinture pour bateaux, par exemple » [...] « Je crois que c'était un

effort conscient pour ne pas entrer dans des routines et pour se donner des défis à lui-même en se servant de matériaux qui n'étaient pas destinés à des pratiques artistiques ». In Françoise Gilot, Maurice Fréchuret, 1946, *Picasso et la Méditerranée retrouvée*, Grégoire Gardette, Nice, 1996.

10. Several receipts from the Droguerie de la Marine for painting materials exist in the archives of the Musée Picasso Antibes. For a detailed discussion of the composition of these paints see F. Casadio, G. Gautier "Picasso at work: making the case for a scientific re-evaluation of the materials of the Antibes cycle" in *Picasso express*. 2011. Antibes: Musée Picasso.

11. Original receipt in the Musée Picasso Antibes archives.

12. It is important to note that Ripolin paints were also produced in a matte version (Ripolin Mat). Referring to Picasso's works of the 1950s later on his friend Roland Penrose reported that Picasso mixed Ripolin Mat with his ordinary artist's oil paints and that he liked enamels because they "dried fast and became very hard. He said that this had given new possibilities to painting: the limits of oil paint from tubes had been reached. This gave new possibilities in speed and texture." Elizabeth Cowling, *Visiting Picasso: The Notebooks and Letters of Roland Penrose*, London 2006, p 111.

13. Research at the Art Institute of Chicago has demonstrated that by mixing traditional artist's oil tube paint and a siccatif such as such as *Siccatif de Harlem*, which the artist is known to have used based on receipts conserved in the Musée Picasso, Paris, and was a mixture of copal varnish and oil cooked at high temperatures, the glossy, hard and brushless surface of an enamel paint could be simulated. Furthermore, scientific analysis of red, black and green paints that had the look of Ripolin paints in the painting "Still Life," 1922 in the collection of the Art Institute of Chicago (oil on canvas, 81.6 x 100.3 cm, Ada Turnbull Hertle Endowment (AIC 1953.28) brought to light that their composition was not consistent with the use of Ripolin paints because of pigments (such as vermilion and lead white) and extenders (such as significant quantities of barium sulfate) that have not been documented for the French Ripolin production of 1890-1950. For more information see: Muir, K., G. Gautier, F. Casadio, and A. Vila. 2011. Interdisciplinary investigation of early house paints: Picasso, Picabia and their "Ripolin" paintings. ICOM Committee for Conservation preprints (CD-ROM). 16th Triennial Meeting, Lisbon, ed. J. Bridgeland Lisbon: Critério - Artes Gráficas, Lda. 10 pp.; and Kimberley Muir, Allison Langley, Anikó Bezur, Francesca Casadio, John Delaney, Gwénaëlle Gautier, "Scientifically Investigating Picasso's suspected use of Ripolin house paints in Still Life, 1922 and The Red Armchair, 1931", JAIC, 52 (2) 2013, 156-172.

14- Reproduced in Picasso, Pablo. 2003. *Les archives de Picasso: «on est ce que l'on garde!» : Paris, Musée Picasso, 22 octobre 2003-19 janvier 2004*. Paris: Réunion des musées nationaux. Picasso P. 2011, Receipts <http://www.archivesnationales.culture.gouv.fr/chan/chan/fonds/picassohtml/d0e5785.html> (accessed 8/1/15).

15. Monod Fontaine, I. 1984. *Donation Louise et Michel Leiris*. Collection Kahnweiler-Leiris.

16. See for example the recent article by Nicholas Sawicki. 2015. "Ripolin, flags and wood: Picasso's "Violin, wineglass, pipe and anchor" (1912) and its Cubist frame". *The Burlington Magazine / Ed. Benedict Nicolson*. 18-26.

17. Gertrude Stein, *The Autobiography of Alice B. Toklas* (1933), New York 1961, p. 141

18. Cowling, E. 2006, cited in note 12.

19. Jardot, M. 1955. *Picasso Peintures 1900-1955*, Exhibition catalogue. Paris: Musée des Arts Décoratifs. no. 76.

20. For more on the historiography of Picasso and Ripolin see M. McCully "Picasso and Ripolin" in *Picasso express*. 2011. cited in note 10, p.27 (French version) and p. 130 (English text).

21. On the significance of the introduction of Ripolin in Picasso's cubist year see E. Cowling. 2002. *Picasso: style and meaning*. London: Phaidon Press.

22. For more on the history of Ripolin and the various paint lines it produced see the essays by M. Raeburn and G. Gautier in *Picasso express*. 2011, cited in note 10.

23. Personal communication, Marcel Lefranc, in conversation with the authors, Paris, March 2012.

24. The iconic image of the three painters painting on each other's back as immortalized by Émile Vavasseur in 1913 is now part of the collection of the Museum of Modern Art in New York.

25. Le Corbusier's 'Loi du Ripolin': 'Nous ferions un acte moral : Aimer la pureté... Chaque citoyen est tenu de remplacer ses tentures, ses damas, ses papiers peints, ses pochoirs par une couche pure de Ripolin blanc...' Le Corbusier, *L'art décoratif d'aujourd'hui* (1925), Paris, 1996, p. 191.

26. We are thankful to Kim Muir, Assistant Research Conservator at the Art Institute of Chicago for bringing to our attention the following quote by Jean Renoir, reporting on his father's description of the merits of home birth: "My father favored having the baby at home because he thought hospitals so ugly. 'How unfortunate to open your eyes on Ripolin-painted walls!'" in Renoir, Jean. 1962. *Renoir, my father*. Boston: Little, Brown.

27. G. Stein, op cit. in note 17, p. 141.

28. Letter from Picasso to Kahnweiler, June 20, 1912; trans in Judith Cousins, "Chronology," in William Rubin, exhib. cat. *Picasso and Braque: Pioneering Cubism*, New York (Museum of Modern Art) 1990, p. 396.

29. Quoted in Dor de La Souchère, 1960, op. cit in note 1

30. After the pioneering work of Suzie Delbourgo and her colleagues published in 1981 (Suzy Delbourgo, "Étude de la matière picturale de Pablo Picasso," Ottawa 1981 meeting of ICOM), we need to wait until very recently for more information on the materials and techniques of Pablo Picasso, with efforts pioneered by the Art Institute of Chicago, the Metropolitan Museum of Art and the Picasso Museum in Barcelona with its January 2015 Blue Period Symposium.

31. Danièle Giraudy *L'Œuvre de Picasso à Antibes*. Vol.4. *À Travers Picasso: Contribution à l'étude de l'œuvre*. Catalogue Raisonné du Musée (Antibes: Musée Picasso/Château Grimaldi, 1981-2).

32. The MOLAB research team (supported by the European Community through the 7th FP - CHARISMA project n. 228330), the Centre Interrégional de Conservation et Restauration du Patrimoine (CICRP, Marseille), and the Centre de Recherche et de Restauration des Musées de France (C2RMF) all contributed to this enterprise.

33. For a complete overview of the composition of Ripolin paints before 1950, how they relate to contemporary technical and industrial manuals of paint technology and selected examples of

scientific identification of Ripolin paints in works by Pablo Picasso and his contemporaries see F. Casadio, K. Muir, and A. Bezur. 2013. "Part One of Special Issue: From Can to Canvas". 2013. Journal of the American Institute for Conservation. 52 (3). "Part Two of Special Issue: From Can to Canvas". Journal of the American Institute for Conservation. 52 (4); G. Gautier, A. Bezur, K. Muir, F. Casadio, I. Fiedler "Chemical fingerprinting of ready-mixed house paints of relevance to artistic production in the first half of the twentieth century. I. Inorganic and organic pigments". Applied Spectroscopy, Volume 63, Issue 6, (June 2009), pp. 597-603; Muir, K., et al. 2011. Cited in note 13; F. Casadio, V. Rose, "High Resolution Fluorescence Mapping of Impurities in Historical Zinc Oxide Pigments: Hard X-Ray Nanoprobe Applications to the Paints of Pablo Picasso", Applied Physics A, 111 (2013) 1-8; Kokkori, M., Casadio, F., Sutherland, K., Vermeulen, M. 2014. "Charting the development of oil-based enamel paints through the correlation of historical paint technology manuals with scientific analysis". Issues in Contemporary Oil Paints (ICOP), K.J. van den Berg et al. (eds.), Springer International Publishing Switzerland 2014: 117-125; M. Kokkori, F. Casadio, J. J. Boon "A complete study of early 20th century oil-based enamel paints: integrating industrial technical literature and analytical data." In ICOM-CC 17th Triennial Conference Preprints, Melbourne, 15-19, September 2014, ed. J. Bridgland, art. 0101, 8 pp. Paris: International Council of Museums; and M. Kokkori; K. Sutherland; J.J. Boon; F. Casadio; M. Vermeulen, 2015 "Synergistic use of Py-THM-GCMS, DTMS, and ESI-MS for the characterization of the organic fraction of modern enamel paints", Heritage Science 2015, in press.

34. For a visual comparison see D. Giraudy 1981, vol4, cited in note 31.

35. For a detailed discussion of the composition of the paints found in the Antibes paintings see Picasso Express. 2011. Op cit. in note 10: "Catalogue of works with media identification based on scientific examination of the materials" p.100

36. Pierre Cabanne *Le Siècle de Picasso*, Paris, Denoël, 1975

37. We are grateful to the C2RMF for access to these samples.

38. We are grateful to Prof. Sotirios Tsafaris, formerly of Northwestern University, Evanston, USA, for developing this innovative computational approach.

39. For a complete view of the results see "La Joie de Vivre: the evolution of a masterpiece" in Picasso express, 2011 cited in note 10; for a detailed description of the process see S. A. Tsafaris, F. Casadio, J.-L. Andral and A. K. Katsaggelos, "A novel visualization tool for art history and conservation: automated colorization of black and white archival photographs of works of art" Studies in Conservation 59, 3 (2014) 125 - 135.

40. A white pigment made of barium sulfate and zinc sulfide that was commonly used for enamel paints in the first half of the 20th century.

41. Ivan Aksenov, *Picasso and the Environs (Picasso i okrestnosti)*, Moscow 1917, p.19. We are grateful to Maria Kokkori, research fellow at the Art Institute of Chicago for bringing this quote to our attention and for sharing her reflections on materiality and modernity with us.

42. Ibid, p. 45.