

Numismatic dating of the Turin Shroud through the analysis of Byzantine coins

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Abstract

The 1988 radiocarbon dating of the Turin Shroud (TS) assigned a calibrated calendar age of 1260-1390 A.D. with a 95% confidence for the linen fabric, but three recent alternative dating assigned an age compatible with the First Century A.D., period in which Jesus Christ lived in Palestine. The present analysis is based on the face and on the posture of Christ reported on many Byzantine coins, that clearly demonstrate that the TS was seen starting from 692 A.D., year in which the emperor Justinian II represented the face of Christ in the coins for the first time in the history.

It is interesting to observe that, as not all the peculiar details of the TS face were represented in such a small depiction of a coin, the choice of which detail had to be considered was let to the single engraver. Therefore we can see coins made by different officinae, under the same emperor, showing different details, all typical of the TS face, but with different faces of Christ.

With the time passing, not all the engravers had the possibility to observe directly the TS; as a result, a degradation of the similarity with the TS of the produced face of Christ results. Nevertheless when the TS was taken in Constantinople in 944 A.D., we detect a great improvement of the partially lost similarity. This is also demonstrated by an analysis based on the variation of the ratio between eyes distance and nose length.

From a probabilistic analysis, it results that the Byzantine engraver who represented Christ on the gold solidus, semissis, tremissis and silver hexagram during the period of Justinian II would have only seven chances in one billion of billions of different possibilities of hitting these peculiar features all together without having seen the TS; this demonstrates that the TS was seen in the first Millennium A.D.

The paper also presents a tracking shot of the various features, different century by century, but all in agreement with the TS body image, reported in the Byzantine coins up to the fall of the Byzantine Empire in 1204 A.D. and in the following centuries, evidencing the various features of the TS image frequently reproduced in accordance with Byzantine canons.

Key words: Turin Shroud, Byzantine coins, Christ's face, solidus

1. INTRODUCTION

The Turin Shroud (TS) is a bloody linen cloth, 4.4 m long and 1.1 m wide, which wrapped the dead body of a scourged, thorn-crowned man who was stabbed in the side with a spear and crucified [Antonacci 2016, Fanti & Malfi 2015, Jumper et al. 1984, Schwalbe et al. 1982]. The image features are unique and, at the present time, cannot be reproduced all together, but the TS is not only an object of religious interest because its body image exists and it can be tested by scientific methods.

From a DNA analysis of the dusts taken from the TS it results a probable Indian origin [Barcaccia et al. 2015] and it seems that it was acquired about in 33 A.D. by a wealthy person in

Jerusalem. According to some historians, the TS was taken to Edessa, now Sanliurfa, in Turkey from 200 to 944 A.D., but, based on the present numismatic analysis, according to the author, the TS was surely seen by some Byzantine engraver from 692 A.D.; it officially appeared in Costantinople in 944 A.D., but it disappeared for more than one century after the Sac of Costantinople in 1204 A.D. It was show in Lirey in 1353 and it was taken to Chambéry in 1502 where it was exposed to the famous fire in 1532.

It was then taken in Turin in 1578 where it is up to now, a part from some displacement in various Italian cities during internal wars; for example it was at Montevergine during the WWII. Hopefully the TS will return in Jerusalem in the next future.

Many believe that the TS is the burial cloth in which Jesus Christ was wrapped in a tomb in Palestine about 2000 years ago and for this reason it is the most important Relic of Christianity, but it has also generated more controversy than any other relic and some still think that it could be the result of a forger.

They in fact are still stuck to the 1988 radiocarbon dating of the TS that assigned a calibrated calendar age of 1260 - 1390 A.D. with a 95% confidence for the linen fabric [Damon et al. 1989], but both this result is not credible [Rogers 2005, Riani 2012] and all more recent alternative dating of the TS assigned an age compatible with the First Century A.D., period in which Jesus Christ lived in Palestine [Fanti Malfi 2015, Fanti et al. 2015].

The present analysis is based on the face and on the posture of Jesus Christ reported on many Byzantine coins [Di San Quintino 1845, Ratto 1930, Breckenridge 1959, Goodacre 1967, Bellinger 1968, Metcalf 1969, Rynearson 1971, Grierson 1982, Sear 1994, Sayles 1998, Suarez 2010], that clearly show that the TS was seen starting from the 692 A.D., year in which the emperor Justinian II represented the face of Christ in the coins for the first time in the history.

This fact happened just after the decree of that year, contained in the Canon n. 82 of Council in Trullo (or Quinisextum), where it is reported that Christ had to be exhibited in images in human form instead as the ancient lamb. In particular it is written: "Thou shalt not paint a lamb for the type of Christ, but himself." Jesus Christ had therefore to be represented as Himself but without the signs of His Passion, see Figure 1.



Figure 1. Solidus of Justinian II, first period (692-695 A.D.) showing the face of Christ(on the left) compared with the TS negative image of face (on the right).

Aim of this work is to show the close similarity between the Christ's face of the Byzantine coins and the TS image, arriving to state that the TS existed in 692 A.D.

The Byzantine monetization is quite complex because it changed many times during the millennium of the Empire, see Table 1, but for the present analysis it is important to evidence the golden solidus, semissis (half solidus), tremissis (on third of solidus), the silver hexagram and the bronze follis in the period around 700 A.D. After about 700 A.D. is important the golden histamenon that subsequently became hyperpyron and the bronze aspron trachy.

Period	Gold coins	Silver coins	Bronze coins
First (310 – about 700)	Solidus Semisse (1/2) Tremisse (1/3)	Hexagram or double Miliarensis (from 615)	Follis And others
Second (about 700 – 1092)	Solidus, Nomisma or Histamenon . Tetarteron	Miliarensis (from 720)	Follis
Third (1092 – about 1300)	Hyperpyron	Elettrum or Aspron trachy (gold alloy)	Aspron Trachy Tetarteron and Half Tetarteron
Forth (about 1300 – about 1350)	Hyperpyron	Basilikon	Aspron Trachy Assarion
Fifth (about 1350 – 1453)	//	Stavraton half- stavraton Doukatopoulon	Toumesion Follaro Aspron (silver alloy)

Table 1. Scheme of the Byzantine monetization.

2. ICONOGRAPHY OF CHRIST'S FACE

From a iconographical study [Marinelli 2014, Fanti & Malfi 2015] it results that Jesus Crist was represented beardless and with short hair, see Figure 2, in the first Centuries A.D. probably because no reference to the TS was possible in that period; in fact it is supposed that in this period the Relic was hidden somewhere, perhaps in the walls of Edessa city.

Instead, starting from the VI century A.D. the representations of Christ drastically change, making reference to a bearded man with long hair, parted in the middle, frequently longer on the left side, see Figure 3, just as the Jesus' face of the TS. This leads to suppose that the TS was somewhere shown to the public and many artists preferred to reproduce the TS face when depicting Christ.

In any case in that period the manner of depicting Jesus was not yet uniform and two models were still in use with some controversy. The first one, named Semitic or Syrian form see Figure 2, showed Jesus with short and curled hair; the second one, see Figure 3 showed a bearded Jesus with long hair parted in the middle, according to some to the manner in which the Zeus was depicted [Brekenridge 1959] and according to others that know the TS, to the same manner in which Jesus is represented in it.

Theodorus Lector remarked [Theodorus 543] that the model with short and frizzy hair was more authentic and to support his assertion, he related a story from John of Damascus. In this, a pagan commissioned to paint an image of Jesus and used the so-called Zeus form instead of the Semitic one, but, as a punishment, his hands withered.

Other iconographic types of Jesus Christ appeared in the centuries; to be mentioned here is the face of Christ Emmanuel, and the Mandylion, see Figure 4.

Christ Emmanuel or Immanuel is a Hebrew name which appears in the Book of Isaiah as a sign that God will protect the House of David. The Gospel of Matthew (1:22–23) quotes "a virgin shall be with child, and shall bring forth a son, and they shall call his name Emmanuel". The icon of Christ Emmanuel is quite frequent in the Orthodox art and represents Christ with the somatic traits of an adolescent beardless, almost adult in a sign of reverence to the Man-God who is indeed wise like an old man.



Figure 2. On the left, the hemorrhaging woman touches Christ beardless with short hair (Catacombs SS. Peter and e Marcellin, Rome III sec. A.D.). On the right, «Syrian» or «Semitic» Crist depicted with short hair and beardless. (Abu-Girgeh Egypt, VI Century A.D., [Breckenridge, 1959].



Figure 3. On the left, Christ Pantocrator with beard and long hair in congruence with the TS face (St. Catherine Monastery at Sinai, VI century A.D.). On the right a depiction of a bearded Jesus Christ with long hair parted in the middle on a cameo (property of Lanckoronoski family, discovered by Traudl Wally, VI century A.D.).

The Mandylion corresponds to the Image of Edessa, a relic consisting of a rectangular cloth upon which a miraculous image of the face of Jesus had been imprinted. According to a legend, King Abgar of Edessa wrote to Jesus, asking him to come and cure him of an illness and

he received his disciple Thaddeus of Edessa bearing the words of Jesus and a miraculous image, the Mandylion by which the king was miraculously healed. The legend tells that Jesus wetted his face and put it on a sheet to produce such an image. From this it came out the tradition of “*Christ with a wetted beard*” that is reported in many pictorial reproductions of the Mandylion where Jesus has a long wetted beard.



Figure 4. On the left, example of icon of Christ Emmanuel (State Museum of Palekh Art. M.: Progress, 1994, Ref. [Palekh]). On the right, two examples of Mandylion of Genova (Constantinople 1200-1300), Italy, on the middle and on a Russian medal of Nicholas I, 1839 «Triumph of Orthodoxy», on the right.

3. FIRST COINS OF CHRIST

3.1 Commemorative coins

As reported above, before the 692 A.D., year in which the Canon n. 82 of Council in Trullo (or Quinisextum) was written, it was forbidden to publicly portray the face of Christ.



Figure 5. On the left Golden wedding solidus minted at Thessalonica of Licinia Eudossia & Valentinian III, 437 A.D.; on the right detail of Christ beardless and with curled hair.

Nevertheless some rare example exist of the depiction of the human figure of Christ. It is the case of the commemorative golden solidus minted at Thessalonica for the wedding of Licinia Eudossia and Valentinian III in 437 A.D., see Figure 5, and of the golden wedding solidus of Marcian and St. Pulcheria, of July 28, 450 A.D. where in both cases it is evident the complete figure of Christ beardless and with curled hair, similar to the so-called Syrian or Semitic model.

This leads to think that the TS was not yet known in the Byzantine area during the V Century A.D.

3.2 TS-like coins before iconoclastic struggles

The Byzantine emperor Justinian II in 692 A.D. (just after the Trullan Council allowed the reproduction of the Christ's face) coined the famous golden solidus, see Figure 6 on the top, in which the first TS-like face of Jesus is reproduced with the inscription "*Jesus Cristus rex regnantium*" (Jesus Christ King of Rulers).

This face clearly shows many similarities with the TS face, but perhaps the most interesting evidence of the fact that the engraver copied the TS face is the following. In the Holy Bible it is reported (Psal 45,2) "*You are the most excellent of men*" but the face of Christ shown on the solidus does not show a beautiful man; his face is not symmetric, there are beard and hair ripped and a tumefaction of the right cheek that lead to think directly to the TS face.



Figure 6. On the top golden solidus (of the First type) and on the bottom silver hexagram (of the Second type) of the First period of Justinian II, 692-695 A.D. minted after the Trullan Council.

Not only the emperor Justinian II minted the golden solidus with the face of Christ but also the golden semmissis, tremissis and the silver hexagram showing the same face too, see Figure 6. During his first period of reign, he remained in power up to 695 A.D. and coined the many TS-

like faces of Christ. He then had a second period of reign from 705 to 711 A.D., but a different face of Christ, the Syrian or Semitic model, was selected by him.

It must be observed that each engraver put in evidence some details of the image that he was reproducing (supposedly of the TS), but these details are not equal in each coins. In particular we can detect the so-called coins of the First type [Fanti Malfi 2015], see Figure 6 on the top, that reproduce a less symmetric face, more similar to the TS, but different from coin to coin, and the so-called coins of the Second type that reproduce a more standard and symmetric face. First and Second type are named in this way, see Figure 7, because it is easy to think that a kind of standardization was reached in the Second type of the more common coins, after a first period in which the engravers were more free to decide what detail was more interesting to be reproduced.



Figure 7. Various types of faces of Christ in the golden solidi of Justinian II, First period. They can be divided in First type (on the left) and Second type, more similar each other (on the right).

3.3 TS-like coins after iconoclastic struggles

After the second reign of Justinian II (from 705 to 711 A.D.), during which a face of Christ following the Syrian or Semitic model was preferred, the iconoclastic struggles rage so that no coins with the face of Christ were emitted up to 843 A.D. when Theodora, mother of the emperor Michael III, who was a great icon lover, minted a TS-like golden solidus with the face of Christ, see Figure 8 on the top.

It is interesting to observe that her son, Michael III continued to mint coins of this type, but the face of Christ became less similar to that of the TS, see Figure 8 on the bottom. For example the longer left hair of Christ coined by Theodora became more symmetric with Michael III thus leading to think that, while some engraver had the possibility to look directly at the TS during Theodora period, this possibility was not let to the engravers of the coins of Michael III that probably reproduced the face of Christ only basing their information on predefined canons.

From then on, until the fall of the Byzantine Empire, several coins came in succession: the gold histamenon nomisma and hyperpyron, the aspron trachy in gold and silver alloy or in bronze (the famous scyphate or cup-shaped coins), and the bronze follis.

The mintages of the face of Christ continued in the years, some of which are very similar to the TS face, but with more softened features compared to the first mintages of Justinian II. In 944 A.D. the TS was triumphally brought to Constantinople and from that period the reproduction of Christ faces had an evident improvement; in fact they became again more TS-like.

Two examples in Figure 9 show golden histamena nomisma of Constantine VII Porphyrogenitus with Romanus who ruled from 920 to 944 A.D., but probably minted this TS-

like Christ effigy just in 944 A.D. Also the emperor Basil II (976-1025 A.D.) continued to mint many coins with a TS-like face of Christ as the golden histamena nomisma shown in Figure 10.



Figure 8. Golden solidus of Michael III with his mother Theodora, 843-856 A.D., on the top, and Golden solidus of Michael III, 856-867 A.D., on the bottom.



Figure 9. Two golden histamena nomisma of Constantine VII and Romanus (949-959 A.D.). The TS was triumphally taken to Constantinople in 944 A.D.



Figure 10. Two golden histamena nomisma of Basil II, 976-1025 A.D.

The gold histamenon nomisma minted by Romanus IV Diogenes (1068–1071 A.D.) depicts the whole person of Christ, see Figure 11, in a style similar to that of the gold solidus dated 437 A.D. and reported in Figure 5, but showing a different face of Christ. While this last shows a Semitic or Syrian, non TS-like face, that of Romanus IV shows a TS-like face, thus confirming that the TS was well known in those years.



Figure 11. Golden histamenon of Romanus IV (1068-71 A.D.) No ears and non-symmetric hair. Christ with emperor and Eudocia. Identification writings: «IC XC». On the opposite side Michael, Costantine and Andronicus.

3.4 Coins not similar to the TS

As above mentioned, not all the coins minted after the Trullan Council in 692 A.D. show a TS-like face. The influence of the Semitic or Syrian model was so strong in the VII-VIII century that it opposed to the more real TS-face of Christ. It is probably for this reason that the emperor Justinian II decided to change the face of Christ in his golden solidi and we find a Semitic or Syrian face in the golden coins of his second reign, see Figure 12.

Also the tradition of the Mandylion reported in Section 2 was widely considered in the Byzantine empire. For example the coins of the emperor Michael VII (1071-1078 A.D.) show a less TS-like face of Christ having a long “wet” beard in accordance to the image impressed by Jesus for the king Agbar see Figure 13.



Figure 12. Golden solidus of Justinian II, II period, 705-711 A.D. showing a Semitic or Syrian face of Christ.



Figure 13. Two golden histamena of Michael VII (1071-1078 A.D.) showing a face Christ with a long "wet beard". The coin on the right reports the TS-like bipartite beard.

With the emperor Manuel I (1143-1180 A.D.) another image of Christ appears on the Byzantine coins: that of Christ Emmanuel or Immanuel (from Hebrew: *עִמָּנוּאֵל* meaning, "God with us"), see Figure 14, perhaps in honor of the emperor's name. The image refers to Christ as a youth. Yet He appears as an adult, showing that the God Who was before all time came in the form of a young child.

Other coins showing Christ as a youth are those who reproduce the "Mother of God of the Sign" icon, see Figure 15 on the left, that is related to Isaiah's prophecy: "Therefore the Lord Himself will give you a sign. Here the Virgin will conceive and give birth to a Son, who will call Emmanuel." The Mother of God is represented frontally, in full or bust shape, with raised forearms, in a praying attitude and the Christ-Child is painted on the breast of the Mother.

Finally also coins reproducing the Mandylion exist but they don't belong to the Byzantine Empire, see Figure 15 on the right.



Figure 14. Examples of Christ Emmanuel. On the left, hyperpyron of Manuel I, 1143-1180 A.D. and bronze aspron trachy of Alessius II, 1195-1203 A.D. on the right.



Figure 15. On the left, silver miliaresion of Basile II (976-1025 A.D.), showing the Mother of God with 3 stars of virginity: before, during and after birth. On the right, a testone of Pope Urban VIII, Vatican, Holy Year 1625 A.D.

4. PECULIAR DETAILS OF CHRIST'S COINS

From 692 to 1204 A.D. (fell of the Byzantine Empire) and later, a countless number of coins of Christ showing a TS-like image were struck from tens of officinae and from hundreds of engravers. They copied the TS-face according to some current canons, reporting typical details like the non-symmetric swollen face, with the hair longer on the left side, but some exceptions must not be forgotten.

From one side not all the engravers always rigidly followed these canons, perhaps because working in officinae very distant from Constantinople where the TS was conserved; for example quite rarely some coin shows the face of Christ with the right hair longer, not the left ones.

On the other side, in addition to the current canons, some engravers who probably had the occasion to look directly at the TS image reproduced some very peculiar details that affected them directly. The following sections present some of these details, after the presentation of the image of Christ enthroned that appeared with the emperor Basilius I in 867 A.D.

It is interesting to observe the extreme accuracy of the production and the skill of the engravers, which succeeded in reproducing details on the order of one-tenth of a millimeter (0.004 in.) without using optic magnifying means.

4.1 Christ enthroned, smaller right foot tilted

The image of Christ enthroned, see Figure 16, was a reproduction of the Savior that thrived not only during the Byzantine Empire but continued for many centuries after its fell in other states like the Venetian Republic and the Balkan States. Figure 16 shows the solidus of Basilius I with his son Constantine, 867-886 A.D. and of Romanus I with Cristophore, 921-931 A.D. Figure 17 on the left shows the golden hystamenon of Romanus III, 1028-1034 A.D. struck one century and half later. It is to note the right feet stylized as a cone in the solidus of Romanus I with Cristophore just to evidence the peculiar detail of the dorsal image of the TS. Also the Figure 19 shows a hystamenon on which is reproduced Christ in throne with the bare right foot smaller and tilted.

Despite the Christ's face has sizes of 3-4 mm in these coins, it is still evident the likeness with the TS-face. In particular the left hair appear longer and thicker than the right ones.

Similarly to the TS the image of Christ shows His bare feet, but also with the right foot much smaller and tilted in agreement with the tradition of the “*Christ lame*”.

In fact the dorsal image, mirrored, of the TS, see Figure 17 on the right, shows one feet (the right) longer than the other (the left) and it is easy to think that many Byzantine observers inverted the left feet with the right one.

To support this hypothesis it must be remembered the strict connection of these images on coins with the famous Orthodox Crux, see Figure 17 in the center, that has always the third horizontal beam inclined, with the upper part on the right, just to nail also the right foot supposed shorter in agreement with the TS dorsal image.



Figure 16. On the left, golden solidus of Basilios I with his son Constantine, 867-886 A.D. On the right, golden histamenon of Romanus I with Cristophore, 921-931 A.D. On both coins the right foot is smaller and tilted, in agreement with the appearance of the TS. The figure reproduces the «*Lame Christ*» as is referred to the Orthodox Cross. The left hair are thicker and longer.



Figure 17. On the left, golden histamenon of Romanus III, 1028-1034 A.D. The right foot is again tilted. The right foot smaller and tilted, in agreement with the appearance on the TS, on the right, reproduces the «*Lame Christ*» as is reproduced on the Orthodox Cross, on the center.

In any case not always the coins show the right foot of Christ smaller and tilted; some examples of coins showing the left foot smaller and tilted exist, leading to think that in these cases the engraver more accurately studied the TS. Among these, there is the golden solidus of Constantine VII & Romanus I, 913-959 A.D. and the bronze follis of Eudocia & Constantine X, 1059-1067 A.D., see Figure 18.



Figure 18. On the left, golden solidus of Constantine VII with Romanus I, 913-959 A.D. On the right, follis of Eudocia and Constantine X, 1059-1067 A.D. On these coins it is not the right feet tilted but the left one (as it should be in reference to the TS).



Figure 19. Golden histamenon of Romanus III, 1028-1034 A.D. on the left, with a zoom of face on the right. Again it is well visible the naked and tilted right feet.

4.2 Swollen eyebrow

The Golden histamenon of Romanus III, 1028-1034 A.D., see Figure 19, shows Christ enthroned having a TS-like face with additional TS-like details. In particular the right eyebrow is

swollen, the beard is bipartite and there are more than one locks of hair on the forehead representing the evident wounds of the TS image of face.

It must be here remembered that the Trullan Council allowed the reproduction of the Christ face but not of His wounds that forcedly are here interpreted as locks of hair.

4.3 Wounds on forehead and hair interpreted ad locks of hair

In addition to the locks of hair representing the evident wounds on the face of the TS Man mentioned in Section 4.2 and shown in Figure 19, other Byzantine coins reproduce these wounds more or less clearly. In the case of the golden solidus of Justinian II (I period, 692-695 A.D.) of Figure 20, there are many locks of hair representing the TS wounds in their specific position; there are so many locks of hair in that face that the Man appears disheveled.

Also the right swollen eyebrow is here represented in a reversed “V” form just as it is visible on the TS face.



Figure 20. Golden solidus of Justinian II, I period, 692-695 A.D., on the top, with the locks of hair and the reversed “V” form of the right eyebrow evidenced on the bottom and compared with the TS face. Also a right swollen eyebrow is evidenced.

4.4 No ears

The TS face show no ears and some Byzantine coins reproduce this feature; for example the golden tremissis of Justinian II (I period, I type, 692 A.D.) shown on the left of Figure 20 and those similar reproduced on the right demonstrate the absence of ears on Christ's face.



Figure 20. Golden tremissis of Justinian II, I period, I type 692 A.D., on the left, that shows the lack of ears, with a zoom of the face, on the center, and another face reproduced in a similar tremissis, on the right, where the ears are lacking too.

4.5 Detached hair

Typical of the TS is the fact that the hair are detached from the face; the golden solidus of Justinian II (I period, I type, 692 A.D.) shown in Figure 21 is an example well showing this peculiarity non typical for a normal face.

This TS-like reproduction of the Christ's face also seems to show the lack of the ear in agreement with the coins reported in Section 4.4. Nevertheless someone not in favor to the TS authenticity has doubts about this feature; as evidenced in a discussion at Shroud Science level (Farey 2017) he wrote : "*And I'm afraid I see ears even on your 'ear-less' example, rather low, but quite distinct, with the hair curling around them.*"

It is obviously a subjective opinion but the author explains his point of view. The two signs reported in blue on the right image of Figure 21 could appear a draft of ears instead of a lock of hair, but there are two problems with this interpretation. First, the hypothetical ears are in a position too low with respect to the face and second, perhaps more important, the hair are well separated from the face (as it is on the TS, see the two orange lines of the right image of Figure 21). So if the engraver had really the intention to reproduce the ears, it is not easy to explain why he reproduced them detached from the face.

4.6 Right shoulder lowered

In agreement with the dislocation of the right arm detected on the TS [Bevilacqua et al. 2013], the right shoulder is frequently lowered with respect to the left one, see for example the coins shown in Figures 1, 6, 9, 19, 20, and 21.



Figure 21. Golden solidus of Justinian II, I period, 692 A.D., on the top, with a zoom of the face, on the left bottom, and the not probable signs of the ears, in blue, with the signs of the hair detachment, in orange on the right bottom.

4.7 Beard and lower lip

While some coins, especially not the golden ones (Follis and Aspron trachy) that not always received the direct approval from the Byzantine Emperor, show a variety of beards for the face of Christ, many of them reproduce the bipartite non-symmetric beard of the TS Man, see Figure 22. This is another clue in favor of the existence of the TS as a model for the reproduction of these coins.

Also gap in the beard below the lower lip and a protruding lower lip, typical of the TS image are evident in the same coin.



Figure 22. Golden solidus of Justinian II, I period, (692-695 A.D.) with the detail of beard compared with the TS image, on the right.

4.8 Crooked nose

Some coins minted by Justinian II (after 692 A.D.) display an interesting feature: the nose twisted to the right in consistence with the TS face that shows the septum fracture and its deviation toward the right.

Someone against the TS authenticity affirmed that some rare case could have been due to a minting flaw or to a blow on the coin during its circulation, but it must be observed that this feature is not so rare because other coins with the twisted nose have been found, even from different mintages of various emperors. In addition to this, while observing the magnified detail of the twisted nose, an engraving continuity can be sometime evidenced that cannot be attributable to blows or similar defects as it is the case of Figure 22 on the left that compares the twisted nose voluntarily produced by the engraver of the golden solidus of Justinian II with another one (on the right) having an apparent skewed nose produced by an evident shock: the difference of two examples is clear.



Figure 22. Golden solidus of Justinian II, I period, II Type, 692-695 A.D., on the left and on the center, showing a voluntarily made skewed nose compared with a "skewed" nose produced by a shock, on the right.

4.9 Long left hair

The TS body image had to be more evident than nowadays in the firsts centuries A.D. because the background had to be whiter. It was therefore more easy in the Byzantine epoch than now to detect the body features of the image. Among them the long hair, that also now appear much longer on the left side than to the right one, probably because partially torn.

A typical feature of many images of Christ is the long hair, with the left ones longer. In fact in many coins, not only from the Byzantine epoch, the face of Christ can be immediately recognized looking at this detail, see for example Figure 23.

It is interesting to observe that this non-symmetry was partially hidden by some of the first engravers that preferred to embellish the face of the Savior by confusing the left long hair with the dress collar (Figures 20, 21 and 22).



Figure 23. On the left, golden solidus of Constantine VII with Romanus (945-959A.D.) and, on the right, bronze follis of John I (969-976 A.D.) showing the face of Christ with long hair, the left one much longer.

4.10 Tears and “T” shaped eyebrows

As reported in Section 4.9, the details of the TS body image were more evident during the Byzantine Empire and it is therefore more easy to explain why some engraver reported details not so easy to detect nowadays. It is the case for example of the tears visible on the two golden coins of Constantine VII reported in Figure 9 where the tears are reported in addition to other details like the swollen cheekbone.

It is interesting to observe that the positive image of the TS face seems to form a “T” shape too, when looking at the nose and the eyebrows. Also this feature is reported especially on the detail of Figure 24.



Figure 24. Detail of face of the golden solidus of Constantine VII & Romanus, 945-959 A.D. shown in Figure 9. The tears, the swollen right cheekbone and the “T” shape of the nose-eyebrows are evidenced with other details previously discussed..

4.11 Christ Antiphonetes

Among the icons of Christ it must be remembered the famous icon of Christ Antiphonetes of the Byzantine Empire that was lost in the centuries but it is reproduced in some coins like the bronze follis struck under Michael IV, 1034-1041 A.D. shown in Figure 25.

It must also be observed that the coins with the effigy of Christ are generally marked with the initials “IC” and “XC” written in capital letters, indicating Jesus Christ, in the Greek alphabet, “Ἰησοῦς Χριστός” (Iesóús Christós); the letters in fact consider the first and the last letter of each word (“Ις Χς”). With the longer left hair discussed in Section 4.9, this is another important sign to recognize Jesus Christ in an ancient coin.



Figure 25. Follis representing the icon of Christ Antiphonetes (a famous icon of the Byzantine empire lost in the centuries) struck under Michael IV, 1034-1041 A.D.

5. POBABILISTC ANALYSIS APPLIED TO ONE COIN

The analysis of Section 4 clearly shows a narrow correspondence between the face of Christ minted by Justinian II in 692 A.D. and in the following centuries of the Byzantine Empire with that of the TS. This fact has been evidenced in the past by various scholars like M. Moroni [1986, 2000] and A Whanger [1985, 2007] who detected more than 100 points of congruence with the TS face.

We can sketch a quick calculation of the probabilities [Fanti & Malfi 2015] considering the 12 features observed in Figure 26 where the TS image of face is compared with that of the golden solidus of Justinian II (I period, I type, 692 A.D.); to each of them an appropriate occurrence probability is assigned, assuming that there is no direct observation by the artist of the particular in a reference image but that the artist arbitrarily decides to reproduce that particular feature without being influenced by any reference. The probabilities assigned to each of the 12 features are reported in Table 2.

Table 2. Probabilities assigned to the 12 features under consideration.

N.	Feature	1 chance in n=	P _n
1	Hair	100	0.01
2	Arched eyebrow	50	0.02
3	“Reversed 3”	100	0.01
4	Eyes	10	0.1
5	Right eye’s contusion	20	0.05
6	Swollen cheekbones	50	0.02
7	Nose	50	0.02
8	Mustache	50	0.02
9	Sparse beard on the right side	100	0.01
10	Beard’s shape	50	0.02
11	Beard’s gap below the lower lip	5	0.2
12	The same fold under the neck as the edge of the garment	10	0.1

Let us consider the following two events in the present probabilistic calculation:

- Event T (truth): the artist reproduces the face of the coin in Figure 26 by chance.
- Event F (false): the artist is not able to reproduce these details by chance, but he needs a reference image.

The two events are mutually exclusive and both have a marginal probability P^I of 50%, so P^I(T) = 0.50 and P^I(F) = 0.50. Thus, by applying Bayes formula:

$$P^{III}(T) = \frac{P^I(T) \cdot P^{II}(T)}{P(E)} \quad (1)$$

in which the probability P(E), that is, precisely the Bayes constant, is:

$$P(E) = P^I(T) P^{II}(T) + P^I(F) P^{II}(F) \quad (2)$$

In fact, for the principle of total probabilities, since the two events T and F exclude each other, the mixed possibilities must be ruled out. Under the hypothesis of two mutually excluding events and with these marginal probabilities, the posterior probabilities P^{II}_i(T) and P^{II}_i(F) are evaluated for each of the 12 characteristics considered in Table 3.

Table 3. Posterior probabilities for each of the 12 events.

n	$P_n^{II}(T)$	$P_n^{II}(F)$
1	0.99	0.01
2	0.98	0.02
3	0.99	0.01
4	0.9	0.1
5	0.95	0.05
6	0.98	0.02
7	0.98	0.02
8	0.8	0.2
9	0.99	0.01
10	0.98	0.02
11	0.8	0.2
12	0.9	0.1

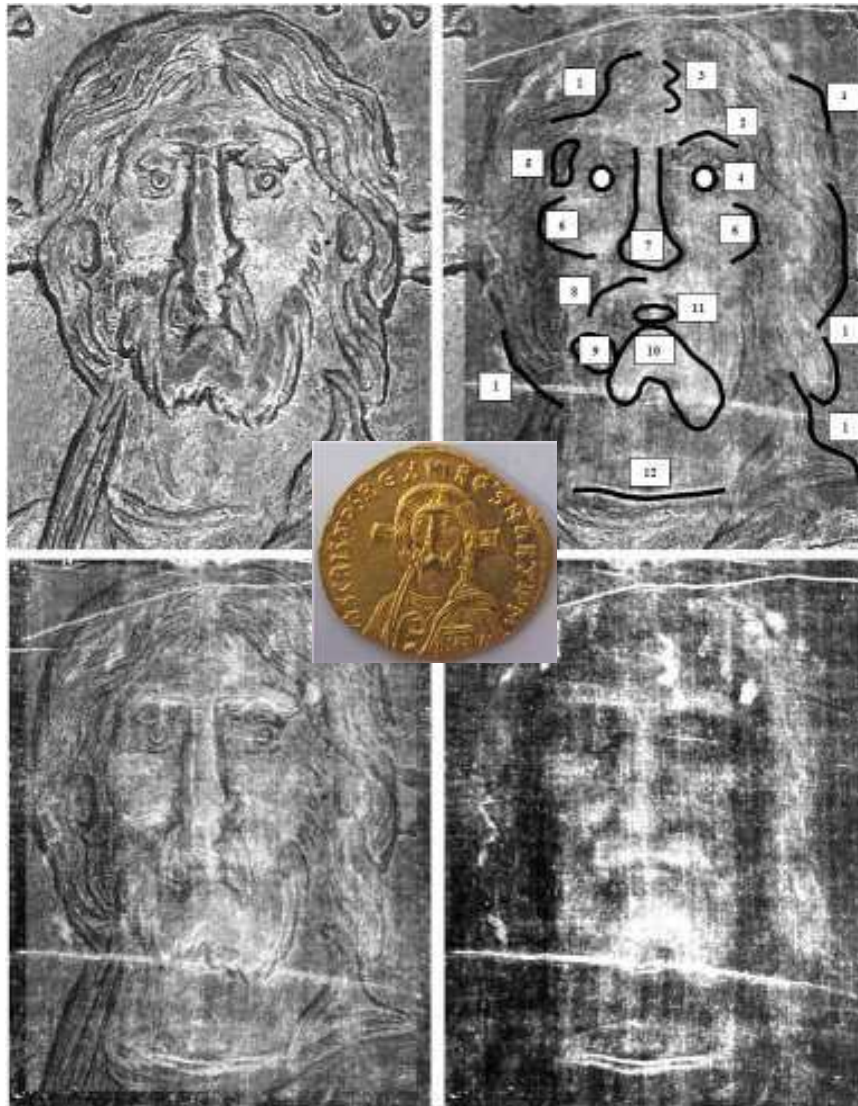


Figure 26. Image processing of the solidus of Figure 6 on the top. From the top left to the bottom right: face of Christ in the golden solidus of Justinian II (I type, I period, 692 A.D.), indication of the 12 features considered in the probabilistic analysis, overlapping of this face with that of the TS and TS face.

The posterior combined probabilities $P^{II}(T)$ and $P^{II}(F)$ are:

$$P^{II}(T) = \prod_{i=1}^{12} P_i^{II}(T) = 3,2 \cdot 10^{-18} \quad e \quad P^{II}(F) = \prod_{i=1}^{12} P_i^{II}(F) = 0,44 \quad (3)$$

The final probabilities P^* without the Bayes constant $P(E)$ are:

$$P^*(T) = P^I(T) P^{II}(T) = 0,50 \times 3,2 \cdot 10^{-18} = 1,6 \times 10^{-18} \quad (4)$$

$$P^*(F) = P^I(F) P^{II}(F) = 0,50 \times 0,44 = 0,22 \quad (5)$$

Then, to calculate the final probability of the true event T , $P^{III}(T)$, the Bayes constant of Equation (2) must be used, in which:

$$P(E) = 0,22000000000000000016$$

so the value calculated from Eq. (1) is: $P^{III}(T) = 7,26 \cdot 10^{-18}$

To justify the great number of similarities of Table 3, someone could look to “coincidence”, but making a rough probability calculus, it can be affirmed that this “lucky” engraver would have had only seven chances in one billion of billions of different possibilities of hitting these features all together without having seen the TS.

To better understand the meaning of this result we can make an example referring to the roulette game. It would be easier to hit for 10 consecutive times the number 0 than an engraver depicting the face reported in the coin without having seen the TS. Obviously, this is not absolutely impossible but extremely improbable.

In conclusion the probability that the engraver has fortuitously got that particular result are seven chances in one billion of billions thus demonstrating that almost surely that engraver had the occasion to accurately observe the TS.

6. QUANTITATIVE ANALYSIS OF THE FACE OF CHRIST

This section is addressed to make a quantitative analysis capable to compare the faces of Christ on various coins with that of the TS. To carry out this quantitative analysis, some features had considered. Scientific bibliography [Bevilacqua et al. 2008, Soyel & Demirel 2007] suggests several features for the analysis of face, but some of which are not so easy to identify on the TS image. Among these features those related to the length of the nose and the distance between the eyes has been considered.

A dimensional analysis of computerized images has been therefore performed to measure the ratio of the length of the nose compared with the distance between the eyes of the various faces of Christ, see Figure 27.

To understand the meaning of varying this ratio, Figure 28 exemplifies a comparison between the TS face, in which the proportion between length of the nose and the distance of the eyes is respectively 1.28, 1 (real image) and 0.7; the results of the quantitative analysis are reported in Table 4.



Figure 27. Nose length and eyes distances are the two parameters considered in the quantitative analysis.

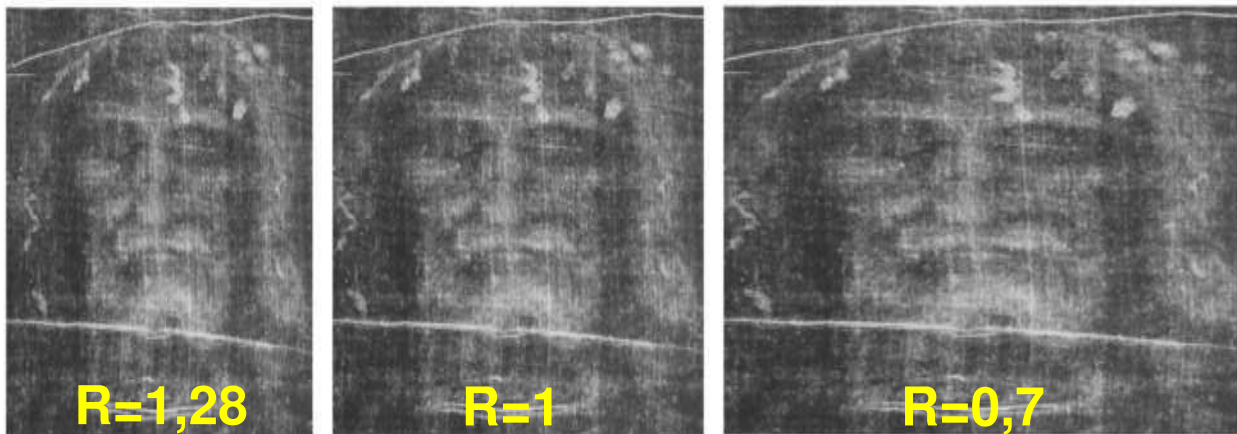


Figure 28. Example of images of the TS face distorted by varying the ratio between length of the nose and distance of the eyes respectively of 1.28, 1 (real image) and 0.7.

It results that the first coins of Justinian II (692) are very close to the TS ratio of 1.28 (1.20–1.27), considering the approximation of ± 0.05 due to the measuring method. Few years later, the proportion decreases to 0.87–1.06, showing that the engravers, had not the chance to directly observe the TS and corrected their result to more a handsome human face. Something changed with Michael III (around 860 A.D.), when a TS-like face appeared again with an even higher proportion equal to 1.30, indicating that probably the engravers again looked at the TS.

From that period on, a deterioration of the typical features of the Christ's face on the coins could be observed and nose/eyes ratios reach values even lower than a unit with Basil I (0.86) and Romanus I (1.00), but under the reign of Constantine VII, when the TS arrived in Constantinople in 944 A.D., the ratio increased again to 1.13-1.20.

From 1028 A.D., with the emperor Romanus III, the ratio instead drastically decreases to 0.63-0.82, showing that the engravers depicted more freely the face of Christ. Under the reign of Manuel I (1143–1180 A.D.) the face of Christ drastically changed and the model was that of Christ Emmanuel, see Figures 4 and 14.

From that moment on, for some decades, the depiction of Christ Emmanuel was alternated with the TS-like Christ. A Sicilian reproduction (Guglielmo I, 1154-1166 A.D.) clearly inspired by Byzantine art shows a nose/eyes ratio equal to 0.71. Also the Republic of Dubrovnik (Republic of Ragusa) came into contact with the Byzantine culture and in 1284-1372 A.D. appeared a TS-like face of Christ on coins, showing a ratio of 1.09.

In the famous Venetian reproductions of the face of Christ on grossi and sequins, which lasted for several centuries, the ratio was 0.85; the same is for the Serbian grossi; a further

deterioration of the features can be found on the Bulgarian coins at the beginning of the fourteenth century with ratios of 0.60. For more than a millennium and a half, till the present day, the face of Jesus Christ has been depicted in a number of coins minted by different empires and states.

This numismatic quantitative analysis therefore also shows in which occasions the engravers could have had the occasion to directly look at the TS and the following conclusion can be reached.

- The prototype of the face of Christ minted in 692 A.D., though being a refined production, does not depict a face with the features of a typical handsome man, because it displays some details linked to the Passion that disfigure the general quality. The decision to follow those peculiar and non-standard canons, not excluded the non-symmetries and swellings must be certainly related to the acceptation of the TS as a reference model.
- The TS provided the prototype of the face of Christ for more than 1000 years in several states and empires.
- The TS existed in 692 A.D and it has been a model for the first coins of Christ, in the Byzantine golden solidi.









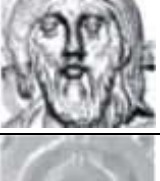








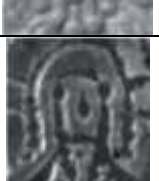
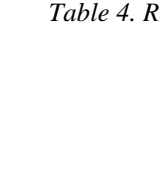
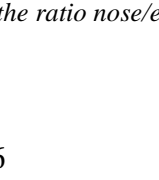
Image of face	Emperor & date	Nose/eyes ratio	Notes	Image of face	Emperor & date	Nose/eyes ratio	Notes
	Turin Shroud	1.28	Control image		Basil II & Constantine VII 976-1025	1.13	Beginning of features deterioration
	Justinian II, I period, I type 692	1.27	First direct observation		Romanus III 1028-1034	0.80	Features deterioration
	Justinian II, I period, I type 692	1.20	First direct observation Different officina		Michael VII 1071-1078	0.82	Features deterioration
	Justinian II, I period, II type 693-695	10.6	Copy from the first mintage		Manuel I 1143-1180	0.63	Features deterioration
	Justinian II, I period, II type 693-695	0.87	Copy from the first mintage		Guglielmo I of Palermo 1154-1166	0.71	Features deterioration
	Michael III 865-867	1.30	Second direct observation		Republic of Dobrovnik (Ragusa)	1.09	Resume of some features
	Basil I 967-886	0.86	Copy from other mintages: deteriorated image		Lorenzo Tiepolo Republic of Venice 1268-1275	0.85	Features deterioration
	Romanus I & Christophorus 921-931	1.00	Copy from other mintages: deteriorated image		Stefan Uros Serbia 1268-1275	0.87	Features deterioration
	Constantine VII & Romanus 944	1.20	Third direct observation, arrival of the TS at Constantinople		T. Svetoslav Bulgaria 1300-1322	0.60	Further features deterioration
	Basil II & Constantine VIII 976-1025	1.20	Probable direct observation		Manuel II Byzantium 1391-1423	0.80	Features deterioration

Table 4. Results of the quantitative analysis based on the ratio nose/eyes; uncertainty in the ratio = ± 0.05 .

7. CHRIST'S FACE IN THE WORLD

The face of Christ on the TS not only influenced the Byzantine Empire but a large area of the world during the Empire and many centuries after its fall. Over the course of centuries, many of the typical details of the Byzantine canons were gradually abandoned, and the depictions of Christ were less and less comparable with the TS face also because the engravers had not the possibility to directly see the most important Christian Relic in the world.

Before the empire's fall in 1204 A.D., there were coins with the Christ effigy minted by Byzantine's friend states or countries that came in touch with their culture. Figures 29 and 30 show the map of the coinages (stars) with either the faces of Christ or Christ on throne in the period 1000-1300 A.D., but Venice continued its coins of Christ in the centuries with the Resurrected Christ and with the "Almond Christ". It is impressive to see that the effigy of Christ on coins interested areas distant thousands of kilometers.

For example, Czar Vladimir I the Great (980-1015 A.D.), after his conversion to Christian religion, minted coins with the face of Christ to evangelize Kiev, see Figure 31 on the left. Roger II (1130–1154 A.D.), king of Sicily (Italy), had strict relationships with the Byzantine Empire and minted, in the cities of Palermo, see Figure 31 on the right and Messina, see Figure 32 on the left, coins with a TS-like face of Christ.

Joscelin I de Courtenay (1119-1131) of the Count of Edessa coined a bust of Christ on a follis, see Figure 32 on the right, showing that the cult of Christ was still active in memory of the TS there a time preserved.



Figure 29. Map of the coinages (stars) with either the faces of Christ or Christ on throne in the period 1000-1300 A.D.; Venice continued its coins of Christ in the centuries with the Resurrected Christ and with the "Almond Christ". Armenian Georgia with Rusudan (1223-1245); Anatolia - Mesopotamia with Fakhr al-Din Qara (Kara) Arslan (1144-1174); Kiev with Vladimir I (980-1015); Venice (1192- 1800 ca.); Bulgaria (1100 ca.); Palermo with Ruggero II (1130-1140); Denmark with Sweyn II (1130-1140).



Figure 30. Map of the Byzantine Empire under Manuel I, 1180 A.D. with the indication of the places (stars) where coins with the Christ were minted.

In Denmark, where relationships with the Byzantine Empire began already in the tenth century, king Sweyn II Estridsson Ulfsson, 1130-1140 A.D., reported on a penny the image of Christ on throne similar to the Byzantine type, even if with some TS features deteriorated, thus demonstrating that the engraver had not a direct access to the TS. In any case the right foot smaller than the left and rotated is still reported, see Figure 33 on the left.

The Republic of Venice kept tight commercial relationships with Constantinople for a long time, and by consequence, it acquired its styles and habits. Under Doge Enrico Dandolo (1192-1205), this Republic, taking perhaps inspiration from the Danish penny, started a series of mintages of Christ that lasted for several centuries till the fall of the Maritime Republic; for example Figure 33 on the right shows the first coin of this lucky series, the ducat named grosso or matapan. The image was engraved according to the Byzantine canons with the rotated right foot. The face becomes more symmetrical and round shaped; the marks of the Passion, like the swollen cheekbones, are less evident, but some features are maintained anyway, like big eyes, beard, mustache, and long, often asymmetrical, hair.

Some states of Turkey minted coins with the effigies of Christ in agreement with the Byzantine tradition; for example Figure 34 on the left shows a bronze dirham with the face of Christ of Amid & Kaifa cities in Artqid state minted by Fakr al-Din Qara Arslan in 1144-1174 A.D.). Also Henry I of Lusignan, Cyprus, coined a bezant «base gold scyphate» in 1218-1253 A.D. showing Christ on throne, see Figure 34 on the right.

The tradition of Christ on the coins continued for centuries in the Byzantine area; for example Figure 35 shows a golden hyperpyron of Michael VIII of Nicea, 1272-1282 A.D., where Christ is reported on the reverse, crowning the emperor with the archangel Michael; on the obverse are reproduced the Constantinople walls with the Mother of God.



Figure 31. On the left, image Principality of Russia – Kiev, Vladimir I (980-1015) representing the Christ's face. «T» shape of the eyebrows have to be noted. On the right, silver ducat of Roger II (Palermo, 1130-1140 A.D.) showing the face of Christ.



Figure 32. On the left, Follaro of Roger II (Messina 1105-1154 A.D.) showing the face of Christ: Arabic influence is evident. On the right, Count of Edessa, Joscelin I de Courtenay (1119-1131). The Bust of Christ shows the cult still active in memory of the TS there a time preserved.



Figure 33. On the left, Danish silver penny of Sweyn II Estridsson Ulfsson (1130-1140 A.D.) showing Christ on throne. On the right, Venetian grosso of Enrico Dandolo (1192-1205 A.D.) showing Christ on throne with evident Byzantine features.



Figure 34. On the left, bronze dirham. Artqids state (Turkey) Amid & Kaifa of Fakr al-Din Qara Arslan. (1144-1174 A.D.) showing the face of Christ. On the right, Bezant «base gold scyphate» of Henry I of Lusignan, Cyprus (1218-1253 A.D.) showing Christ on throne.



Figure 35. Golden Hyperpyron of Michael VIII of Nicea (1272-1282 A.D.) showing Christ on the reverse (see arrow); Constantinople walls with the Mother of God on the obverse.



Figure 36. On the left, silver coin of Rusudan, Georgia, (1223-1245 A.D.) showing bust of Christ with the Gospels. On the right, silver coin of Levon I, Armenia (Cilicia), (1198-1218 A.D.) showing Christ with the king.

In Georgia under the reign of Rusudan, 1223-1245 A.D., appeared images of Christ on coins, see for example the silver coin of Figure 36 on the left where the bust of Christ with the Gospels is reported in the Byzantine style.

In Cilicia (Armenia) a silver coin of Levon I, 1198-1218 A.D. was struck with Christ crowning the king, see Figure 36 on the right. Similarly to the TS, the face of Christ is always reported with beard and long and non-symmetric hair.

An example of the coins of Serbia, see Figure 37 on the left, a grosso or dinar of Stefan Uros II Milutin, (1282-1321 A.D.), shows Christ on throne with hairs detached from face as appear on the TS face.

The Venetians, not only copied the typical Byzantine depictions of Christ on throne of the grossi, but they went further beyond minting also different representations, always being coherent with the canons acquired through the observation of the TS image. An example, see

Figure 37 on the right is the mezzanino minted by Doge Andrea Dandolo in 1343–1354 A.D. depicting Christ resurrected with TS-like asymmetrical long hair and a bipartite beard, though sizes of face are only 2-3 mm.

The gold sequin again minted by the Venetians, for example, the one by Francesco Foscari (1423–1457 A.D.), see Figure 38 on the left, shows a new image of Christ within an oval or “vesica piscis” (fish bladder), called “mandorla” in Italian for almond. The coin depicts Christ with a face quite far away from the Byzantine canons, though maintaining the general features of the TS image.



Figure 37. On the left, Grosso or Dinar of Stefan Uros II Milutin, Serbia (1282-1321 A.D.) showing Christ on throne with hairs detached from face as appears on the TS face. On the right, Venetian mezzanino of Andrea Dandolo (1343-1354 A.D.) showing the Resurrected Christ with a Shroud-like face.



Figure 38. On the left, Venetian zecchino (or ducat) of Francesco Foscari 1423-1457 showing the «Almond Christ» or «vesica piscis». On the right, Grosso of Balcan Republic of Ragusa, 1284-1372 A.D. showing Christ with a TS-like face.

The “mandorla” or almond is an oval frame with decorative function enclosing a sacred figure therein highlighted. This Romanesque-Gothic decorative element has a double value. It

refers to the almond fruit and to the seed in general, it is a clear symbol of life, so an attribute for Who that is “*the Way, the Truth and the Life*”. As intersection of two circles it also represents the communication between the two worlds, the material level and the spiritual one, the human and the divine. Jesus, made Man, becomes the only mediator between the two realities, therefore He is depicted within the intersection thus as a means of communication between the spiritual and the material world.

Also the Republic of Dubrovnik (Republic of Ragusa), in the Balkans, in the fourteenth century reproduced an image of Christ in the almond, like the Venetian sequins, see Figure 38 on the right. In this case the face of Christ is more TS-like with long hair, bipartite beard and pronounced cheekbones referring to the TS swellings.

Bulgarian silver coins minted from the fourteenth to the fifteenth centuries depict a face less defined by Byzantine canons; for example Figure 39 on the left shows Christ on throne on a grosso of Theodor Svetoslav, 1300-1322 A.D., where it is to note the TS-like hair detached from face. Figure 39 on the right instead shows a grosso of Ivan Alexander, 1331-1371 A.D., with a different depiction of Christ standing facing full-length and blessing with two hands.

Christ’s depictions endured during the centuries in different states till the present years but never more with the same frequency of representations as during the Byzantine Empire. For example, for celebrating the Great Jubilee in 2000, some states minted coins with the face of Christ, among them the 500 schilling coins minted by Austria, see Figure 40, in which a “modern” Christ is depicted, even though with some TS-Byzantine reminiscences.

It is clear how the Byzantine tradition, linked to the TS, had left a faint sign, especially as far as the beard and mustache are concerned. The hair are still wavy and there are swellings in correspondence to the cheekbones that are TS-Byzantine details handed down by tradition during the centuries. After more than a millennium, the face of Christ is still depicted recalling the features of a Byzantine tradition that used the TS as a model.



Figure 39. On the left, Grosso of Theodor Svetoslav, Bulgaria, 1300-1322 A.D., Christ on throne. On the right, Grosso of Ivan Alexander, Bulgaria 1331-1371 A.D., showing Christ standing facing full-length, blessing with two hands.



Figure 40. Austria, 500 shillings for the 2000 Jubilee. The face of Christ still has a weak Byzantine- sindonic reminescence (for example long wavy hair, but now symmetric).

8. CONCLUSION

The close similarity between the TS body image and the Christ's effigy of the Byzantine coins (see Figure 41) allows to state that the TS was surely seen starting from 692 A.D. This sentence is demonstrated by the following results.



Figure 41. Golden coins of the Byzantine Empire showing the face of Christ with long hair, the left ones much longer. From the left, Justinian II (692-695 A.D.), Basil II (976-1025 A.D.) and Constantine VII with Romanus (949-959 A.D.).

The image of Christ's face reported in these coins shows, among others, very typical details like the following.

1. At least one lock of hair at the center of the forehead referring to the reversed "3"-shaped forehead wound. It must be remembered that the Trullan Council forbade to reproduce the signs of the Passion, so the bloodstains were confused with locks of hair. Other coins report more than one lock of hair in a position corresponding to the bloodstains.

2. Wavy shoulder-length hair, longer on the left side, similar to “payot”, the side curls Orthodox Jews. The right side of the hair is less bushy, maybe because partially torn, like the beard.
3. High-arched left eyebrow due to a hematoma.
4. Protruding cheekbones, the right more than the left one, because of the swelling caused by the blows.
5. Long bipartite beard; the right side is quite sparse probably because torn like the hair.
6. A gap in the beard below the lower lip.
7. Broken nasal cartilage, therefore nose is slightly flattened and turned to the right side.
8. Protruding lower lip.
9. In accordance with the tradition of “Christ lame” one of the two feet, generally the right one is smaller and tilted.
10. In agreement with the dislocation of the right arm detected on the TS, the right shoulder is frequently lowered with respect to the left one.

Not all these peculiar details were possible to be represented in such a small depiction of coins so each engraver selected the details that struck him more; it is therefore interesting, as it has been done in this paper, a comparison of a relative high number of Byzantine coins.

As not all the engravers had the possibility to observe directly the TS with the centuries passing, a degradation of the similarities between the TS and the depicted image of Christ results, but a great improvement of the similarity is detectable when the TS was taken in Constantinople in 944 A.D. This is also demonstrated by a quantitative analysis based on the variation of the ratio between eyes distance and nose length.

From a probabilistic analysis, it results that the engraver who represented Christ on the gold solidus, semissis, tremissis and silver hexagram during the period of Justinian II would have only seven chances in one billion of billions of different possibilities of hitting these peculiar features all together without having seen the TS. We can therefore be almost sure that the TS was seen in the first Millennium A.D.

The paper also presents a tracking shot of the various features, different century by century, but all in agreement with the TS body image, reported in the Byzantine coins up to the fall of the Byzantine Empire in 1204 A.D. and in the following centuries, evidencing the various features of the TS image frequently reproduced in accordance with Byzantine canons.

In 1988 the TS was radiocarbon dated [Damon et al. 1989] to a Medieval age but this result has been widely criticized [Rogers 2005, Riani et al. 2012]. Three alternative dating methods, based on chemical (FT-IR and Raman methods) and mechanical (mechanical multi-parametric method) properties of the TS fibers [Fanti & Malfi 2015, Fanti et al. 2015] instead dated the TS to the first century A.D. in agreement with the age in which Jesus lived in Palestine, see Figure 42. This numismatic study confirms these last results.

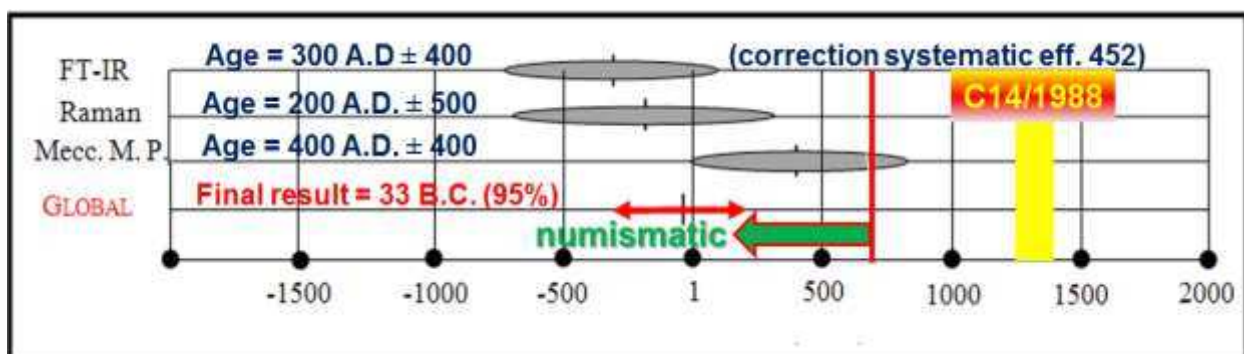


Figure 42. Scheme of the resulting dates assigned by different dating method: a part from the radiocarbon method that was widely criticized, all the other four methods are in agreement with a date of the TS of the first century A.D.

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