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MICHELANGELO AND ST. PETER'S: OBSERVATIONS ON THE INTERIOR OF THE APSES, A MODEL OF THE APSE VAULT, AND RELATED DRAWINGS*

* This article is dedicated to the memory of Rudolf Wittkower, whose own work and the interest he took in ours were a constant stimulus.

In our first article on Michelangelo and St. Peter's (Millon/Smyth [1969]) we acknowledged the help of a number of individuals and institutions to whom we remain indebted for assistance in the preparation of the present study. Even so, special thanks should be given here once again to Don Cipriano Cipriani, Custodian of the Archives of the Fabbrica of St. Peter's, for his help in searching out documents relating to the history of the later decoration of the basilica and to both Padre Cipriani and Hellmut Hager for measurements they made of the north, south, and east apses of Sangallo's model of St. Peter's; to Wolfgang Lotz, Director of the Bibliotheca Hertziana, for continued aid in providing space for us to work together; and to Adolf Placzek and the staff of Avery Library of Columbia University also for granting us space to work. We want to express our gratitude as well to individuals and institutions who were not cited in the previous article but were helpful in aspects of the present study: above all to Franz Graf Wolff Metternich for generously sharing his knowledge of St. Peter's before Michelangelo and for reading a portion of the text while still in typescript; also to Janet S. Byrne for information about the group of drawings in the Metropolitan Museum to which a drawing published in our study belongs; to James Lees-Milne for generously providing information about the painting in his collection and his help in obtaining a photograph; to Deborah Wilde for getting certain data for us about the sheets in Arezzo that figure in the study; to Milton Lewine for sharing his knowledge of the literature on architecture of the Cinquecento; to Nicholas Adams and Toby Yuen for help with revisions in the text; to Benedict Nicolson and John Shearman for help in locating a photograph; to James Conant of the Fogg Art Museum for special photographs taken of plates in Ferrabosco's volume; to the photographic room of the Metropolitan Museum for special photographs of Dupérac's prints of St. Peter's; to Diane Lunde, Vicky Margulies, Nancy Rosen, Nancy Jones, Roberta Kurland, and Gloria Ramakus for aid in preparing the manuscript for publication. Others who have given us assistance will be mentioned in the footnotes.

Our work was aided by a number of grants for which we are most grateful: to Mr. and Mrs. Charles B. Wrightsman for a grant to the Institute of Fine Arts, New York University, that aided Smyth's study in Rome in 1967; to the Max-Planck-Gesellschaft for an invitation to Smyth to work on the project at the Bibliotheca Hertziana in Rome as Visiting Scholar in 1972 and 1973; to the National Endowment for the Humanities for a Research Grant to Millon for work in Rome in the spring and summer of 1972; to Massachusetts Institute of Technology for his two Art History Summer Travel and Research Grants in 1969 and 1971. A shorter and somewhat different version of Part 2 of this article was presented by Millon at the Art Historians' Dinner Club in Cambridge in the fall of 1969 and at the Annual Meeting of the Society of Architectural Historians and College Art Association in Washington, D.C. in January 1970.

A bibliography of the references we cite frequently and in abbreviated form is to be found at the end of this article.

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Several years ago when we discussed our study of Michelangelo's design for St. Peter's with Franz Graf Wolff Metternich in the light of his great knowledge of St. Peter's before Michelangelo, he kindly told us of a curious insertion he had noticed high up inside Antonio da Sangallo's famous wooden model of St. Peter's built by Antonio Labacco (Fig. 1).[1] He suggested we look at it because, as he said, it made the interior of the vault over the apse at the end of one arm of the building look approximately the way the apse, or hemicycle,[2] vaults of St. Peter's do now (Fig. 2) – and *not* the way Sangallo had designed them as seen elsewhere in Sangallo's wooden model (Fig. 3) and in Salamanca's engraving of Sangallo's project (Fig. 4).[3]

Metternich is the first student of St. Peter's, as far as we know, to note this foreign body in the model of Sangallo. We are very grateful to him for calling it to our attention. For what has been inserted into Sangallo's model is an early model of the inside of the vault Michelangelo constructed in 1556–58 over the apse at the end of the south transept of St. Peter's, the apse named the Cappella del Re di Francia.[4] This vault was repeated in the apse vaults built after Michelangelo's death in the north transept and in the choir on the west. The evidence shows that the inserted model represents preliminary stages of Michelangelo's design for the apse vault, that it was made under his direction, and that he used it to study and develop his design.

Readers of our first article on Michelangelo and St. Peter's will understand why we took an immediate interest in the vault model. The model is for the area included on the interior of the sixteenth-century plan we published there showing the top story – the attic story – of the south hemicycle of St. Peter's as Michelangelo originally built it.[5] In the earlier article our subject was the information furnished by that plan about Michelangelo's design of the exterior of the attic. In the present study much of our attention will be given to unexpected information provided by the model of the vault concerning the evolution of Michelangelo's design of the interior at the attic level – that is to say, his design of the vault area: its gored semi-dome, its window walls, and its membering.

Four sheets survive with drawings by Michelangelo of the apse vault. Two sheets, in the Casa Vasari at Arezzo, are well known. They contain letters from Michelangelo to Vasari explaining the mistake of the foreman in constructing the vault on the south apse and explanatory draw-

1 This conversation took place in the spring of 1967. For the Sangallo model and its builder Antonio Labacco see: Vasari-Milanesi, V, 467; see also G. Clausse, *Les Sangallo*, Paris (1900–02), II, 131; K. Frey, "Studien zu Michelagniolo Buonarroti und zur Kunst seiner Zeit", *JbPrKs*, Beiheft (1909), 167–170 (for documents); G. Giovannoni, *Antonio da Sangallo*, 2 vols., Rome (1959?), I, 143–144; Ackerman (1964), 87.

2 The term "hemicycle" is synonymous with "apse" in this and the first article of this series (Millon/Smyth [1969]) when used in reference to the semicircular ends of the north, south, and west arms of St. Peter's. In the sixteenth century the terms "nicchione" and "tribuna" refer to the hemicycles. (The term "tribuna" was also used in documents and by Vasari to refer to the main crossing and dome.)

3 Differences exist between Labacco's large wooden model of Sangallo's St. Peter's and Salamanca's longitudinal section, primarily in the vault area. These differences, in both the barrel vault and the apse vault, will be noted below in Part 2.
M. Fischer ("Lafreri's 'Speculum Romanae Magnificentiae': Addenda zu Hülsens Verzeichnis", *Berliner Museen*, NF, XXII [1972], 10–17) has recently discussed differences between the two Salamanca prints of the exterior east elevation of St. Peter's (dated 1548 and 1549) and the Labacco model in relation to some of the sixteenth-century drawings of the Sangallo model from the so-called "Anonymous Destailleur" group now in the Berlin Kunstbibliothek.

4 For the chronology of the construction of the Cappella del Re, see Millon/Smyth (1969), 484 and 497, including notes 2 and 54. Paolo Portoghesi in his *Roma del Rinascimento*, Venice (1970), pl. 144 (*Rome of the Renaissance*, London–New York [1972], pl. 144) has included a photograph of the inside of Sangallo's model that shows, like our Figure 1, the inserted vault model – it is in the west arm – but he did not refer to it in the text or captions.

5 Millon/Smyth (1969), figs. 12, 13, 14.

6 For the date of the mistake of the foreman, who was Sebastiano

1. Antonio da Sangallo: Model of St. Peter's. Interior view of west arm with inserted model of Michelangelo's apse vault (St. Peter's)

ings (Figs. 22 and 23).[6] Thanks to the new model the drawings in Arezzo yield new information, also unexpected, about the history of the vault's design and construction. As we shall see, they represent designs preliminary to the final design. The other two sheets, in the Bonnat Museum in Bayonne and in the Louvre, have drawings that Charles de Tolnay first published recently and associated with the apse vault (Figs. 43 and 44).[7] These drawings were probably occasioned by the foreman's error, and one of them proves of particular interest for its analysis of the stereometric problem posed by the vault's design.

Two other representations of the vault prove to derive from designs preceding the final design and shed some additional light on the vault's evolution. One is the well-known print by Etienne Dupérac, the French architect and printmaker, showing St. Peter's in section (Fig. 5), the other an unpublished drawing (Fig. 41) evidently made in preparation for Dupérac's print and belonging to a group of drawings given to the Metropolitan Museum by Janos Scholz. (Some other drawings of the group have already been associated with Dupérac by Janet S. Byrne and Rudolf Wittkower.[8])

The information provided by the new model and these representations yields insights into Michelangelo's achievement in the vault and increases understanding of the way he worked toward a final design in architecture. It also gives

da San Gimignano, see Millon/Smyth (1969), 484, including note 2.

7 See Tolnay (1960), 185, no. 174 and 221, no. 248 and Tolnay (1965), 250–251, note 13.

8 Janet S. Byrne, "Design for a Tomb", *The Metropolitan Museum of Art Bulletin*, XV (1957), 162; Wittkower (1964), 101–107, esp. 107. For another view of their authorship see Tolnay (1967), 65 and 67. The drawing will be discussed below in Part 3.

2. St. Peter's, south arm and apse

an unusual glimpse of Michelangelo as engineer, which St. Peter's required him to be. In our own case, knowledge of the adjustments leading to the vault's final form has helped open our eyes to the design of the whole apse interior and to subtleties, not only of the vault, but of the elevation below, for which preparatory drawings and models by Michelangelo are missing.

The vault area is so integral a part of the whole elevation of the apse that it cannot be considered in isolation. As it happens, Michelangelo's design of the interior of the apses at St. Peter's has had little attention in writings devoted to the building or in studies of Michelangelo. We shall therefore begin by giving some consideration to the interior design of the apses as a whole.

When Michelangelo became the architect of St. Peter's at the end of 1546, very little of the exterior elevation of the building had been constructed – only the first story of the apse at the end of the south transept. Michelangelo, having redesigned the entire exterior of the building, eliminated this beginning.[9]

9 For the appearance of the exterior of the south hemicycle in 1546, see Vasari's fresco of that year in the Cancelleria showing *Paul III Ordering Continuation of the Construction of St. Peter's* (Ackerman [1961], pl. 52b); see note 11 below for the fresco's date. Metternich has pointed out to us that Vasari painted the same view again later in the Sala di Leone X of the Palazzo Vecchio. An anonymous drawing in the Heemskerk sketchbook in Berlin (Egger [1911], pl. 35), dated by Ackerman at the earliest 1548, shows the exterior of the apse at the same height and perhaps, as Ackerman suggests, its demolition in progress (Ackerman [1964], 94). As seen in these representations, construction of the exterior had reached a level only a little above the rectangular exterior niches of the first story.
The construction had reached this state in the late 1520s. The Heemskerk views (Egger [1911], pls. 29 and 32), drawn in the

But on the interior the situation was obviously different. Bramante had built the piers and arches that were to support the main dome, including portions of the buttressing piers, and thus determined, not only the scale of the structure, but the principle of a domed central space and four buttressing arms.[10] By the time of Sangallo's death the walls supporting the main barrel vaults of the arms, the architectural membering of the walls, and the barrel vaults themselves had been built on the east and south.[11] On the east the barrel vault included the salient, or projecting, arch over the salient pilasters at the end of the arm.[12] On the south the salient pilasters existed,[13] but probably not the salient arch, as we shall observe later. Part of the walls of the north arm, though not the vault, had also been constructed.[14] The design of the arms was thus well established.

first half of the 1530s, show the apse exterior already at the same height. For the date of the construction of the apse exterior see Frey (1911), 82–83, nos. 193–195, 205, 206 (architraves, probably over rectangular niches on the outside of the exterior ambulatory wall) and Ackerman (1964), 86.

10 See Ackerman (1961), 89–93 and (1970), 199–202 for the determining effect of the achieved portions of Bramante's project on the later development of the building.

11 The following is the evidence for the state of construction reached by 1546 in the east and south arms of St. Peter's.
East: The eastern arm is shown shortly after it was vaulted in an anonymous Flemish view of St. Peter's in the Vatican Library drawn in late 1544 or early 1545 (Egger [1932], pl. 20), listed previously as in a private collection in Vienna (Egger [1911], pl. 20; Ackerman [1961], pl. 52a), and in a drawing of 1545 in the collection of Sir Anthony Blunt (RUTH O. RUBINSTEIN, "Pius II's Piazza S. Pietro and St. Andrew's Head", *Essays in the History of Architecture Presented to Rudolf Wittkower*, London [1967], fig. 3). Documents record that the barrel vault of the eastern arm was under construction in 1544 (Frey [1913], 74, 409.2ff.) but was not yet finished on 14 October 1544, since formwork for coffering was then still being supplied (*ibid.*, 77, 409.37). In December 1545 portions of the formwork from the eastern arm were being placed on the south arm preparatory to building the barrel vault there (*ibid.*, 409.48, 409.49); and a payment in March 1546 records completion of the work of taking down the formwork from the eastern arm (*ibid.*, 409.54). (It appears that the transfer of the formwork took at least eleven six-working-day weeks.)
For the termination, and roofing, of the east arm as of the end of 1546, see notes 12 and 16.
(The documents enable a precise dating for the two drawings cited here. In the Vatican drawing the curve of the masonry vault on the east arm is complete, giving us a *terminus post quem* for the drawing some little time after mid-October 1544. The formwork used to build the vault is to be seen still in place through the rectangular opening visible above the remaining part of old St. Peter's, and there is no centering yet on the south arm. This gives a *terminus ante quem* for the drawing which can be still further refined. The drawing also shows the campanile of old St. Peter's as it was before its alteration, for which there are documents beginning in the week of 12–23 May 1545 [*ibid.*, 86, 426]. The date of the drawing is therefore limited to the short period from late 1544 to early 1545. The Blunt drawing is to be dated slightly later. Although it does not show any formwork in place yet on the south arm, it includes the altered campanile – "by the odd device", as Mrs. Rubinstein wrote, "of representing the campanile, which would not fit on the page, in two sections, side by side..." With respect to the eastern barrel vault, the Blunt drawing differs from the earlier one in making the angled buttress on the vault's south side larger and more distinct.)
South: Vasari's fresco of *Paul III Ordering the Continuation of the Construction of St. Peter's* in the Cancelleria (Ackerman [1961], pl. 52b) shows the south arm as it was by the middle of 1546: vaulted, with the formwork still in place.
(The vault was closed 12 June 1546 – Frey [1913], 81, 409.71, also 409.73 – and Vasari portrayed it soon after, since his fresco decoration at the Cancelleria, commissioned 29 March 1546, took only one hundred days to paint and was complete no later than October, when Vasari left Rome [see A. DEL VITA, *Il Libro delle Ricordanze di Giorgio Vasari*, Arezzo (1927), 54–56 and Vasari-Milanesi, VII, 678–681, 683]. A date in the 1550s is given for the fresco in Ackerman [1964], 89.)
Another view of the vaulted south arm before Michelangelo's additions is provided by the anonymous drawing in the Heemskerk sketchbook in Berlin (Egger [1911], pl. 35). See note 9 above for the date.
In the period of 4–10 September 1546 payment was made for tiles to cover the vault (Doc. I), indicating presumably that the roof for the vault was to be built shortly afterwards, as seen in the drawing Uffizi 4345 (Egger [1911], pl. 36; Wittkower [1964], fig. 34) dating from early 1553 (Millon/Smyth [1969], 497, note 54).

12 As described below, the salient arch is marked by the third step of the east roof seen in the anonymous drawing of 1580–81 in Frankfort depicting St. Peter's from the southeast (Millon/Smyth [1969], 492, note 20 and fig. 16; Egger [1911], pl. 41; Wittkower [1964], fig. 42). This drawing and the anonymous Flemish view of St. Peter's of late 1544 or early 1545 in the Vatican Library (Egger [1911], pl. 20; Egger [1932], pl. 20), and cited in the previous note, chronicle the construction and roofing of the east arm.
The Vatican view shows the newly completed vault with a smaller, lower gable-roofed structure abutting it to the east. This gable-roofed structure was a temporary brick addition joining the east arm of the new basilica to the *muro divisorio* which separated the remaining portions of the old basilica from the new. The precise location of the *muro divisorio* in plan may be found on the plan by Alfarano in plate II appended to M. CERRATI, *Tiberii Alpharani, De Basilicae Vaticanae antiquissima et nova structura*, Rome (1914). The *muro divisorio* is shown in the Vienna drawing by the diagonal buttress connecting the eave of the nave clerestory to the eave of the roof covering the side aisles of old St. Peter's. (This buttress may also be seen in the Frankfort view.) Several curving lines on the left haunch of the vault (south side) indicate a change in level of the vault surface close to the end of the vault itself.
The Frankfort view shows the vault after it was roofed (the roofing dates from 1546: Frey [1911], 117, 489.6 and 489.8). It shows three steps, corresponding to the changes in the level of the vault on the interior. The vault evidently maintains a constant thickness throughout its length. The highest level of the roof (nearest the base of the drum) corresponds to the barrel vault level above the area where arches lead from the nave to the main corner chapels. The next lower level accords with the portion of the vault above the pilaster pair towards the hemicycle, and the third

Of the interior terminations of the arms, however, very little had been built. The apses Sangallo (and before him, Raphael) had projected – for the north, south, and west arms – had an inner and outer wall and an ambulatory between them in the first two stories, providing space for numerous chapels (Figs. 4 and 6). At the end of the south transept the first story of the interior wall of the apse had been begun; we shall see in a moment the height it had reached. On the north the foundations of the apse had been laid, but probably neither exterior nor interior wall had been started above ground level.[15] There was no apse on the east: nothing of the new building existed there beyond the salient pilasters holding the salient arch at the end of the arm (Fig. 5a).[16] On the west, Bramante's choir still stood; no new arm or apse had yet been started there.

Michelangelo accepted the existing interior elevation of the sides of the arms and their barrel vaults.[17] But he changed Sangallo's design for the interior of the apses – not so completely as he changed the exterior, yet decisively nonetheless.

The interior elevation of the inner wall of Sangallo's apse – the elevation seen from inside the transept (Fig. 4) – had three niches in the first story, each with a doorway in it

and lowest level, following immediately, corresponds to the area of the salient arch. One can see on Alfarano's plan *(op. cit.)* that the position of the salient pilasters holding the arch in relation to the *muro divisorio* corresponds with the position of the third step of roof in relation to the *muro divisorio* in the Frankfort drawing. On the interior these level changes in the vault are 2 *palmi* (1 ft. $5^5/_8$ in.; 0.446 metres) each. The change of level on the roof surface was probably the same.

It was Metternich who, in a conversation at the Bibliotheca Hertziana in 1967, first pointed out to us the correspondence between the changes of level on the roof and the interior vault surface.

The east arm presented Sangallo with a special situation. There was no room to build an east apse (see note 16 below) as long as the remaining part of the old basilica was retained, as it would be for many years. In this case it was desirable to extend the vaulting of the east arm as far as possible by building the salient arch, thereby finishing off the new arm evenly and reducing the length of the provisional roof in the gap before the *muro divisorio*.

13 The capitals and entablatures of the salient pilasters at the end of the south transept, which would support the salient arch, had been placed on the building in 1527 (Frey [1911], 82, 191). On the north they were not placed until Michelangelo's tenure (*idem* [1916], 99, 611a; 100, 416; 106, 674a; 107, 674d).

(The salient pilaster on the eastern side of the south arm can be seen in two drawings dating before the barrel vault was built: one, by Heemskerk, from the early 1530s [Egger (1911), pl. 32; Hülsen/Egger (1916), pl. 72, f. 54r; see note 9], the second, an anonymous drawing of the early 1540s in Stockholm [R. Krautheimer, "Some Drawings of Early Christian Basilicas in Rome: St. Peter's and S. Maria Maggiore", *ArtBull* XXXI (1949), 211, fig. 1]. The salient pilaster is omitted, incorrectly, in a Heemskerk drawing showing the west flank of the south transept's interior [Egger (1911), pl. 29; Hülsen/Egger (1916), 31–32, pl. 67, f. 50].)

14 Two drawings by Heemskerk show the state of the wall construction in the north arm in the first half of the 1530s (Egger [1911], pls. 33, 34). By 1546 the walls were sufficiently high to begin the *volta a rosoni* (the vault with octagonal coffers and inset rosettes) between the north transept and the future Cappella Gregoriana (Frey [1911], 82, 409.76; 114, 487.6). The *volta a rosoni* on the west, however, was not completed until 1547 in Michelangelo's tenure (Frey [1916], 65, 584).

15 The foundations of the north hemicycle were begun in 1546, the last year of Sangallo's life (Frey [1913], 119, 492.11, 492.13 and 492.14). The foundations of the outer hemicycle wall, the wall that Michelangelo eliminated from his design, are still visible to the north of the existing apse at the base of the retaining wall of the hill. We know of no record that Sangallo had begun to build either wall of the north hemicycle above pavement level, and there was very little time for him to have done so.

16 The hemicycle wall and vault of the east apse were never begun. As is evident from a careful reading of the Frankfort drawing (Millon/Smyth [1969], fig. 16; Egger [1911], pl. 41, see note 12 above), there was no space for the apse between the *muro divisorio* that closed the west end of the remaining portion of the early basilica and the east end of the east arm of the new basilica. For confirmation, see pl. II appended to M. Cerrati, *op. cit.*, drawn by Alfarano on top of the print Dupérac published as Michelangelo's plan, which shows the remaining portions of the early basilica overlapping the area of the apse. Sangallo's inner apse wall would have been in the same location as the apse wall in the Dupérac print. (Ackerman [1961], fig. 12, [1964], 88 and [1970], fig. 92 and 330 states that the apse and apse vault were built, on the basis of documents in Frey [1913], 111. We think these documents probably refer to the pair of niches flanking the eastern arm of the upper level as shown in the drawing Uffizi Arch. 2555 by Dosio (Egger [1911], pl. 24).

Projects after Michelangelo's death that are prior to the competition for the completion of the east end of St. Peter's and reflect the absence of the east apse include the following: a long nave scheme by Mascarino (J. Wasserman, *Ottaviano Mascarino*, Rome [1966], fig. 24); a nave extended by one bay, attributed to Della Porta (C. Thoenes, "Studien zur Geschichte des Petersplatzes", *ZKg* XXVI [1963], 140, note 99; reproduced in H. Hibbard, *Carlo Maderno*, London [1971], fig. 48c); and a short nave scheme, but without façade, in a drawing in the Biblioteca Estense, Modena by an unknown draftsman (Codex Campori I, 1, f. 26 – kindly brought to our attention in 1969 by Jack Wasserman, who also gave us a photograph of the drawing).

17 Ackerman (1964), 94, writes, on the basis of a comparison of the sections of St. Peter's by Salamanca (Fig. 4) and Dupérac (Fig. 5), that Michelangelo "intended to simplify the vault coffering and a portion of the membering of the crossing piers". The observation about the crossing piers is correct, but the chief difference between the coffering shown by Dupérac and that in Salamanca's section of Sangallo's building is due to a mistake by Dupérac as to the height of the vault, which put the start of the coffering too near the entablature (for the mistake and its cause see especially Part 3, and meanwhile note 37 below). The design of the coffering in Dupérac's print remains the same (except that it shows octagons inserted in the square coffers of the main arches under the dome and at the end of the transept, which do not appear in the building). Michelangelo did not alter the existing scheme for the coffering, and he repeated it in the barrel vault he himself constructed over the north arm.

leading to the ambulatory. When Michelangelo took over, the inner wall of the south apse was at a height of a little over thirty-three feet (ten metres). It had reached the top of the three niches and comprised, besides the niches, the walls and columns flanking them as well as the lower portion of the giant pilasters between them.[18] There is no evidence the entablatures over the columns had been started.

While Michelangelo eliminated the outer wall and ambulatory of Sangallo's apse, he accepted the interior elevation of the inner wall up to the height it had already reached on the south, only converting the three niches containing doorways into semicircular chapels.[19] (These would serve in lieu of the chapels of the ambulatories.[20]) This decision meant that in the other arms Michelangelo would have to build the counterpart of the interior apse elevation already existing on the south. He probably was responsible for constructing the north apse from the pavement up, since it is unlikely it was begun previously, as we noted.

In addition, Michelangelo also accepted certain basic elements of Sangallo's scheme for the interior apse elevation as a whole (Figs. 2 and 4): the three levels (first-story niches, second-story window area, and vault area); the main, or giant, pilaster order and the main entablature, both of which continued from the sides of the transept and assured continuity with it; the principle of jutting sections of entablature – *ressauts* – above the two main pilasters; and the idea of having ribs, gores, and window lunettes in the vault. (The ribs and gores are seen in Salamanca's engraving of Sangallo's design [Fig. 4], not in the earlier wooden model [Fig. 3].[21])

But Michelangelo reworked the elements of the scheme from the top of the existing niches upward. He redesigned the entablature over the first-story columns. He replaced the walls and windows of the design for the second story. He gave the main entablature a new set-back. And he changed the design at the level of the vault. In so doing he altered the inside of Sangallo's apses fundamentally and made them his own.

At the outset we should consider the extent of the decorations added to Michelangelo's apses after his time and how his apse interiors must have looked before these additions. It is particularly valuable to do this because, apart from the apses, drum, and dome, we cannot be sure of Michelangelo's intentions for the only other parts of the interior of St. Peter's that he was free to redesign – the four great chapels (Gregoriana, Clementina, S. Michele, and della Colonna) occupying the corners of the building. The foundations of two of these chapels were begun in Michelangelo's lifetime,[22] but the walls were built after his death.

18 A drawing of the view toward the south from the southwest pier for the main dome, in Heemskerk's sketchbook (Hülsen/Egger [1913], pl. 9, f. 8r), shows that as early as the 1530s a portion of the main pilasters and piers of the inner wall of the apse had been built up to the moulding at the height of the spring point of the arches over the niches and that at least one of the columns between the piers of the hemicycle inner wall was in place. (The pilaster stands upon a pedestal which was hidden afterwards when the pavement level was raised in 1543; the column stands at the level of the original lower pavement. The columns in Vasari's view of 1546 [Ackerman (1961), pl. 52b] are at the new higher level.) The state in the 1530s is confirmed by another Heemskerk view (Hülsen/Egger [1916], pl. 67, f. 51r; Egger [1911], pl. 29) of the same date, showing St. Peter's from an elevated position to the southeast, in which the upper portion of one of the inner piers of the apse may be seen between the outer wall and the pilasters of the west side of the south arm. In 1545 the walls, niches, and pilasters had been carried by Sangallo up to, but most likely not including, the level of the entablature above the columns on the interior of the inner hemicycle wall (over 45 *palmi*). We can tell this from the fact that the documents mention the placing of capitals over the small pilasters on the ambulatory side of the inner apse wall (Frey [1913], 101, 480.3–5 [walls]; 106, 484.18–19 [bases] .33 and .35 [pilasters and capitals]). The relative height of the membering on the two sides of the wall can be ascertained from Sangallo's model or Salamanca's engraving (Fig. 4). (Ackerman [1964], 89, relying on Vasari's fresco in the Cancelleria [Ackerman (1961), pl. 52b], assumed that "the columns, but not the wall of the inner hemicycle" were in place.) Metternich has drawn our attention to the importance of a drawing formerly in Ashby's collection showing St. Peter's from the southwest (Egger [1932], pl. 38, first published in Th. Ashby, "Due vedute di Roma attribuite a Stefano Du Pérac", *Miscellanea Francesco Ehrle*, II, Rome [1924], pl. II). In it the outer wall of the south hemicycle is under construction and includes the rear domed surface of at least two niches and some of the engaged columns and wall of the exterior. Visible are the top of at least one interior column and behind it the southeast buttressing pier. The centering for the *volta a rosoni* on the southwest is in position. The drawing must date before 1527, when the capitals of the main order on both buttressing piers were installed (Frey [1911], 82, 191).

19 Michelangelo's niches were thus slightly deeper than Sangallo's, as Metternich pointed out to us, because Sangallo truncated the niches to make vertical planes for the doorways.

20 Vasari wrote of the reduction in the number of chapels resulting from Michelangelo's substitution and observed that, in making the change, Michelangelo rejected intentions going back as far as Bramante, Raphael, and Peruzzi, whom Sangallo had followed in this respect (Vasari-Milanesi, VII, 221). Michelangelo was certainly aware of the long tradition behind the plan he rejected.

21 Tolnay noted that Michelangelo's continuation of the lines of the giant pilasters in the vault is anticipated in Sangallo's design of the apses of St. Peter's, and he pointed out that Michelangelo used the motif elsewhere in the architecture of his later years (Tolnay [1965], 249–250 and note 12).

22 It has not been known hitherto that Michelangelo began the foundations of the two northern corner chapels, the Cappella Gregoriana and the Cappella di San Michele, and probably brought those of the Gregoriana to completion. The history of the corner chapels will be discussed and documented in a study in preparation (see also note 24 below).

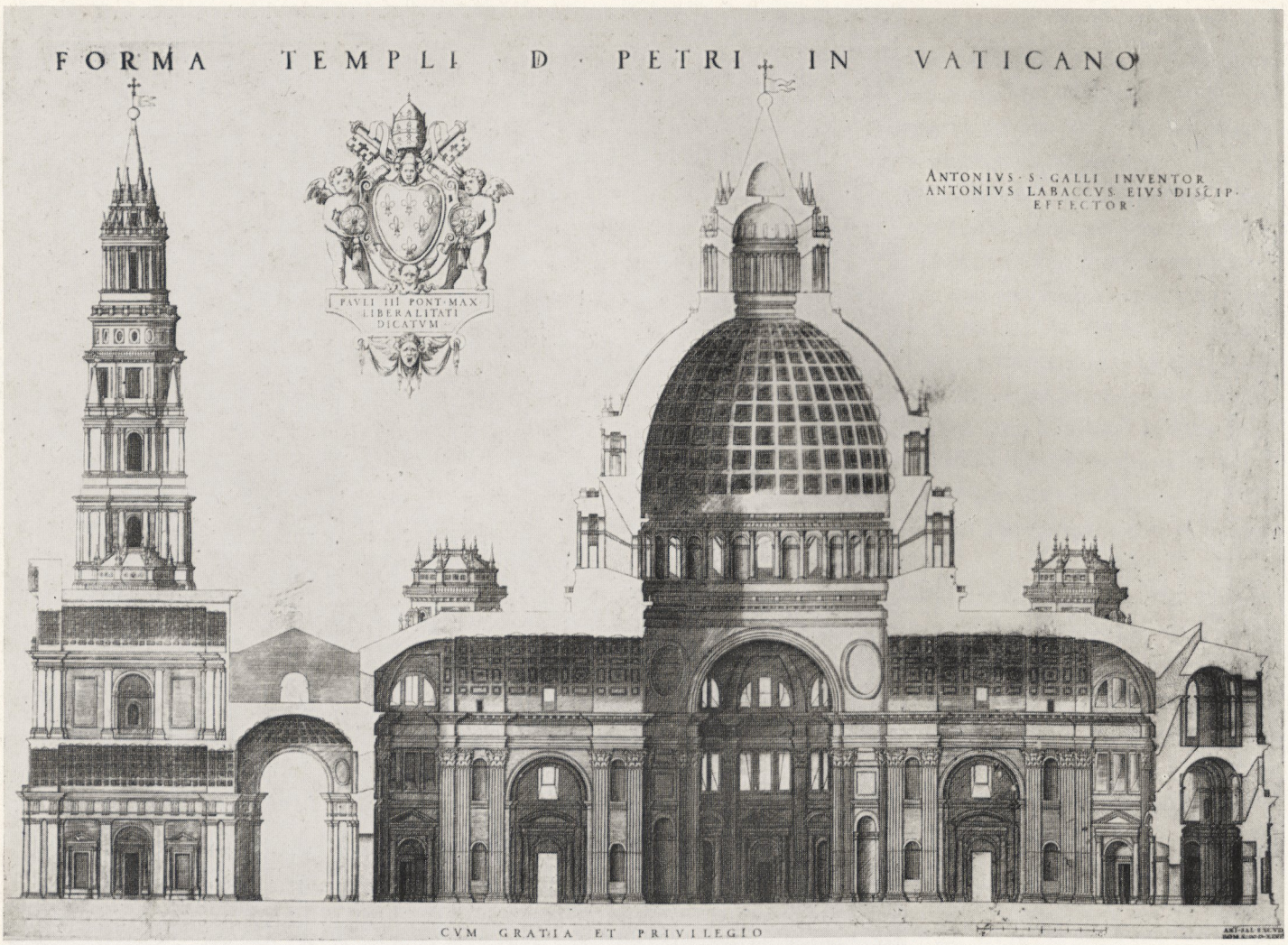
3. *Antonio da Sangallo: Model of St. Peter's. Interior view of east apse (St. Peter's)*

There is no contemporary representation or description of what he intended for their interiors,[23] and so we cannot know to what degree his successors were faithful to his intentions.[24]

23 Besides the plan of the corner chapels, about which all the known representations agree except in some details, the only nearly contemporary evidence for the design of their interiors is the section Dupérac published as Michelangelo's about 1569 (Fig. 5). Unfortunately his print clarifies little. He inexplicably omitted the second-story windows on the interior of the chapels (above the *aediculae*) and left the whole area blank, lacking even the cornice over the *aediculae*. On the evidence of Dupérac's own elevation (Ackerman [1961], fig. 60), as well as the representation of the exterior of Michelangelo's large model of St. Peter's depicted by Passignano (*ibid.*, pl. 58a), Michelangelo obviously planned second-story windows in these chapels.

At pavement level in the section, Dupérac repeats the *aediculae* already present in Salamanca's section of Sangallo's design (omitting the doors and changing the pediment from segmental to triangular as it is today). Some of these *aediculae* had already been built in Sangallo's time in the sides of the vaulted passageways connecting the arms with the corner chapels and were retained by Michelangelo. Michelangelo's large model (see Appendix II) could have included the *aediculae* of the corner chapels shown in the Dupérac section.

24 Giacomo della Porta executed most of the elevation of the Cappella Gregoriana, the first of the corner chapels to be completed.



4. St. Peter's, longitudinal section of model by Antonio da Sangallo. Engraving by A. Salamanca. 1546 (?)

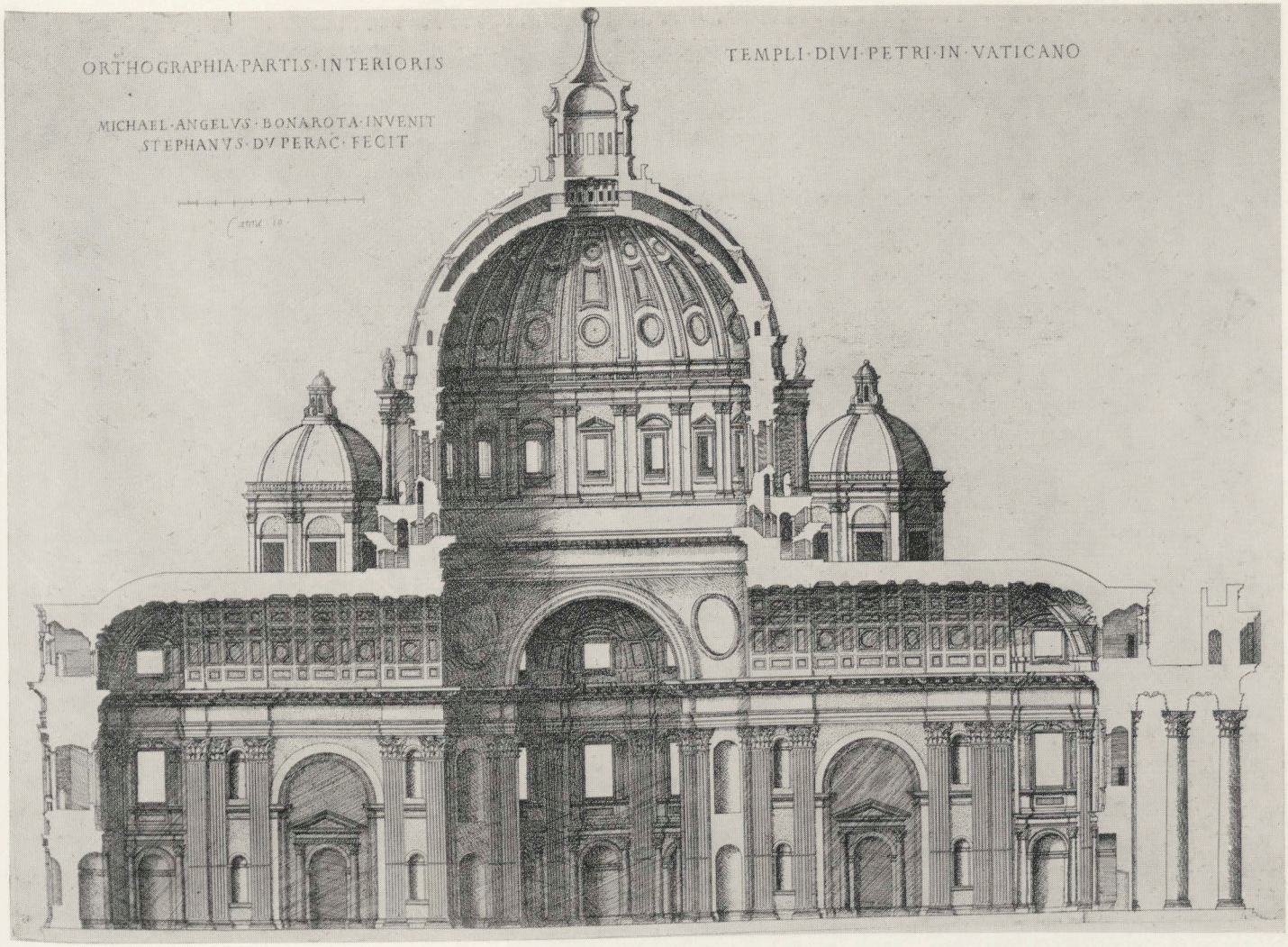
The apse of the choir on the west, built to Michelangelo's design after his death, is much obscured by seventeenth-century additions. But fortunately in the two matching apses of the transepts, north and south, we have interiors that Michelangelo himself completed (with the exception of the vault of the north apse, done shortly after he died[25]) and are still as he designed them – with the important exception that originally their surfaces were without decoration and probably were of exposed travertine throughout.

It is clear from explicit statements in Vasari's *Lives*, in letters of Michelangelo to Vasari, and from later assertions by Bottari and Milizia that the whole area of Michelangelo's apse vault was originally exposed travertine.[26] In a letter

As we shall show later elsewhere, the lower portions of the walls were constructed in the time of Ligorio and Vignola and the walls, arches, and inner and outer dome completed during Giacomo della Porta's tenure.

25 The engraving by Master H.C.B., showing a tournament in the courtyard of the Belvedere, pictures St. Peter's from the north as of the late summer of 1565 at the earliest (Ackerman [1961], pl. 53b; Millon/Smyth [1969], 487, note 4 and 496, note 46), and the apse vault is not yet in place.

26 In Vasari's account of Michelangelo's meeting with the Deputies and Pope Julius III in 1551, Michelangelo is quoted as saying that the vault was to be of travertine (Vasari-Milanesi, VII, 232), and Michelangelo himself says so in two letters to Vasari (Frey [1923], 481, no. CCLIV and 484, no. CCLV; Ramsden [1963], II, 178, no. 437 and 180, no. 439; for our translations of the letters see Part 2). Vasari tells us elsewhere that the travertine of the completed apse vault was bare. He marvelled that from the ground Michelangelo's apse vault looked as if made of one piece of travertine rather than individual blocks: "But what passes every marvel is the fact that, [Michelangelo] having made the vault of one of the three tribunes [*i.e.*, apses] of the same St. Peter's out of this same stone [*i.e.*, travertine], the pieces are joined in such a way that, not only is the fabric very well assembled with fittings together of various kinds, but seen from below it appears to be all made out of one piece" (Vasari-Milanesi, I, 123). Bottari and Milizia, bemoaning the redecoration of the apse vault in the mid-eighteenth century (see note 34 below), confirm that it was ori-



5. St. Peter's, longitudinal section. Etching by Etienne Dupérac. Circa 1569

to Vasari, Michelangelo also referred to "the other things below [the vault]" as travertine.[27] Such as it is, the visual evidence to which we shall turn shortly agrees in making the membering and walls of the apses, from pavement to vault, appear to be of the same material as the vault. The uniformity tends to indicate that travertine was indeed used throughout[28] or, if not throughout, that it was simulated where it was not actually used.

Elsewhere in the building travertine had not been used for all the surfaces. The coffered barrel vaults were lined on the interior with stucco, and there is no evidence that the wall surfaces were travertine.[29] A differentiation had evidently been made between wall surfaces and membering. Documents show that prior to Michelangelo travertine was used for the bases and capitals of the pilasters of the main order, for the main entablature, for all arches including those surrounding niches, and perhaps for string courses as well.[30] There is nothing to indicate that the shafts of the

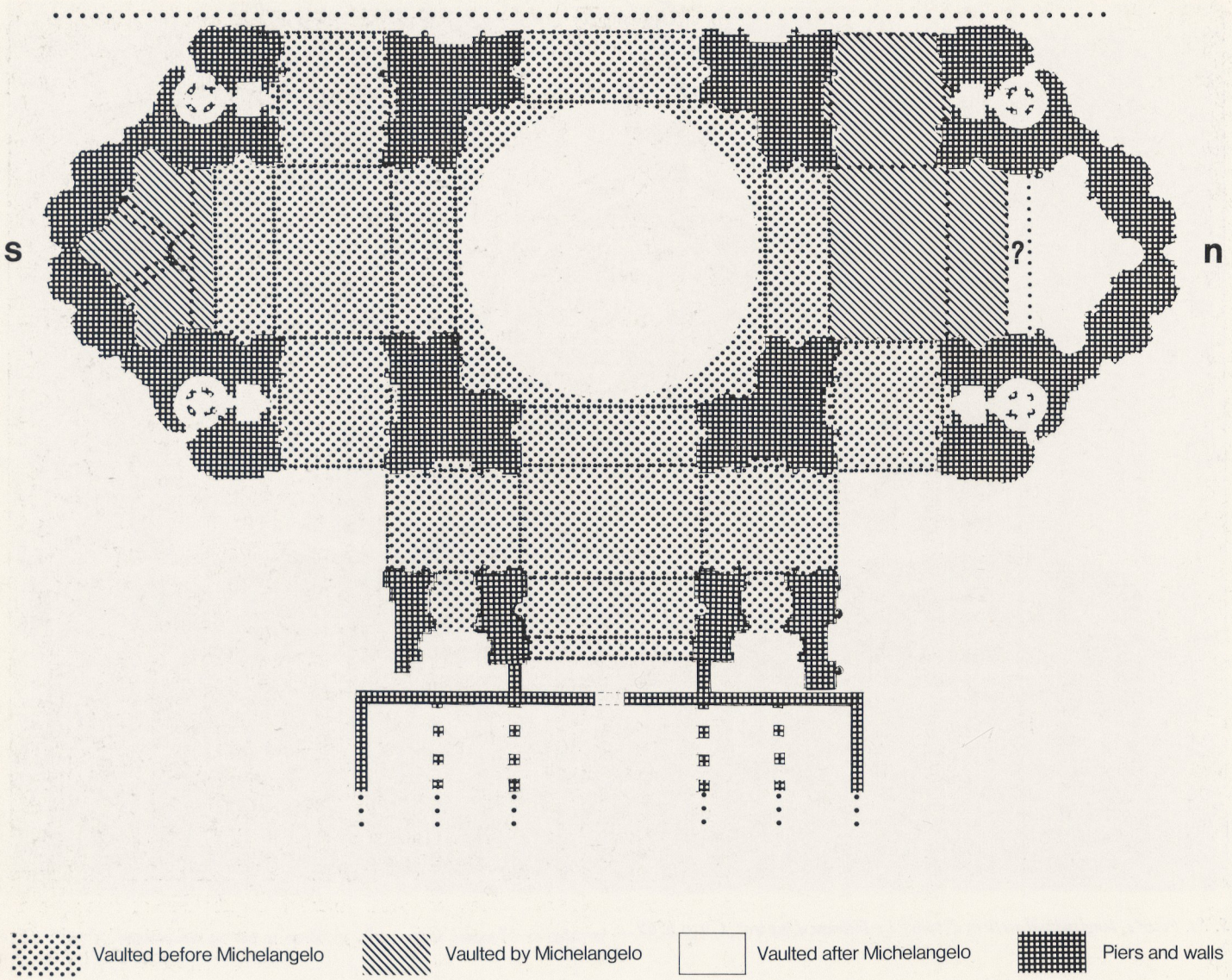
ginally blank travertine (G. Bottari, *Vite de'più eccellenti pittori, scultori e architetti, scritta da Giorgio Vasari*, Rome [1759–60], III, 264, note 2; F. Milizia, *Le vite de'piu celebri architetti d'ogni nazione e d'ogni tempo precedente da un saggio sopra l'architettura*, Rome [1768], 232; Barocchi [1962], III, 1475 for both).

27 The letter of 17 August 1557 from Michelangelo to Vasari appears to testify that the main elevation of the south apse interior was of travertine as well as the apse vault: "The vault, both the dressed stone and spaces, is all of travertine like the other things below, something not practised in Rome" (Frey [1923], 484, no. CCLV; Ramsden [1963], 180, no. 439).

28 Schiavo is of the opinion that the interiors of Michelangelo's apses were travertine (Schiavo [1949], 109, 119; Schiavo [1953], 193–194). F. Barbieri and L. Puppi have indicated their agreement (see their catalogue in Portoghesi/Zevi [1964], 921).

29 The vaults were of massive brick and mortar lined with stucco, as documents and our examination show. The wall surfaces appear in some drawings of the building under construction to have been left rough in some places. The rough finish could have been preparatory to stucco or to some other finishing (see, for example, Ackerman [1961], pl. 56b).

30 Frey (1911 and 1913), *passim*.



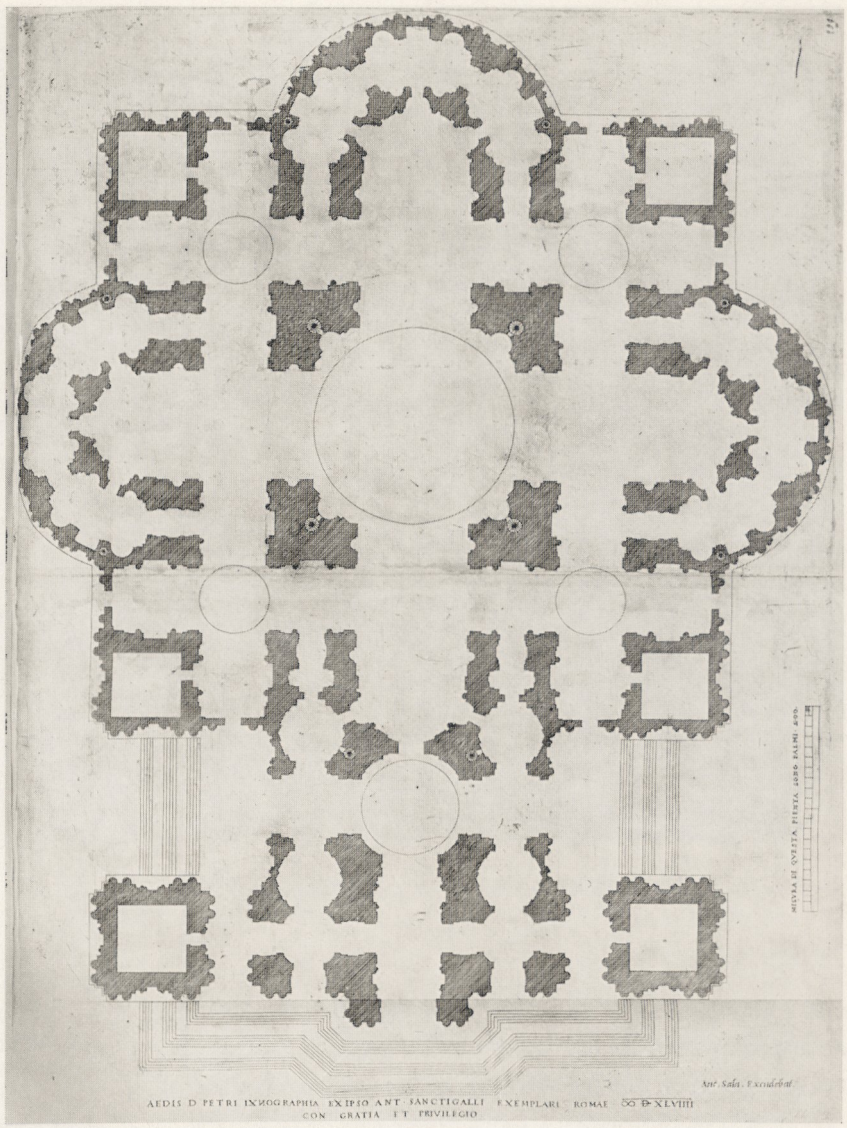
main pilasters were travertine.[31] The shafts were probably all made of brick covered with stucco.[32] But to judge from Sangallo's model of St. Peter's (Fig. 1), he intended the stucco surfaces of the pilasters to simulate travertine, and thus match the exposed travertine of the bases, capitals, and entablature, while the wall surfaces were to be light grey. For, in the model, the portions of the membering documented as travertine are painted yellow, the shafts of the pilasters are also yellow, while light grey paint is used for the wall surfaces.

Without archaeological soundings there is no way to tell for certain that, in contrast to the previous construction of the transepts, the interiors of Michelangelo's apses were of travertine throughout. If so, Michelangelo must have

31 Documents indicate, however, that in the ambulatory the shafts as well as the capitals and bases of the small pilasters were made of travertine (Frey [1913], 106, 484.35).

32 The indications are as follows:
1) Graf Metternich tells us that in 1954 he saw the northeast buttressing pier at the point where it joins the Maderno nave with its surface removed. Metternich says the material exposed was brick (reddish brick in the lower portion, yellowish above). The bricks were shaped to form the fluting of the pilaster. He took no photographs and after inquiry found out that none were taken by the Fabbrica.
2) Wolfgang Lotz has kindly told us that Palladio on 7 May 1567, when suggesting brick for the piers and walls of the Cathedral of Brescia, cited St. Peter's: "... per addurre di questo alcun esempio moderno S. Pietro chiesa maggiore di Roma, fatta dai Papi con grandissime spese, e tutto di pietra cotta, eccetto che agli altari vi sono alcune colonne di marmo..." (First printed by B. Zamboni, *Memorie intorno alle Pubbliche Fabbriche ... di Brescia*, Brescia [1778], 150.) Palladio omitted mentioning the travertine bases, capitals, and entablature already in place.
3) In the choir constructed later on the west the pilasters were made of brick (Frey [1911], 95, 280 concerning construction executed in 1585).

◁ *5a. St. Peter's, plan showing vaulting constructed before and during Michelangelo's tenure and the* muro divisorio *between new and old St. Peter's (not including construction to the west of the main crossing pre-existing Michelangelo's tenure and later demolished)*



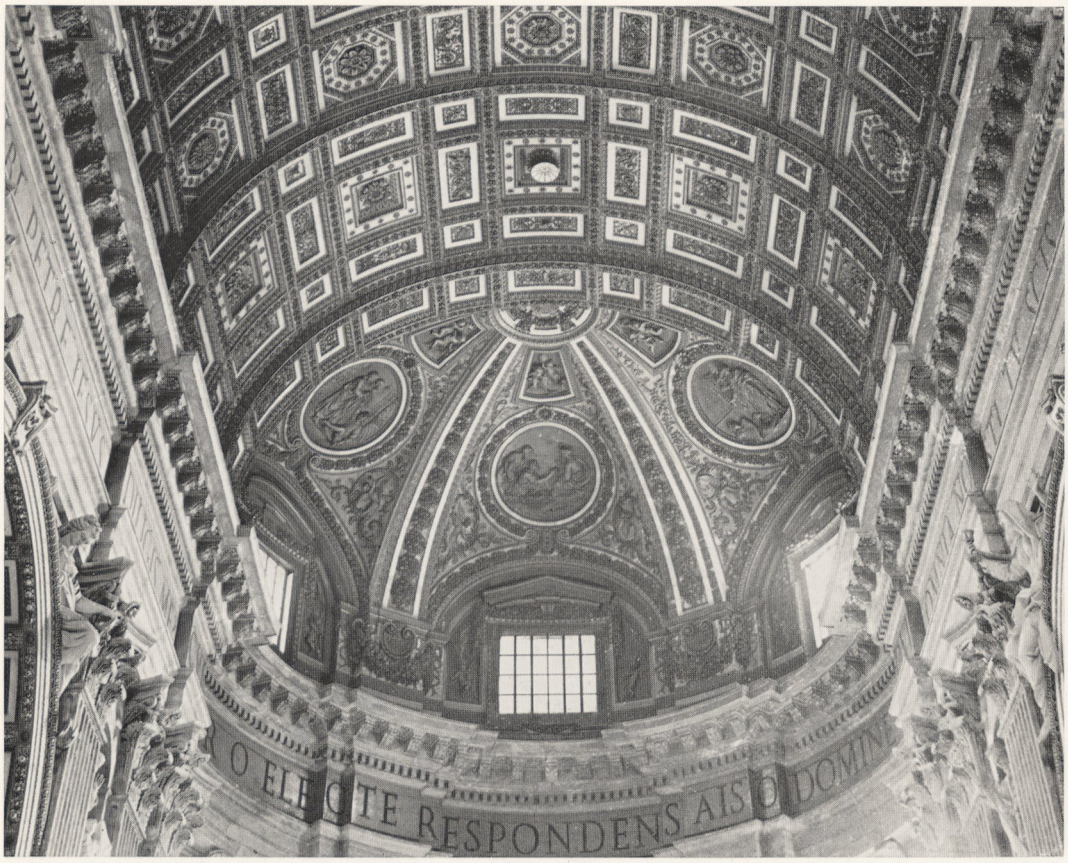
6. St. Peter's, plan of Antonio da Sangallo. Engraving by A. Salamanca. 1549

sheathed the walls and pilaster shafts of the pre-existing lower part of the south apse with travertine. If not, depictions of the original state of his apses suggest that he colored already existing surfaces to simulate travertine and then used travertine or simulated it for all the rest.

Whatever the case, there is no doubt that the apse interiors were originally free of surface decoration and that the addition of decoration has done much to alter their effect. The colored marble sheathing in the first story of the apses (Figs. 2 and 15) dates from the end of the sixteenth century.[33] The prominent stucco relief in the apse vaults (Fig. 7), gilded and with some of the main outlines in white,

33 The present decoration of the niches and surrounding areas on both the north and south was put in place in 1598–99. (See Docs. III–XIV: Docs. XI–XIV for the preparation and placement of the marble encrustation of the surface surrounding all six of the niches on the north and south; Docs. III, IV, VIII, and X for marble altars and encrustation; Docs. VI and IX for stucco work; and Doc. VII for gilding of the niches and altars in the north apse. Doc. V records the masonry work involved in placing the altars. We have not yet found documentation for the work, probably done immediately before, on the altars and niches of the south apse. The date for the decoration cited by H. SIEBENHÜNER, "Umrisse zur Geschichte der Ausstattung von St. Peter in Rom von Paul III. bis Paul V. [1547–1606]", in K. Oettinger and M. Rassem, eds., *Festschrift für Hans Sedlmayr*, Munich [1962], 307 was later in the Pontificate of Paul V, based apparently on the dates of the transportation of relics to these altars.) In 1599 there followed the decoration of the walls of the passage connecting the south transept to the Cappella Clementina (AFP, Armadi, 162, 37ff.), which is similar in design to that of the niches of the apses. Giacomo della Porta is specifically mentioned as the supervising architect for the decoration of the niches and of the passageway to the Clementina.

The columns flanking the niches in the first story of the apses, introduced in an early phase of the work on the south hemicycle and retained by Michelangelo, had always presented some color. Those flanking the center niches in both north and south apses are of yellow antique marble; columns of grey *cipollino* marble, grey granite, and pink granite were used for the side niches.



7. St. Peter's vaults of south arm and apse

was added in the mid-eighteenth century.[34] It has produced an appearance of strong separation between vault area and the elevation below at the cost of vertical unity. Also it

34 The gilded stucco embellishment of the apse vaults was executed in 1749 (Docs. XV–XVII, XIX, XXII–XXIII). L. Vanvitelli was responsible for the design of the decoration (see the perspective rendering [of the west apse vault?] reproduced in F. Fichera, *Luigi Vanvitelli*, Rome [1937], fig. 3) as well as for the lighting of the cupola for the Holy Year 1750 (N. Roisecco [publisher], *Roma antica e moderna*... [1765], I, 60–61 and L. Vanvitelli, *Vita dell'architetto L. Vanvitelli*, Naples, 1823). We have not found a payment for the design of the decoration for the apse vaults. (That Vanvitelli did get paid for such designs is indicated by Doc. XXIV, which records a payment to him in 1751 for the decoration of the small oval Cappella del SS.mo Crocefisso, to the west of the chapel now containing Michelangelo's *Pietà*.) The relief sculpture in the *tondi* in all three apses was executed by G.B. Maini (Roisecco, *op. cit.*, 61 and Docs. XVIII, XX–XXI). See also J. Garms, *Disegni di Luigi Vanvitelli nelle collezioni pubbliche di Napoli e di Caserta* (exhibition catalogue), Naples (1973), 69, no. 71.

The stucco decoration sheathed the entire vault area above the main entablature (Fig. 7). The following is a list of the stucco additions made in this period:

a) *Attic windows and window walls:* panels of relief stucco (*putti* with palms) at either side of each attic window; additional pediments over the windows (on the sides segmental pediments over the triangular ones – with new volutes – and in the center triangular pediments over segmental); keystone on and under the lower pediments (with XP symbol on the two side windows and with a console on the center window); garlands pendant from the keystones and from the sides of the windows.

b) *Segmental arches and pedestals:* egg and dart moulding on the arch; garlands resting on the upper surface (extrados) of the arch; garlands hanging from pedestal below cornice.

c) *Ribs:* three panels originally on the face of each rib (see our Part 2) removed and replaced by a single panel filled with clusters of fruit and flowers; space between the panel and the rib edge filled with a running guilloche motif; double shells (hinge up), with a head above, placed just below the cornice of the rib socle (on top of the original panel?).

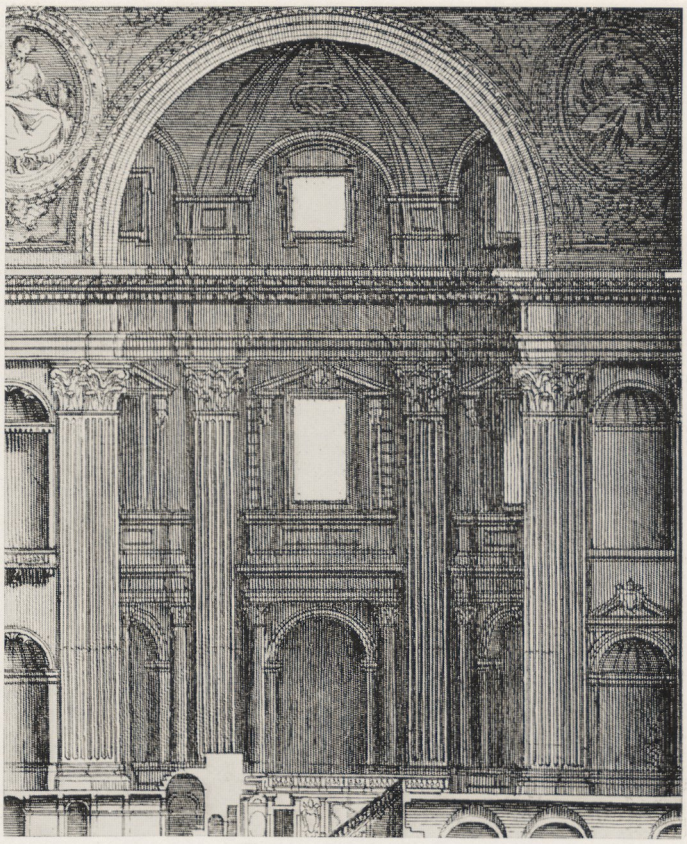
d) *Gores:* outline moulding and plant and human forms in relief over whole surface of gore except for space occupied by *tondi* and trapezoidal panels.

e) *Tondi and trapezoidal panels:* second, larger, concentric frame filled with clumps of fruit and flowers; the new frame ends at the bottom in two inward turning volutes where, near the crown of the segmental arch, a "tongue" protrudes outward and downward between them; congruent frame encloses the trapezoids.

f) *High relief sculpture:* in the south hemicycle the *tondi* contain scenes taken from the Raphael tapestries (from east to west – *The Healing at the Golden Gate*, *The Miraculous Draught of Fishes*, *The Death of Ananais*) while the trapezoidal panels each contain two *putti* holding (respectively from east to west) a crown and flower, crown and palms, and bishop's mitre and stole.

g) *Half-medallion:* fruit and floral semicircle midway between center and edge.

surely has created a closer relation between the apse vaults and the stuccoed and gilded barrel vaults of the arms than had existed previously between their very different surfaces (Fig. 9). The gold mosaic with inscriptions in the frieze of the main entablature was added in the 1860s and '70s before the first Vatican Council, an additional influence for separation between the vaults and the main elevation.[35] Finally, wherever the apses remain undecorated the original surfaces are covered by a greyish stucco coating simulating marble. This coating could have been added when other parts of the building were marbleized. In the nave and side aisles sheathing of portions began in the first half of the seventeenth century.[36]



8. St. Peter's, longitudinal section (north apse). Ferrabosco [1620], pl. XIV (detail)

It is probable that all articulated frame mouldings (egg and dart, egg and tongue, bead and reel, guilloche, and leaf) were added at the time the stucco was done, since none is visible in the prints of Ferrabosco (Figs. 8 and 9).

35 The mosaic inscription in the frieze of the main order was placed there during the reign of Pius IX. A trial section of the frieze inscription painted on cloth was put up on the west side of the north transept next to the crossing early in 1868 (AFP, Filze, ser. 7, vol. 205, *Ristretto* for period 3–29 Feb. 1868, nos. 29, 30, 33, and 34). This was followed by a trial (painted?) section on a false gold mosaic field later in the same month (*ibid.*, *Ristretto* for March, no. 36). Two trial wooden models for the alphabet to be used (23 letters following that of the inscription at the base of the dome, dating from 1605–06 during the reign of Clement VIII [AFP, Armadi, vol. 178, fols. 27v–51v, 68v, 75–91; vol. 185, fols. 85–159, and ser. IV, vol. 12, 1606, fols. 1v and following] and 6 "of another style") were paid for in April 1868 (AFP, Filze, ser. 7, vol. 205, *Ristretto* for April, no. 28). The "Latin letters" of Clement's reign were chosen. Five letters in wood of the Greek alphabet were paid for in May (*ibid.*, *Ristretto* for May, no. 26). In May the necessary scaffolding was constructed (*ibid.*, *Ristretto* for May), and the placing of the mosaic began in June (*ibid.*, vol. 206, *Ristretto* for June, nos. 28, 36, 38, and 45). In June, on top of letters he had painted, Fabrizio d'Ambrozio placed the first piece of final mosaic (also as a trial) – the letters 'O PETRE' (*ibid.*, *Ristretto* for June, no. 45). Once approved, the execution was given over to the mosaicists Pietro Devecchio and Gioacchino Deangelis, who executed the mosaic frieze in the north, west, and south arms in that order 1868–71 (*ibid.*, vols. 209, 211, 212). Portions of the inscription in the main nave were completed only in the 1930s (verbal communication by Don Cipriano Cipriani, Archivista della Reverenda Fabbrica, who also provided invaluable aid in locating these and the documents cited in the previous and following notes).

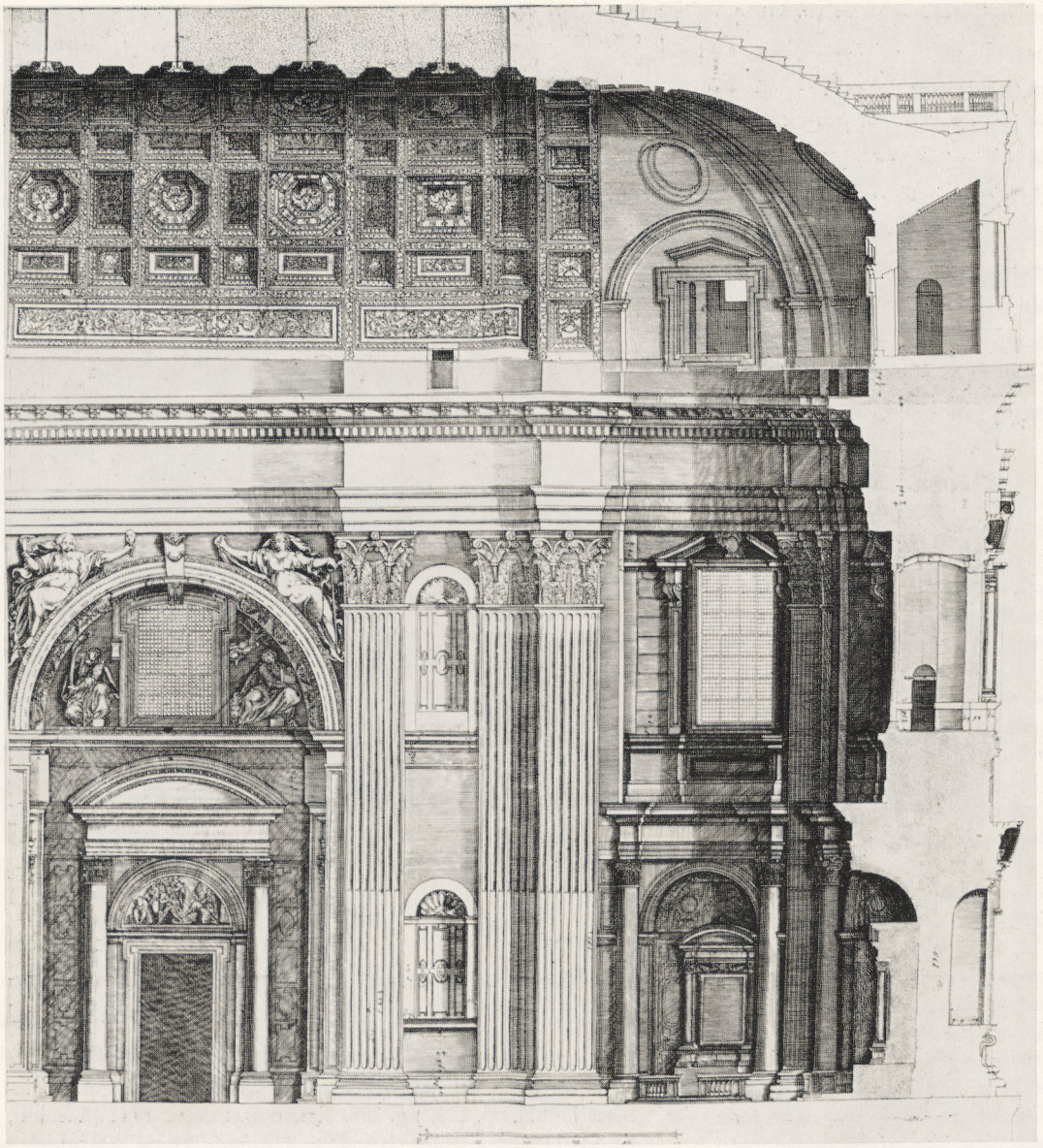
In 1803 there was a project to decorate the frieze, and cartoons devoted to some of the principal acts of the Apostles Peter and Paul were prepared. Nothing came of it (AFP, Armadi, vol. 465, 409).

36 Embellishing and improving upon the mid-16th century building began before 1600 with the decoration of the Cappella Gregoriana, followed by that of the six niches of the north and south apses (see note 33 above) and the Cappella Clementina. Renovation of existing architectural membering was accelerated in the time of Innocent X. In addition to decorating the small pilasters of the nave, he had 32 granite columns of the side aisles replaced with red-veined antique *cotanello* marble because the original granite columns were "broken and damaged" (F. M. Mignanti, *Istoria della S. P. Basilica Vaticana*, II, Rome [1867], 81 – quoted in Schiavo [1960], 65).

Paintings by Panini in the 1740s and '50s show the main pilasters of the nave in a marbleized state (F. Arisi, *Gian Paolo Panini*, Piacenza [1961], no. 151, fig. 198, signed and dated 1741 [London, Leonard Koetser Gallery]; and no. 242, figs. 298 and 300 initialed and dated 1755 [Hannover, Landesgalerie]). If Panini represents the interior correctly rather than an idealized version, the grey stucco coating imitating marble was applied before 1741. For this we have not yet found documents. (The interiors of several monochromatic Roman churches renovated in this period also come to mind – S. Cecilia [1712]; S. Anastasia [1721]; and S. Maria del Priorato [1764].)

Luxurious marble bases for the main pilasters were installed in the late 1850s during the reign of Pius IX. If the stucco coating had not yet been applied earlier, it would have been at this time. Thirty-six of the 16th and 17th century travertine bases of the main order were replaced by polished grey marble between 1857 and 1859. An inscription on the first pier on the south side of the nave reads *Bases pilarum ex lapide tiburtino marmoreae Pii IX pontificatus an. XIII* (Schiavo [1949], 110). In 1914, Pius XI replaced eight of the 16th century pilasters of the main order of the choir (or west apse) with a grey marble of matt finish. Pius XII, just before World War II, completed the renovation of the choir by replacing, with the same marble, the four remaining pilasters (G. Turcio, *La Basilica di San Pietro*, Florence [1946], 86). Piecemeal replacement and repair continue.

(During the time we have been studying St. Peter's, several travertine bases of the main pilasters have been replaced by marble



9. St. Peter's. Section through south transept looking east. Ferrabosco [1620], pls. XXIII (detail) and XXIV (detail) joined by authors

To help us visualize the original appearance of the apses, there is the following visual evidence. Most familiar is Dupérac's section of St. Peter's (Fig. 5). It should be noted, however, that the print is in error concerning the height of the apse vault, as we shall observe later.[37] The engravings in Ferrabosco's publication of 1620 (Figs. 8 and 9) are more reliable except for slight additions they show in the first story.[38] There is an anonymous painting from the early

ones; and several of the marble bases of the nave piers [made up from smaller pieces of marble and, in places, discolored] dating from the 17th century decoration by Bernini, have been replaced by monolithic marble bases. We have also noticed that several of the small pilasters sheathed in marble in the Cappella Gregoriana and the Cappella di San Michele have had the marble stripped, mechanically polished, and put back in place. The smooth machined surfaces now show no traces of the manual labor that originally produced them. In their new highly polished condition one cannot tell if all the original marble on the pilasters was re-used or some replaced. Piecemeal *ad hoc* embellishment, undoubtedly for the best motives, as well as zealous maintenance are altering the quality of the surfaces that form the interior of St. Peter's. It is becoming increasingly difficult to see the building or imagine it as it was in the past.)

37 In brief, the hemicycle vault is warped owing to the omission throughout the vault of the vertical wall surface below its spring point. Also, there is an extra vertical member in the apse vault, and the relationship between the height of rib socle and window is incorrectly shown (see Part 3 for discussion of these deviations in Dupérac's print). In the second story of the apse the coursed masonry is not included.

38 Ferrabosco (1620), particularly pls. XXIII and XXIV (combined in our Fig. 9). Ferrabosco's sections show correctly the state of the apses before decoration was added, with the following exceptions.

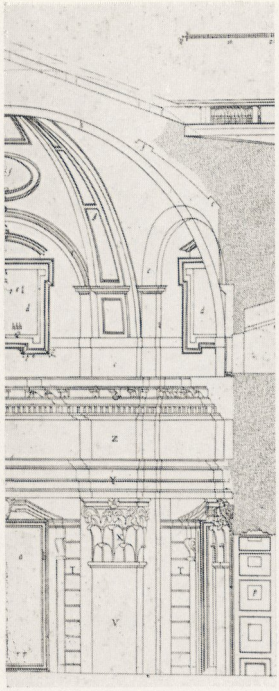
10. St. Peter's. Interior view looking west. Painting, author unknown (Collection of James Lees-Milne)

seventeenth century in the collection of James Lees-Milne showing the west apse in the distance, before the interior of St. Peter's was marbleized (Fig. 10). The painting is at least partly imaginary – witness the marble pavement in the nave.[39] Although the apse shown was built after Michelangelo's death, it seems a safe assumption that it was built to look like the other two. It is depicted here as being a uniform travertine-like color throughout. The color, how-

Surface additions at the lower level (the colored marble decoration of the inner surfaces of the niches of the hemicycle) are seen in Ferrabosco's plate XXIII (Fig. 9). (The pilasters under the arches of the niches were decorated with inlaid marble at the time the plates were published, even though not shown in plate XXIII. For the date of this encrustation see note 33 above.)
In plates XXIII and XXIV (Fig. 9) the string course below the windows of the upper level is not shown, although its dimension is included. In plate XIV (Figs. 8 and 42) the string course is shown across the face of the rib in the north apse, but it does not extend under the window. Plate IX (Fig. 11) shows it correctly as it is on the building.

In the arm, between the pair of pilasters of the main order, plate XXIII shows the two niches (one above the other) with their inner surfaces articulated by vertical panels and half-domes with shells, as they remain today. Plate XIV shows that all of these niches were decorated. But they are not decorated in either the Dupérac (Fig. 5) or the Salamanca section (Fig. 4).
In Ferrabosco's careful engravings there appears to be no differentiation of material between the main elevation of the apses and their vaults, but neither is there between apses and transepts.

39 In James Lees-Milne, *St. Peter's*, London (1967), 238, the date of the painting is rightly given as about 1616–1626. (The stuccoing and gilding of the vault in the nave was finished in 1616



11. St. Peter's, transverse section (detail of west apse). Ferrabosco [1620], pl. IX (detail)

ever, is only a lighter version – lighter perhaps owing to the intensity of light in the apse – of the color used uniformly for both membering and wall surfaces in the nave and choir,[40] where Sangallo intended differentiation. There are also Rubens' painting and preparatory sketch of the Miracles of St. Ignatius, both in Vienna, depicting Michelangelo's apse interior somewhat fancifully. Again the apse is of uniform color throughout.[41]

On the assumption that Michelangelo probably did intend all the surfaces of his apses to be travertine, we can follow a suggestion of Armando Schiavo[42] and consult the interior of San Biagio at Montepulciano (Figs. 12 and 13) for an idea of the qualities that unadorned travertine, precisely and sensitively cut, would have imparted to Michelangelo's apses. At San Biagio, travertine – plainly used as a building material, not sheathing – lends itself in the interior light to effects both of softness of surface, especially in curving transitions, and sharpness of line, seen to particular advantage in mouldings. Used for all elements of the articulated interior except the barrel vaults and dome, it appears both malleable and resistant, ideally suited to achieving the plasticity of sculpture in the medium of architecture. Its color and texture make for sobriety and richness. The use of the single material is unifying, drawing all together, but the variety of texture and hue in the individual blocks gives complexity and life.

Even though the original appearance of the apses has been changed at the level of the niches, in the entablature and especially in the vault, Michelangelo's work does survive untouched, except for the grey coating, in the second stories of the north and south apse (Fig. 14). Above all, the essential form of his apse design still remains clear and is definitive for the interior of the transepts of St. Peter's as we know them today.

It is a surprise to find that there is little about the inside of Michelangelo's apses in writings on Michelangelo and on St. Peter's.[43] There are few other interiors by Michel-

[H. Hibbard, *Carlo Maderno*, London (1971), 185]. The painting does not show Bernini's *baldachino*, the four columns of which were unveiled on 29 June 1627 [R. Wittkower, *Gian Lorenzo Bernini*, London (1966), 189].) The marble pavement in the nave, replacing the brick floor of Maderno (which was at a lower level), was only installed by Innocent X for the Jubilee of 1650 (Hibbard, *op. cit.*, 71–72); and it was unlike the one shown.

40 We are most grateful to James Lees-Milne for supplying information about the colors of the painting and for permission to publish a photograph. He describes the color of the apse as a greyish muddy khaki, looking like travertine and lighter than, but of the same hue as, the color of nave and choir. He adds that the vault of the nave is a mustard-like color apparently indicating gilding.

41 In both sketch and finished painting the apse is represented as homogeneous grey throughout. (In the painting there is gilding on the capitals and some membering, but not in the sketch.) We are grateful to Graf Metternich for pointing out to us Rubens' use of Michelangelo's design. Artur Rosenauer most kindly answered our queries about the color; we thank Hanna Kiel for putting us in touch with him. For Rubens' debt in his composition to a painting by Balducci, also in Rome, see Milton J. Lewine, "The Source of Rubens' *Miracles of St. Ignatius*", *Art-Bull* XLV (1963), 143ff., figs. 1 and 3. Sketch and painting are datable about 1617 (J.R. Martin, *The Ceiling Paintings of the Jesuit Church in Antwerp*, Corpus Rubenianum Ludwig Burchard, Part I, Brussels [1968], 30). The relation to Michelangelo's apse was pointed out in Graham Smith, "Rubens' Altargemälde des Hl. Ignatius von Loyola und des Hl. Franz Xaver für Jesuitenkirche in Antwerp", *JbKhSW* LXV (1969), 45 and credited to Harold D. Kalman. Rubens was in Rome in 1601–02 and for a longer period between 1605 and 1608.

Also worth consulting are paintings by Panini of the same view as that seen in Lees-Milne's painting but done about one hundred years later, particularly one dated 1741 (F. Arisi, *Gian Paolo Panini*, Piacenza [1961], no. 151, fig. 198), giving a helpful idea of the way Michelangelo's apses appeared before additions. A drawing at Windsor (no. 5590, I. Lavin, *Bernini and the Crossing of St. Peter's*, New York [1968], fig. 34 and Appendix I, no. 16) includes a representation of the west apse vault of St. Peter's. It gives an impression of the appearance before the later decoration was applied, although it is inaccurate in the relation of window head and cornice across the face of the rib. The south apse before decoration may be seen in prints by Falda from 1669 (A. Bartsch, *Le peintre graveur*, XXI, Leipzig [1870], 250.77; 252.5).

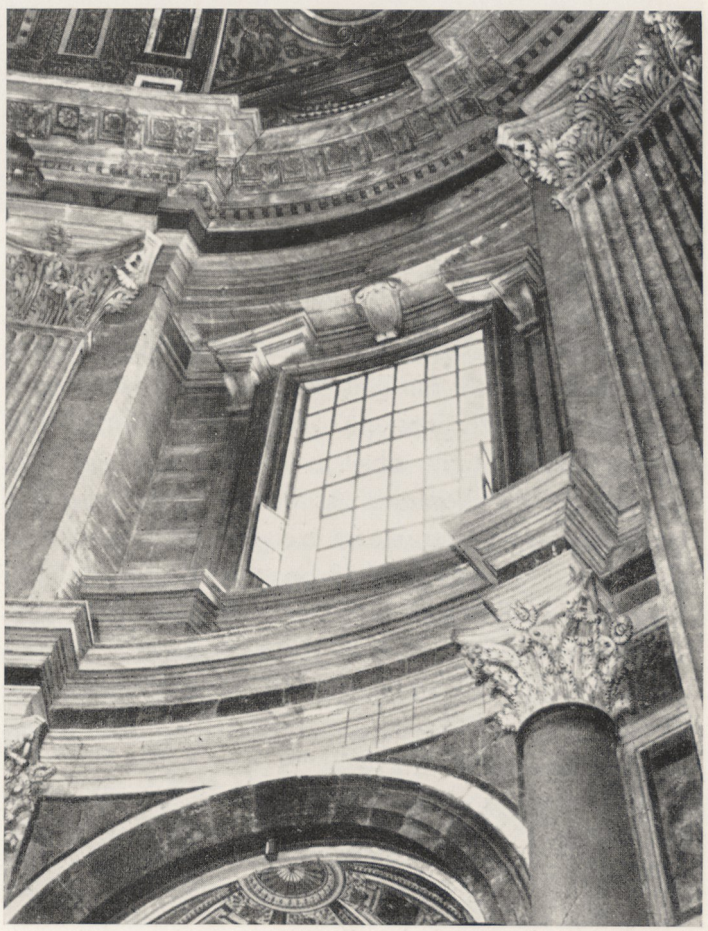
42 Schiavo (1949), 109, 119; Schiavo (1953), 194.

43 H. Thode, *Michelangelo und das Ende der Renaissance*, Berlin (1912), III, 717–718 noted briefly the importance of the window frames, details, and the entire apse form in Michelangelo's achievement

12. San Biagio, Montepulciano. Vertical interior view of corner at main entrance

13. San Biagio, Montepulciano. Interior view upwards from transept into dome

14. St. Peter's, interior view of south apse (detail of southwest window)



angelo, and they have been much studied. Inside St. Peter's, however, the concentration has been on Michelangelo's drum and dome and on the way he consolidated Sangallo's ground plan of the building. The lack of critical attention to his apses – in this most frequented of church interiors – must be partly because the later decoration, extending to the building's whole interior, has detracted from their individuality.

Recently, however, three writers on architecture later than Michelangelo's have looked back to his apse elevations in St. Peter's and briefly noted the beginning there of developments they were concerned with in the history of later architecture. Paolo Portoghesi has observed of the apse vaults in their original state that the way "the segments of the vault appear to billow out toward the exterior while restrained by the two ribs" influenced the domes of Bernini's S. Andrea al Quirinale and Borromini's S. Ivo.[44] In tracing the importance of vertical continuity in the architecture of Giacomo della Porta for the development of seventeenth-century architectural style, Howard Hibbard singled out "the treatment of the pilaster-*ressaut* within

at St. Peter's. Since finishing this essay we have become acquainted with the paragraph P. PORTOGHESI devoted to the interior of the apses in his *Roma del Rinascimento*, Venice (1970), 211 (*Rome of the Renaissance*, London–New York [1972], 215) containing observations on the "sockets" holding the second-story windows and on the light.

44 P. PORTOGHESI, *Borromini*, Milan-Rome (1967), 27; *idem*, *The Rome of Borromini*, New York (1968), 22.

15. St. Peter's, interior view of north arm and apse

Michelangelo's St. Peter's" as one of the sources of Della Porta's verticalism.[45] Similarly Richard Pommer saw Michelangelo's St. Peter's as one of two sources for the "continuity of pilasters and ribs" in Borromini's Oratorio of San Filippo Neri. Pommer was writing on the historical background of open structures in eighteenth-century Piedmont. Although he remarked on "the fortress walls of Michelangelo's St. Peter's" as a culmination of "the massive and shut-in architecture" of the sixteenth century, he cited at the same time "Michelangelo's scaffolding of giant pilasters and ribs in St. Peter's ... [as one of the] sources of some later skeletal structures."[46]

45 H. Hibbard, "The Early History of Sant'Andrea della Valle", *ArtBull* XLIII (1961), 307, note 117.

46 Richard Pommer, *Eighteenth-Century Architecture in Piedmont*, New York and London (1967), 4.

Billowing vault, vertical continuity, and skeletal structure – it is right to see an anticipation of these attributes of later architecture in the apses of Michelangelo. They are crucial to his design.

Michelangelo conceived the primary structure of the apses to be two great vertical members and, by presenting them as pilaster-pier combinations in his treatment of the second story, emphasized their thickness and strength as well as height. By the same token, he did not treat the walls on either side of these members as bearing elements (as they were treated in the arms of the transepts, where there is a balance between pilasters as structure and walls as structure). In the second story he recessed the walls and in both second and third stories opened them with large single windows. From pavement to vault the walls appear pro-

16. *St. Peter's, north apse interior (vertical view of north and northeast windows and walls)*

gressively less massive and less in evidence. At the same time emphasis on the vertical, structural forms continues through the levels of the second story and entablature into the vault, where, narrowing to ribs, they curve upward between deep concave gores to the half-medallion at the summit.

From a distance (Figs. 2 and 15) Michelangelo's apses appear higher than the arms which they terminate, though the height is the same, and also wider, as if expanding outward, though the ground plan attests they have the same width as the arms. There was help for the creation of such an effect in the design chosen for the ends of the arms before Michelangelo (Figs. 3 and 4) to mark the boundary between arm and apse: single jutting pilasters on either side carry a salient arch lower than any part of the vault over the arm. Michelangelo's design takes advantage of this inheritance. Beyond the salient pilasters and arch and using them as a foil, his apses open the ends of the transepts even while terminating and enclosing them. To be sure, the apses continue the transepts, as the giant pilasters and entablature that are common to both emphatically state. But the apses are also distinct. They can be seen as pavilions filled with light – higher, wider, and radically different from the transept arms. In the original undecorated state this effect must have been more pronounced (Fig. 10). Michelangelo concerned himself here with effects of enclosed space, not confining himself to a sculptor's concern with mass.

Before looking at Michelangelo's apses more closely, we should consider Sangallo's design (Figs. 3 and 4) in more detail.

Sangallo, we noted, had the three-level division with niches below, windows in the second story, and, as represented by Salamanca's engraving (Fig. 4), windows, ribs, and gores in the vault. He already had two continuous verticals formed by single pilasters, by *ressauts* in the entablature, and by ribs in the vault.

But the two giant pilasters of Sangallo's design were against a plain, curved wall surface, with only a simple *ressaut* above. The wall surface belonged to one uniform curve throughout, without set-backs, and the windows were divided in threes. The ribs of Sangallo's vault led to an immense half-medallion continuous with the salient arch over a large area, suggesting that arch and apse vault were parts of the same structure. The gores were shallow and undecorated and so small they appeared to be infill between the half-medallion and the window walls of the third story. The windows took up these walls almost completely.[47]

Because at both second and third levels Sangallo divided his windows into three parts (in the vault this was on ancient precedent), the pieces of wall that were repeated between, to frame them, reasserted the wall surface, provided vertical accents, and articulated the light. Because of Sangallo's two-story ambulatory around the apse, the light for his second-story windows was borrowed from the upper gallery of the ambulatory and brought in through light chutes. It would have been reflected from all intermediate interior surfaces – from the vaults of the gallery, from the sides and bottoms of the chutes. The same would have been true of the windows of the vault – even though there, in addition to the chutes for the light from the gallery, other long narrow chutes would have brought some direct light from small openings in the top of the vault as well.

One of Michelangelo's most significant departures from Sangallo's design was to recess the window walls in the second story. By this recession he emphasized the thickness and strength of the vertical structure.

Below, at pavement level, the wall accepted by Michelangelo from his predecessor is only 2 *palmi* (1 ft. $5^5/_8$ in.; 0.446 metres) behind the face of the giant pilasters. The massiveness of the wall is conveyed by the three altar niches (Figs. 2 and 15). In addition, the attached columns flanking the niches advance into the space of the chapel (Fig. 15). The new, continuous entablature Michelangelo introduced just above the columns intensifies their advance by its prominent *ressauts*. It stresses the contrast between the advance of the first story and the set-back of the second, underlining the abrupt transition between them (Fig. 19).

In the second story the walls recede 5 ft. $6^3/_4$ in. (1.69 metres; *palmi* 7, *minuti* 35)[48] – except for narrow, vertical pieces of wall, or wall strips, that remain next to the pilasters and are still in the original plane (Figs. 15 and 16). The wall strips tend to reduce the apparent structural value of the window wall. Less than three feet wide (2 ft. $9^3/_8$ in.; 0.847 metres; 3.8 *palmi*),[49] they convey the effect of a pier and pilaster combination (not unlike the pilaster-piers of the ground level of Michelangelo's Palazzo dei Conservatori) and so impart a sense of the massiveness of the vertical structural members – and, by contrast, the non-structural nature of the recessed window walls. At the same time, the window walls are distinguished by their treatment from all other elements in the elevation: they are textured with coursed ashlar masonry. They made a strong contrast to other surfaces when the apses and transepts were in their original undecorated state. The deep soffits of the entablature over the window walls give further evidence of their recession and, by emphasizing the mass of the entablature, testify to the sturdiness of the piers that support it.

The combination of recession plus pilaster-pier in the second story affects the reading of the first story as well (Fig. 2). It indicates persuasively that the beginning of the great piers is there in the narrow sections of wall between the giant pilasters and the marble and granite columns.

Michelangelo continued the pilaster-pier effect upward. He recessed the main entablature over the window walls (Figs. 2 and 16). This produced additional *ressauts* over the wallstrips-turned-piers. These *ressauts*, in turn, confirm the reading of the wall strips *as* piers. Combined with the *ressauts* over the two giant pilasters, they achieve vertical continuity for both pilasters and piers up through the main entablature, to be prolonged then at the level of the vault by the pedes-

47 Although the sills of the upper windows are shown only just above the main entablature in both Salamanca's engraving of 1549 and Labacco's model of 1538, there is good reason to believe they were intended by Sangallo to be higher, about the same height as those constructed by Michelangelo (see Part 2, note 9).

48 This dimension is obtained from adding the two inscribed dimensions to the right of the central window on the plan of the second-level corridor in Uffizi, *Arch.* 96 (Millon/Smyth [1969], fig. 13), *i.e.*, *palmi* 5 *minuti* 25 and *palmi* 2 *minuti* 10. It scales a bit larger in Ferrabosco (1620), pls. VIII and X.
There is an antecedent for this recession in the set-back panels for the windows in Michelangelo's Laurentian Library (Portoghesi/Zevi [1964], pls. 345 and 334), brought to our attention in the manuscript of Wolfgang Lotz on sixteenth-century Italian architecture to be published in the Pelican series. We are most grateful to him for the opportunity to see the manuscript.

49 This dimension is scaled from Ferrabosco (1620), pls. VIII and X. The width of the wall strip as inscribed on Uffizi, *Arch.* 96 (Millon/Smyth [1969], fig. 13) is *palmi* 4 *minuti* 5 – a larger dimension than that scaled from Ferrabosco.

tals of the ribs and the little pilasters carrying the segmental arches over the windows (Fig. 8). While the giant pilasters lead to the ribs, the wall strips thus lead to the arches.

At the vault level the ribs, carrying the major vertical lines, support the gores of the vault and thus the vault as a whole. The window walls, conceived as infill under the arches, are the only remaining elements supported independently of the vault's major articulation (Fig. 7). Although not set back like the window walls below, they appear more closely related to them than to the vault above (Fig. 8), heightening the effect of skeletal structure and its vertical continuity.

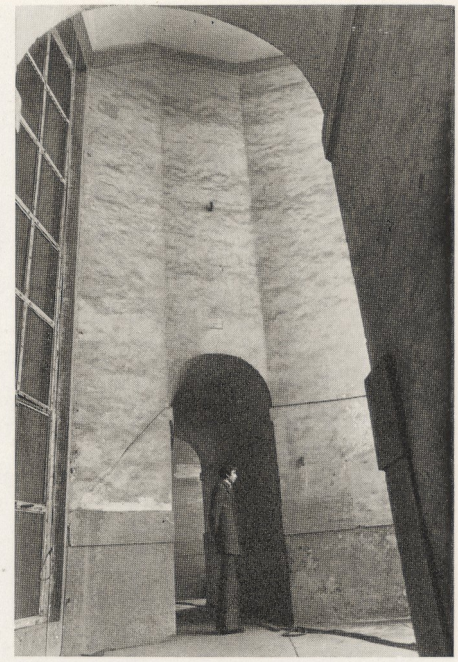
The actual open area of Michelangelo's windows is not as great as in Sangallo's design in either the second story or at the level of the vault, where he narrowed the width.[50] Nevertheless they look very large. They have the effect of opening the walls, reducing them and affirming their nonstructural role, not simply because of the amount of available wall area they occupy, but also because of their position, the lack of subdivisions, and their brightness.[51]

In the second story Michelangelo lowered the window sills more than ten feet (10 ft. $7^1/_2$ in.; 3.24 metres; 14.5 *palmi*), bringing the light source nearer (Figs. 4 and 8). His window pediments are thrust up under the soffits of the main entablature and broken, stressing that the windows extend as high as it is possible to make them. Most important of all, Michelangelo intensified the incoming light by making his windows undivided openings, removing the ambulatory ring from the apse, and eliminating many intermediate reflecting surfaces.[52]

50 As mentioned in note 47, reason will be given in Part 2, note 9 for believing the sills of the upper windows in Sangallo's design were to be at about the same height as those constructed by Michelangelo, despite Sangallo's model (Fig. 3) and Salamanca's engraving (Fig. 4).

51 Vasari was impressed by the windows of Michelangelo's apses. He referred to them as "finestre vive di lumi, che hanno forma varia e terribile grandezza" (Vasari-Milanesi, VII, 221).
Relative to the amount of available vertical wall surface, the upper windows are much larger than the windows of the second story and therefore the most significant element in the wall area at vault level. Although the window walls at the vault level are not recessed as are the window walls of the second story, from most locations at pavement level in the arm the view of their lower portion is obscured by the projection of the main cornice just below (Fig. 15).

52 In the criticism he wrote of Sangallo's design Michelangelo had singled out particularly the way the ambulatories kept light from the building (G. Milanesi, *Le lettere di Michelangelo Buonarroti edite e inedite, coi ricordi e i contratti artistici*, Florence [1875], CDLXXIV; Ramsden [1963], II, no. 274).



17. St. Peter's, view of "Loggia" at second-story level

Whereas Sangallo's second-story windows drew light from the upper ambulatories, Michelangelo's draw light directly from outside. But the light passes through spaces wider and higher than the windows, loggia-like spaces, or light boxes, carved in the thickness of the hemicycle wall – a thickness at this level no greater than Sangallo's *inner* wall (Figs. 9 and 17). Standing below, one sees the vaults and sides of the "loggias" (Fig. 45). They convey a sense of expansion outward beyond the boundary of the inner wall of the apse and suggest that the walls of the windows are only thin screens, drawn across the "loggias" at their inner opening.[53] The surfaces of these loggia-like light boxes serve to reflect light into the interior, but they can also block direct view of the open sky, now more now less, depending on where one stands, a matter we shall return to at the close of this study.

53 The glass and its framework in the windows today suggest that exterior space begins beyond it. The glass and frame of the large windows at the second-story level are set within a smaller frame inside the principal window moulding. The present glass and supporting elements form a plane surface rather than following the curve of the window frame. They are probably of recent date. In the windows of the upper level in the building today the plane of the glass is again set within a smaller inset frame.
What the glass enclosure could have been in the early 17th century can be seen in Ferrabosco's plate XXIII (Fig. 9). He shows glass in the large windows of the second story, where the major divisions are 7×4 instead of the present 7×6. Ferrabosco also shows glass in the east window of the Cappella Clementina ($6? \times 3$ divisions). But he shows no glass in the openings at the upper level of the hemicycle (Fig. 9). Glass may be seen in place in the upper windows in an engraving by G.B. Falda dated 1669

In the upper windows, at the level of the vault, there is much more interference with a direct view of the open sky now than there was originally. As Michelangelo built the exterior of the attic at this level in 1557 (to be seen in figs. 12, 16, 17 and 18 of our first article in this series), it did not have the exterior screen walls and raised windows of the present revised attic facing. These were substituted afterwards for Michelangelo's original design. The sills of the outside openings were originally at the same level as the inside sills; and the spaces of the openings beyond the inner windows broadened outward and upward toward the outside, their walls splaying widely and their vaults rising to nearly the full height of the attic. Michelangelo's original attic of St. Peter's was built to admit as much direct light as possible.

As a final preliminary to considering the information given by the vault model and related drawings concerning the design of the vault, we should notice some subtleties in the second story that take account of the observer's position and movement.

The sides of the vertical strips in the second story do not go straight back to the window walls. After a short distance (the thickness of the *ressaut* above) they recede before continuing back to form a recess for the window wall (Fig. 16). At first (Fig. 2) an observer is not likely to be conscious of the thinness of the wall strips. He becomes aware of it thanks to the behavior of the light in a diagonal view: seen diagonally, the projecting edges reflect more light than the rest.

Hence the strips are subject to more than one reading. The readings tend to alternate, changing one to the other, particularly as the observer moves.[54] Now the wall strips

18. St. Peter's, south apse interior (vertical view of southeast window and wall)

appear to constitute the solid front of the piers, now to form only shallow screens backing the pilasters, or to be simply shallow individual vertical strips projecting next to the piers toward either side.

With awareness of the true shape of the wall strips comes recognition that the piers are somewhat narrower than they at first looked. It becomes apparent that the narrowing of the piers allows greater width to the window wall. With the further observation that the mouldings on the window wall continue on the sides of the pier, behind the wall strips (Fig. 19), comes realization that the pier wall asks to be read with the window wall – pier wall and window wall together forming a wide recess for the window, a pocket preliminary to the light pocket lying beyond (Fig. 18).

Michelangelo's treatment of the wall strips and piers has various consequences. It makes the pier system appear rather more skeletal when viewed diagonally, thicker and more sturdy in front view: it both emphasizes and "deemphasizes" the piers. In diagonal views, it contributes to the effect of the set-back of the window walls, removing them further from connection with the weight-bearing structure and contributing to the impression of lateral expansion in the second story. But this, too, is countered to a degree. For by extending the window-wall mouldings onto what

(A. Bartsch, *Le peintre graveur*, XXI, Leipzig [1870], 250.77). Some metal frames to hold the glass in the main apse windows were made in 1592 (AFP, Armadi, 136, *passim*). The glass enclosures will be considered in a later publication.

In the Dupérac print (Fig. 5) – and in the preparatory drawing for it (see below, Part 3) – no glass is shown either in the second story or at the attic level. We cannot be sure whether Michelangelo intended glass or not. As we shall have occasion to observe in Part 3, Dupérac's St. Peter's can be misleading. In prints of other buildings designed by Michelangelo glass is used in openings, as, for example, in Regnard's engraving of the model of S. Giovanni dei Fiorentini (Ackerman [1961], fig. 71b) and de'Rossi's engravings of the Sforza Chapel (Ackerman [1961], figs. 72a and b). These prints, however, were executed in the 17th century like the Ferrabosco volume.

54 Michelangelo's awareness of the effect of the observer's movement on the character of his architectural forms is stressed by Ackerman (1961), 4, 7, 8, and 9. He appears to be writing particularly of exteriors.

19. St. Peter's, north apse interior (view of northwest window and wall)

20. St. Peter's, north apse interior (vertical view from chapel on northeast)

is known to be pier Michelangelo laid a stress on the unity of piers and wall. He tied together and separated at the same time.

When viewed on axis from the crossing (Fig. 2), the *ressauts* of the entablature over the central pair of columns in the first story lead up directly to the pedestals flanking the central window of the second story. The pedestals, in turn, appear to be the principal supporting elements for the small pilaster strips framing the central window, and for the coursed masonry wall at either side as well (Fig. 8). From the same vantage point (Fig. 2), the entablatures over the columns of the *side* chapels are seen obliquely. The *ressauts* above the columns beside the pilaster pier on each side of the apse then lead vertically instead to the wall strips flanking the main pilasters. They also lead diagonally in depth – because of their similar form – to the pedestals flanking the windows and from them to the recessed window and window wall itself, stressing the depth of the recession.

But as one advances on axis toward the hemicycle or diagonally toward its side niches, the vertical relationships change (Fig. 15). Column and entablature that had previously led to pedestal now lead to wall strip, and vice versa. Parts evidently related appear to lose connection and become integral to another relationship that also emphasizes verticality.

As the viewer nears the hemicycle itself, the mouldings of the entablature over the columns become juxtaposed with those of analogous forms under the windows (Fig. 14). They make overlapping arcs because they follow different radii of curvature in accord with their distance from the center of the hemicycle. In changing views (Fig. 19) the overlapping arcs produce a changing and complex interplay, emphasizing recession. It is an interplay of fine, crisply detached multiple mouldings in contrast to the larger scale, plainness, and severity of the adjacent pilasters and wall strips. From closer viewpoints (Figs. 16 and 18) the pedestals become hidden by the *ressauts* of the columns, and the entablature over the columns of the first story is finally seen in dramatic juxtaposition with the entablature of the main order above (Fig. 20).

At the vault level, Michelangelo arrived at refinements both of structure and membering that were significant for the effect of his whole apse. The new vault model and the related representations of the vault show something of their evolution. Only after the vault was begun did Michelangelo make two major decisions, critical and telling for the design.

2

At the start of Part 1 we referred to the wooden model of the apse vault of St. Peter's (Fig. 21) which is inserted in the west end of the large wooden model of the building made for Antonio da Sangallo by Antonio Labacco. In its basic form and articulation the inserted model of the vault is like Michelangelo's apse vaults (Figs. 2 and 7), not Sangallo's (Figs. 3 and 4). In turning to it now we shall observe that it shows certain differences from Michelangelo's vaults and obvious traces of alteration. It incorporates, in fact, two stages *en route* to Michelangelo's final scheme. These mark it as a model made for Michelangelo prior to his final design and used by him for study.[1]

In Part 2 we shall consider also the two familiar sheets in the Casa Vasari at Arezzo mentioned briefly earlier (Figs. 22 and 23). The sheets contain Michelangelo's letters and drawings explaining to Vasari the foreman's error in building Michelangelo's vault over the apse of the south transept – the only apse vault of Michelangelo's St. Peter's constructed in his lifetime. The error, discovered between 23 April and 4 May 1557, necessitated dismantling and rebuilding the vault.[2] Michelangelo's first explanatory letter to Vasari is dated 1 July 1557 and is illustrated by two drawings (Fig. 22). His second letter is dated 17 August 1557 and is illustrated by one drawing (Fig. 23). The upper of the two drawings in the first letter proves to represent a design of the apse vault that precedes the final design. The drawing illustrating the second letter is closer to the design realized in the finished apse.

Some striking points of testimony are offered by the wooden model and the drawings. Most unexpected are the following: that originally Michelangelo accepted the salient arch as planned by Sangallo between the semidome over the apse and the barrel vault over the transept (Fig. 4), but after seeing the wooden model decided to try wedge-shaped ribs in place of the salient arch; that the model was revised accordingly (Fig. 24); that when Michelangelo first began constructing the vault he built it with the wedge-shaped ribs; and that after discovering the foreman's error and dismantling the vault, he returned to the salient arch as we see it in the south transept today (Fig. 2). At issue, we shall find, were differences both in structure and in the formal relation of apse and transept arm.

The model and drawings show also that originally Michelangelo intended to make a continuous horizontal of the tops of the windows and the little pilasters carrying segmental arches over them (Fig. 21) and planned a vault with relatively shallow gores (Figs. 21, 25 and 30). Later he lowered the little pilasters (Fig. 26) and deepened the gores, making them the billowing ones of the final scheme (Fig. 7). The results were significant for the verticality and skeletal structure of his apse design and thus for its importance in anticipating future developments in architecture. The evidence is again that Michelangelo made the changes only after the foreman's error was discovered.

The principal reason for dating these last major alterations of design after construction had been begun and halted is the evidence given in the upper drawing of Michelangelo's first letter to Vasari on 1 July 1557 (Fig. 22). In several details Michelangelo was inexact in this drawing, but its testimony as to the vault's basic scheme is clear. If we did not have the drawing, the evidence of the model would still show that Michelangelo's design went through the same stages. We should have no reason, however, to think the last stage was reached after construction began. Since Michelangelo's testimony in the drawing is inescapable, our account of the design of the apse vault involves the history of the construction of the vault itself, and the final design is seen to depend on the opportunity presented by the accident of the foreman's error.

An earlier stage in the design of the apse vault, before construction began, also followed an accident. Originally, we shall find, the wooden model of the vault inserted in Sangallo's model was constructed incorrectly because of a mistake on the part of the model-maker. To be useful, the model had to be reworked. Its wedge-shaped ribs were introduced in the alteration correcting the model-maker's mistake. Indeed, in all probability they were suggested by the nature of the mistake itself. Twice, then, Michelangelo made an error of an assistant the occasion for rethinking and changing his design.

The wooden model of the apse vault inserted in the west end of Sangallo's model of St. Peter's (Figs. 21, 27 and 28)

1 The new model brings the number of surviving architectural models done for Michelangelo to three. The others are those for the façade of San Lorenzo in Florence and for the drum and dome of St. Peter's (the dome portion of which was altered later). Whereas the first of these projects was never built and the second was finished only partially by Michelangelo himself, the vault model was for a project that Michelangelo himself saw through to completion, on the apse of the south transept of St. Peter's. (For recent summaries of information on Michelangelo's models see Ackerman [1961], 16, 99; *idem* [1964], 11–13, 107ff.; *idem* [1970], 64–68, 304, 210ff., 335; Portoghesi and Zevi [1964], 834ff., 917ff.; and Wittkower [1964], *passim*.)

2 For the date of the discovery of the foreman's error, see Millon/Smyth (1969), 484 and note 2.

21. *Antonio da Sangallo: Model of St. Peter's. Interior view of west arm with inserted model of Michelangelo's apse vault (St. Peter's)*

was made at a scale of 1:30, the same scale as that of Sangallo's model. The vault model's maximum inside dimensions are 47 cm. deep ($18^1/_2$ inches), 79.5 cm. wide (30 inches), and 39 cm. high ($15^3/_8$ inches).[3]

3 Sangallo's model, built by Antonio Labacco, at a scale of 1:30, is about 7.1 metres (23.3 ft.) from entrance to apse and about 4.5 metres (14.8 ft.) from its pavement level to the top of the lantern, excluding the base of 1.2 metres (3.6 ft.) high.

At the open end of the inserted vault model, the wedge-shaped ribs and half-medallion (elements added later, as we shall see) narrow the width of the opening by 4 cm. (to 75.5 cm.) and the height by 2 cm. (to 37 cm.), making the model at that point smaller than the adjacent barrel vault of Sangallo's model. The width of the vault in the west arm of Sangallo's model measured just above the cornice next to the hemicycle vault, is 82 cm. ($32^1/_4$ in.). Its height is 41 cm. ($16^1/_8$ in.).

Figs. 27 and 28 illustrating the inserted vault model in its present state were drawn from measurements taken from it. In the following list of dimensions those in *palmi* were obtained by multiplying the dimension in centimetres by 30 (the scale of the model) and by 4.48, the conversion factor from centimetres to *palmi*. Scaled dimensions from Letarouilly (1882) and Ferrabosco (1620) are given for comparison. The most important differences between dimensions of comparable parts of the model are discussed in the text.

Ribs: The two central panelled ribs are at their base 3.1 in. wide (8.0 cm.; 10.7 *palmi*). In Letarouilly (pl. 7) the scaled dimension at the same location is 9.85 *palmi*; Ferrabosco indicates 10.1 *palmi* (pl. XIV) and 11.0 (pl. XI). The ribs taper to 1.8 in. (4.5 cm.; 6.0 *palmi*) at the half-medallion. The two plain ribs at the open end of the vault model are only 2.3 in. wide (5.8 cm.; 7.8 *palmi*) at their base and, at the half-medallion, one (south) is .9 in. (1.8 cm.; 2.4 *palmi*) and the other (north) 1.1 in. (2.8 cm.; 3.8 *palmi*).

Gores: The widths of the gores (distance between ribs) are at the base (right, middle, and left respectively) 12.2 in. (31.2 cm.; 41.8 *palmi*), 9.75 in. (25 cm.; 33.5 *palmi*), and 12.3 in. (31.5 cm.; 42.2 *palmi*). At the half-medallion the right and left gores both measure 2.5 in. (6.3 cm.; 8.4 *palmi*), while the central gore is only .12 in. (.3 cm.; .4 *palmi*) wide. The width of the base of the gores scales in Letarouilly (pl. 7) 43.8 *palmi* and Ferrabosco (pl. IX) 43.5 *palmi*.

The model is like the apse vaults of St. Peter's as built (Figs. 7, 8, 25 and 28) in obvious major respects. As in the building originally (Fig. 8), ribs with panels divide the whole into three gored vaults. The gores, containing trapezoids and *tondi*, rest upon segmental arches springing from small pilasters beside the ribs. Under the arches are the window walls and windows. And at the crown of the vault is the decorated half-medallion.

The vault model is clearly unlike the building in the following respects. At the open end of the vault it has two wedge-shaped ribs without panelling instead of the salient arch (Figs. 24 and 29). The gores of the vault in the model are shallow (Fig. 30) in comparison to the gores of the apse vaults in the building (Fig. 7). The small pilasters flanking the ribs and carrying the segmental arches under the gores are as high as the tops of the windows (Fig. 21), whereas in the building they are lowered to about two-thirds of the height of the windows. The representations to be considered later confirm that these differences belong to an early stage of Michelangelo's design.

There are also less noticeable differences from the existing vault. None of the windows is slotted at the corners, as the windows are in the building (Figs. 28, 30, 38 and 26).[4] The openings for the windows are approximately square (Figs. 28 and 34),[5] not horizontal rectangles (Fig. 26). The pediment over the central window is triangular instead of segmental, as constructed (Figs. 28, 11 and 31). Unlike the building, the model shows no cornices across the face of the ribs at the level of the capitals on the small flanking pilasters, though breaks in the paint (Fig. 30) suggest there may possibly have been cornices originally.[6]

In addition, an entire zone of wall is missing in the model below the windows (Figs. 28, 30 and 31). But this does not represent a difference from the building in design. It is the result of an adjustment to a discrepancy in the wooden model of Sangallo. The same zone is missing there. In St. Peter's itself the arches over the piers at the main crossing and the barrel vaults over the four arms radiating from the crossing spring from a height of about 2.05 metres (6 feet 7 inches) above the top of the main entablature (Fig. 32).[7] This stilted spring-point was established by Bramante when he built the arches of the crossing, and it was inevitably continued by Sangallo in the two arms he vaulted, east and south.[8] Salamanca's engraving of a section through Sangallo's St. Peter's (Fig. 4) shows the arches and barrel vaults correctly. But in Sangallo's model, built by Labacco, the arches under the dome and the barrel vaults of the arms spring from the top of the cornice (Fig. 33).[9]

Tondi: The dimensions of the *tondi* are as follows.
Model (left, center, and right respectively): Inside dimension: 5.0 in. (12.8 cm.; 17.2 *palmi*), 4.6 in. (11.8 cm.; 15.8 *palmi*), 4.8 in. (12.4 cm.; 16.6 *palmi*). Outside dimension: 6.4 in. (16.4 cm.; 22.0 *palmi*), 5.5 in. (14.2 cm.; 19.0 *palmi*), 6.2 in. (16.0 cm.; 21.4 *palmi*). *Letarouilly* (pl. 11), west apse: Inside dimension 14.7 *palmi*. Outside dimension 21.9 *palmi*. *Ferrabosco* (pl. IX), west apse: Inside dimension 12.0 *palmi*. Outside dimension 17.3 *palmi*.
Trapezoids: These are all equal in length, 2.4 in. (6.2 cm.; 8.3 *palmi*) inside, and 3.4 in. (8.7 cm.; 11.65 *palmi*) outside. On the right and left they are 1.6 in. wide at the top (4.0 cm.; 5.36 *palmi*) and 2.7 in. (7.0 cm.; 9.38 *palmi*) at lower edge. The central trapezoid is however only 1.0 in. (2.5 cm.; 3.35 *palmi*) at the top and 1.8 in. (4.5 cm.; 6.03 *palmi*) at the bottom. In Letarouilly (pl. 11) the length of the trapezoid (the width cannot be measured) is 13.4 *palmi* inside and 16.1 *palmi* outside. In Ferrabosco the same dimension scales 19.0 *palmi* and 24.5 *palmi* respectively.

4 Although only indicated in two dimensions, the horizontal slots in the top corners of the window and the vertical slots in the bottom corners are shown also in Ferrabosco (1620), pls. IX (Fig. 11), XXIV (Fig. 9), in the section by Dupérac (Fig. 5) and that by Letarouilly (1882), pl. 11.

5 See note 19 below for the dimensions. In contrast to the sills of the two side windows, the sill of the central window is bevelled downwards from the outside. Probably this was done when the model was modified (see note 19 and section in Fig. 28). For the modification of the vault model, see text below.

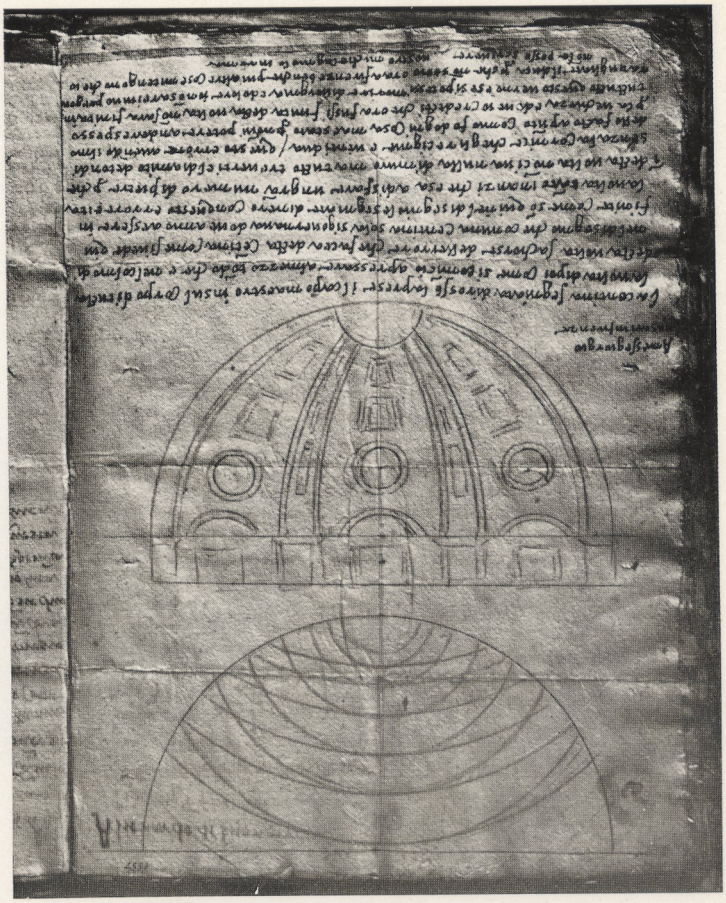
6 In the space between the single lower and upper three panels on the ribs of the vault model the paint is cracked and has lifted off the wood (Fig. 30). A horizontal moulding might possibly have been attached there at one time. Such a member would correspond to the cornice moulding at the top of the rib pedestal in all the representations in Ferrabosco (1620) and as seen in the building today (Fig. 26).

7 The distance from the top of the interior cornice to the top of the string course measured on the building at the windows varies from 1.97 to 2.11 metres (6 ft. 5 3/4 in. to 6 ft. 11 in.; 8.84 to 9.45 *palmi*).

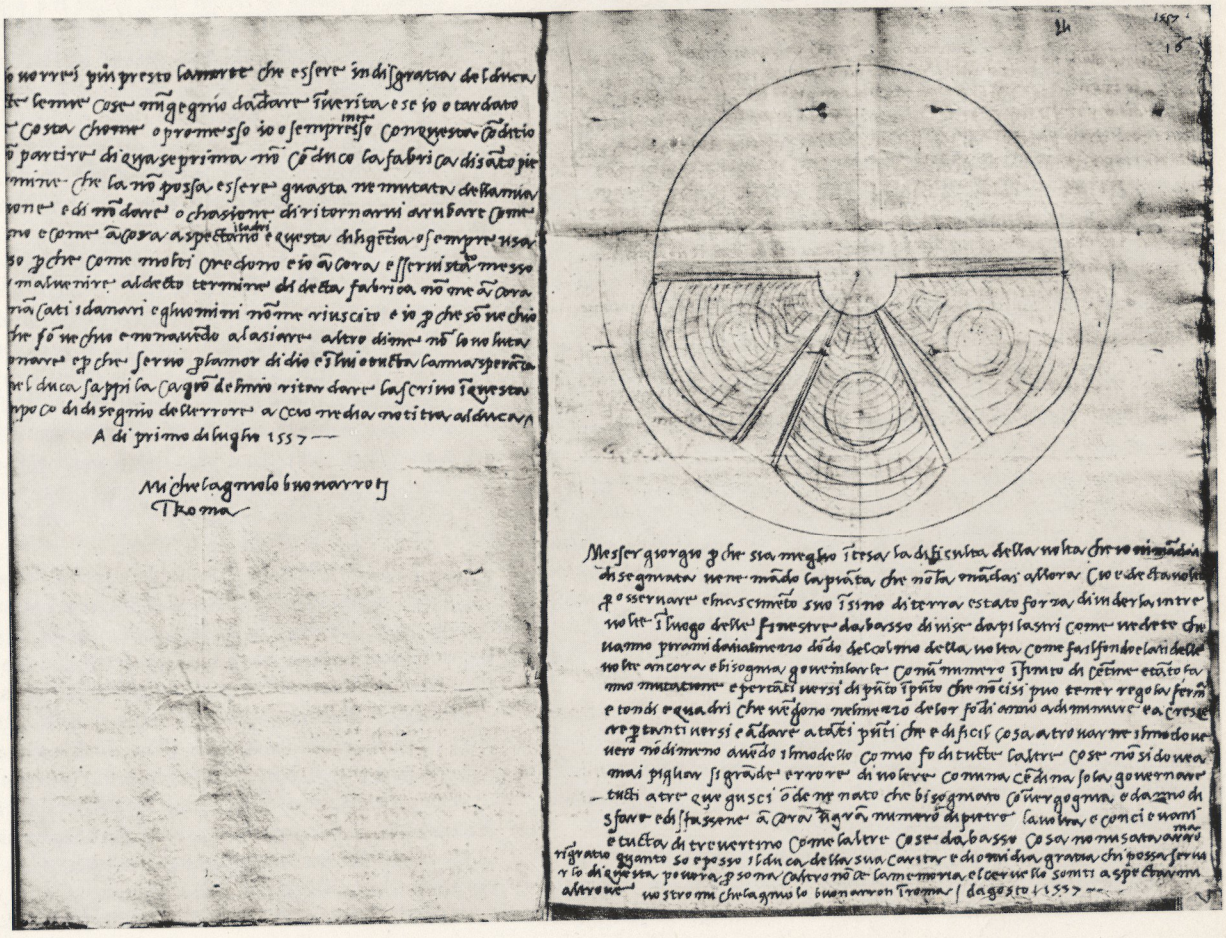
8 Bramante had followed an ancient precedent to insure that the full semicircular curve of the vault would be seen from below and not hidden by the projecting cornice of the main entablature.

9 In the section of Sangallo's St. Peter's engraved by Salamanca (Fig. 4) the vertical zone below the semicircle of the barrel vault is bare of coffering; it is present in the arms from the crossing through the salient arches, as in the building. Its dimension, therefore, is also included in the apse vaults of the engraving.
Nevertheless, in this engraving the windows of Sangallo's apse vaults are the same distance above the main cornice as they are in the model made for Sangallo by Labacco (Fig. 3), where the zone is missing; in both cases their sills are just above the cornice.
There are two possible explanations. It could be that Sangallo's model, though built without the vertical zone in the arms, was to indicate the actual relationship of windows to cornice in the apses. In this case, the engraving would be right. But it seems to us more likely that Sangallo's model and Salamanca's engraving both erred in showing the windows near the cornice. If not, the curve of the apse vault of Sangallo's model, a semidome, is wrong in respect to the vault in Salamanca's engraving, which is stilted. Moreover, one would expect the apse vaults to be semidomical as in the model, not stilted as in the engraving. The stilting in the latter is explainable as due to extra height in the vault thanks to misplacement of the windows and spring point. Moreover, with low windows the main cornice would have

22. *Letter of 1 July 1557 by Michelangelo to Vasari with sketches by Michelangelo of the south apse vault of St. Peter's (Casa Vasari, Arezzo)*



23. *Letter of 17 August 1557 by Michelangelo to Vasari with sketch by Michelangelo of the plan of the south apse vault of St. Peter's (Casa Vasari, Arezzo)*



To our knowledge, no one in modern times has noticed this anomaly. It is not obvious. But anyone making use of the vault areas of Sangallo's model in relation to vaults to be built on the building itself would sooner or later discover the discrepancy and have to allow for it.

Our vault model appears to have been made originally without knowledge of the discrepancy and to have contained the missing zone, since the bottom of the model shows traces of alteration.[10] In this case, at least 6.35 cm. ($2^1/_2$ inches) had to be removed from the base to make the model match the height of the vaults in the model of Sangallo when put into it. This brought the attic windows and the springing of the ribs down nearer the cornice and distorted the design. But it corrected the relationship of the upper, curved portions of the apse vault and the barrel vault to each other.

Even if built without knowledge of the condition of the vault in Sangallo's model, the new model was certainly made to be inserted in it.[11] It was made, as we said, at the same scale. It was painted the same light grey for wall and vault surfaces and yellow for the membering,[12] and the evidence appears inescapable that it had already been painted before it was placed in Sangallo's model.[13] Like the vaults of that model it was built to be viewed only from the in-

blocked much light. Finally, since Sangallo never built his apse above the first story, the building itself could not be consulted in preparing the engraving, and so a discrepancy in placing the windows of the model could have been taken over in the engraving the more easily.

However incorrect, the lack of the vertical zone in the model may have been intentional. John Coolidge, in a conversation in the fall of 1970, suggested to us that the omission of the vertical zone might be a subtlety which recognized that the height of a viewer's eye in the model would be well above the pavement level. In Coolidge's view, Sangallo may have realized that inclusion of the vertical zone in the model would give the vault a curious look from an elevated eye level. A case of simple error in the model, Coolidge felt, could easily have been corrected, since the missing portion is only a vertical surface and there is a joint in the model between vault and cornice.

10 There are two unpainted pieces of string course under the windows on the left and right sides of the inserted vault model (Fig. 34). These are separate pieces of wood extending from the barrel vault some little distance beyond the windows. The fact that they are unpainted, in contrast to the string course remaining under the central ribs and in the central bay probably indicates they were added after the model was first built. The most likely reason for such additions appears to be the mutilation of the vault model involved in removing the zone below the windows. (We shall find that most of the other scars resulting from changes to the inserted vault model have been touched up, but these two pieces remain unretouched probably because they are largely hidden from an observer's viewpoint below, by the cornice of the main entablature.) In addition, the paint along the bottom edge of the central section of the inserted vault model is chipped, suggesting again that the missing zone was originally present in the vault model and cut away.

11 Although the vault model is now inserted in the *west* apse of Sangallo's model, it could originally have been installed on the south, corresponding to the side of the building where Michelangelo's first apse vault was built. The space available for it in the south apse of Sangallo's model is the same. (The dimensions, in centimetres, at pavement level of all four apses of the Sangallo model, including the area of the salient arch, are, depth by width, 48.4×79.5 [south] and 48.3×81 [west]. The same dimensions in the other two apses are 49.0×79.5 [north] and 49.7×82.2 [east].) Sangallo's model has been dismantled, moved, and reassembled repeatedly. If the model of the vault was inserted on the south originally, it could have been moved to the west at a later date. Since Sangallo's model is entered from the north apse, it could well be that the insert was moved later in order to make an observer's initial view of the interior, toward the apse in the south, conform to Sangallo's intentions. (The observer's entrance on the north is made possible by hinges on both sides of the hemicycle at the juncture of hemicycle and arm. The hemicycle opens on axis, both sides swinging wide to reveal the full width of the arm.)

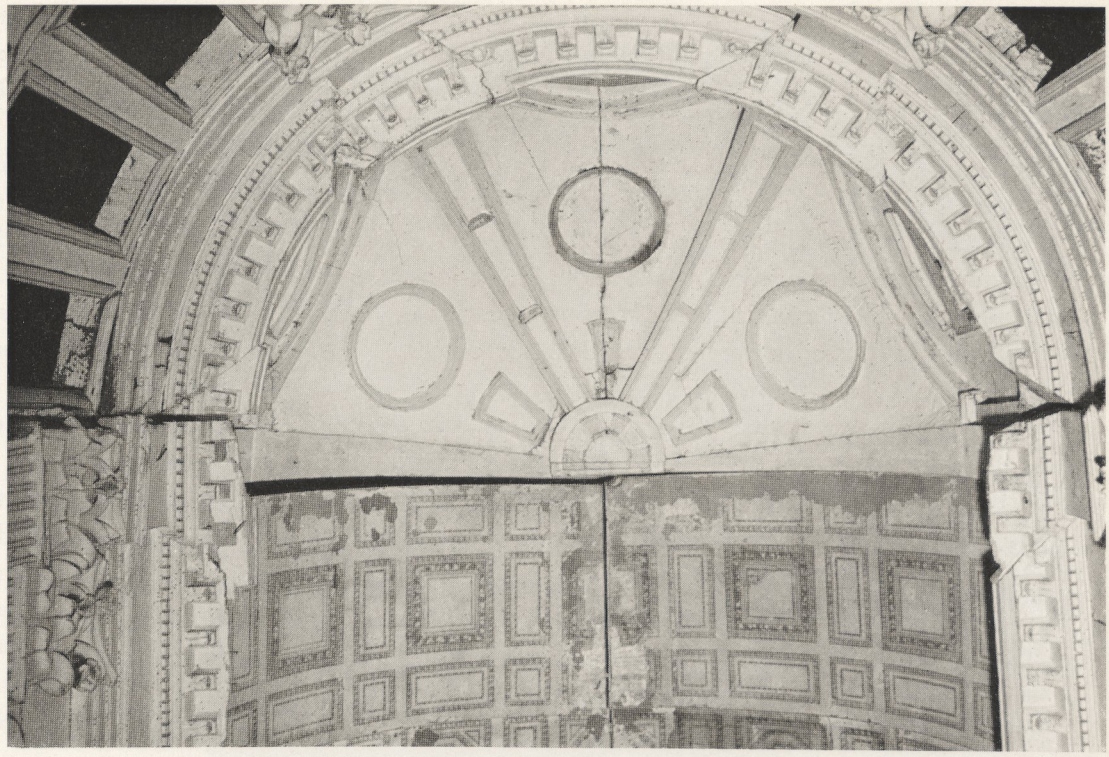
The hemicycle vault representing Sangallo's design on the south apse of the model today differs somewhat from those on the east and north. Whereas the latter are painted and made of pieces of wood of various sizes and shapes, with some of the joints now parted, the apse vault on the south is of unpainted smooth wood. Although shaped like the other two, it appears to be composed of carefully fitted and well-joined laminations of approximately equal width, and the surface appears to have been machined on a lathe. It looks of recent date, while the workmanship and condition of the east and north apse vaults point to their having been made at the same time as the rest of Sangallo's model.

(We should like to thank Professor Hellmut Hager and Padre Cipriano Cipriani, curator of the Archivio della Reverenda Fabbrica di San Pietro, for the measurements they made in August 1970 of the east, south, and west apses of Sangallo's model, supplementing those we had taken of the west apse and the vault model of Michelangelo.)

When we told Howard Saalman about the vault model, he construed it, without however having seen our text, to have been originally part of a Michelangelo model showing the attic. This supposition is most unlikely for the reasons cited below in the text – primarily the nature of the model-maker's mistake in the longitudinal dimension – but also because of lack of evidence of any attachment behind and above suggesting that the model could have once been part of a model showing the exterior of Michelangelo's building. (See now H. SAALMAN, "Michelangelo: S. Maria del Fiore and St. Peter's", *ArtBull* LVII [1975], 380 to 409.)

12 In Sangallo's model of St. Peter's, yellow is used for membering in cut stone, light grey for wall surfaces presumably in a different material (see Part 1). It is notable therefore that the builder of the inserted vault model followed the convention of the Sangallo model, differentiating members from surfaces by the colors, even though Michelangelo's apse vault would all be constructed of a single material, travertine. (The model-maker might have been directed to use Sangallo's colors to facilitate study of the vault design in relation to Sangallo's model, or have decided to do so on his own, or not have been aware that Michelangelo intended only one material to be used for the vault.)

13 Retouching after the various changes were made to the vault model, because of the model-maker's mistake described below,



24. Model of Michelangelo's apse vault. View from below (inserted in west apse of Sangallo model). Before 1557 (St. Peter's)

side – not from the outside. Only the outer edges of the top of Sangallo's model were meant to be seen; the rest of the top is unfinished. It is the same with the inserted vault model (Fig. 35). Finally, in the vault model's original state the dimensions of the apse vault included, in addition to the area of the hemicycle itself, the area of the salient arch. Thereby the vault model matched the other hemicycle vaults in Sangallo's model in a notably eccentric way.

The apse vaults of Sangallo's model of St. Peter's (made up of blocks of wood of various sizes) were each built to be one section, separate from the barrel vaults they abut (Fig. 3). Each apse-vault section included, besides the area of the hemicycle vault itself, the dimension of the salient arch between the hemicycle vault and the barrel vault – *without*, however, showing the salient form of the arch itself, pictured in Salamanca's engraving of Sangallo's design (Fig. 4).[14] (Also not shown on the apse vaults of Sangallo's model are the ribs seen in Salamanca's representation.[15]) Each apse-vault section was thus deeper than a semicircle by the width of the salient arch – as was the space into which it fitted in the model (since, by the same token, the dimension of the salient arch was not included in the portion representing the barrel vault).

The telling fact is that as the inserted model was originally built the central ribs, gores, and medallion extended into the area of the salient arch. As we shall find shortly, the model-maker evidently built the model first without either the salient arch or the wedge-shaped ribs at the vault's open end or a provision for them, but only with the three gores and two central ribs of the hemicycle vault (Figs. 36 and 37). The area occupied by the gores and two central ribs should have been semicircular in plan, with the gores equal in size, like the finished apse vaults of St. Peter's. Instead, even without salient arch or wedge-shaped ribs the inserted vault model filled almost entirely the *extended* semicircular space available in the model of Sangallo, the increase in depth being absorbed in such a way as to make the gores

indicates that it had been painted prior to the changes. The mistake that necessitated the changes would have been discovered as soon as the vault model was placed in Sangallo's model, if not before. It is most unlikely that the model would first have been painted only after discovery of the error, since great changes in the model were needed to make it useful. Hence there is every reason to believe it was painted before insertion, not inserted first in an unpainted state. See also note 20.

14 In the Salamanca section (Fig. 4) the salient arch is treated both as an arch, *i.e.*, marked by its coffering, and as a portion of the hemicycle vault, *i.e.*, continuous with the hemicycle vault at the crown.

15 In Sangallo's model the coffering of the barrel vaults is drawn with brown ink on paper pasted to the surface of the wood (Fig. 3). That the surface articulation of the salient arches may once have been shown in this way is indicated by a fragment of paper, hanging down at left in Figure 3. There are no remains indicating ribs.

appear to form a semicircle.[16] The model-maker had made an error, and this was in all likelihood because he thought the dimension available for the vault model in the model of Sangallo was for the hemicycle vault alone, though it was not.[17]

That the model of Michelangelo's apse vault was made to be inserted in the model of Sangallo must have been in order to study the design of the new apse vault in relation to Sangallo's barrel vault, which it had to abut. This relation could not have been observed as well in any other model available, to our knowledge, when Michelangelo came to design the apse vaults. The new design could be studied there at a suitably large scale in the context of the whole existing arm of St. Peter's, which was to remain even though Michelangelo changed the design of the two upper levels of the apse.[18]

From its present state we can tell what alterations were made in the inserted model of the vault to correct the model-maker's mistake and can thereby reconstruct its original form (Figs. 36 and 37).

There is a split down the middle of the inserted model which can be seen on both the inside and outside (Figs. 25 and 35), and the central bay of the model is obviously narrower than the other two (Figs. 24 and 27). Missing from the central bay is a wedge-shaped section about 6 cm. ($2^3/_8$ inches) wide at the bottom and tapering to almost nothing at the crown. When it was taken out, the remaining two parts were rotated to close the gap. The central window thereby lost 6 cm. and had to be widened to compensate for the loss.[19] The central *tondo* lost a portion of its middle. To make the *tondo* round again, the original moulding was removed and a new moulding put in its place. The scars were repainted, but the traces of the original *tondo* can be seen (Fig. 30).[20] Below the *tondo*, the pediment over the window must also have been removed; a new unpainted pediment replaces it.[21] But neither the loss to the segmental

16 The dimension to be filled was about 48 to 49 cm. As we shall observe below, in making the vault model originally the model-maker added to the semicircle about 4.5 cm., resulting in a depth of 45.5 cm., by extending the semicircle as it passed the diameter, making it parallel thereafter to the barrel vault. (He apparently intended fudging the remaining 2.5 cm.) The adjustments involved were small and virtually unnoticeable (see Figs. 36 and 37).

17 In conversation in 1973 Graf Metternich suggested that the inserted vault model might have been made by using one of the pre-existing semidomes of Sangallo's model. It seems unlikely for the following reasons:

1) Semidomes in the Sangallo model are about 48–49 cm. in depth and not the c. 45.5 cm. of the inserted vault model in its original state.

2) In the semidomes of Sangallo's model the three windows and arches above them are centered above the windows of the main order below. In the inserted vault model, as we shall observe in the text, the side windows and segmental arches above them did not in their original state correspond vertically to the windows below.

3) The exterior surface of the inserted vault model (Fig. 35), made of irregular shaped blocks roughly hewn, is more crudely fashioned than the upper surfaces of the original hemicycle vaults in Sangallo's model.

4) Irregularly shaped pieces of wood make up the inserted vault model. Under the segmental arch they do not seem to be those that would have been required to fill in the arches and windows of the Sangallo model.

(It is worth noting, however, that the peculiar symmetry as to the shape of the pieces of wood making up both the left and right windows of the inserted model may indicate Michelangelo experimented at one period with larger openings. On the other hand, the piecing could result from the procedure adopted for framing the opening when the model was initially built.)

18 In the interior of the arms of St. Peter's, Sangallo's model showed, except in the case of hemicycles, what had already been constructed on the east and south (see Part 1) and showed it in detail at a large scale. To our knowledge, it was unique in its scale among the models of St. Peter's available. The evidence appears to be clear that Michelangelo's own models of St. Peter's showing apses were much smaller, the principal one, Model II, having been made at a scale of about 1:96 in our view, as against Sangallo's 1:30, and possibly not including vaults on the interior (see Appendix II).

19 A thin piece of wood has been added to the left jamb of the central window to narrow it slightly, doubtless after the alteration. The dimensions (height by width) of the openings of the three windows are now (from south-left to north-right) as follows: 16.5×16.9 *palmi* (12.3 × 12.6 cm.); 16.6×16.6 *palmi* (12.4 cm. square); 17.3×17.0 *palmi* (12.9 × 12.7 cm.). One window is square, one higher than wide, and one wider than high.

At the bottom of the center window the string course was removed and replaced by a new sill sloping down from the outside to the inside, meeting the top of the main cornice at the plane of the inside of the window.

For comparison, the windows in the building also vary in size, but are always wider than high. The inside dimensions of the interior attic windows (height × width) in *palmi* on the three apses from south to north are as follows:

southeast	south	southwest
15.2×16.6	15.6×17.4	15.2×16.3
southwest	west	northwest
15.2×16.8	15.1×16.9	15.0×16.8
northwest	north	northeast
15.2×16.6	15.2×18.2	15.2×17.4

20 On the area of the vesica-shaped scars surviving from the original *tondo* of the central gore the quality of the paint is different from that of paint elsewhere (the surface was roughly chiselled and thickly painted). The paint of the wedge-shaped ribs at the open end of the vault, which we shall find could not have been present in the model originally, is also different (was it applied without primer?). These differences indicate that only retouching followed the changes in the model, not the original painting itself (see note 13 above).

21 The unpainted pediment is fastened by a pair of metal studs, unlike the two pediments over the other windows. Also unpainted

25. *Model of Michelangelo's apse vault. View from below (inserted in west apse of Sangallo model). Before 1557 (St. Peter's)*

26. *St. Peter's, south apse vault (south and south-west windows)*

arch under the central gore nor the loss to the trapezoid at the top was corrected. In the half-medallion the central pair of consoles abutting the ribs had to be shifted to maintain their alignment with the ribs in their new positions.

Narrow wedge-shaped slivers were also cut off where the model joined Sangallo's barrel vault: parts of the two outer gores and little pilasters were removed. Hence both of the outer gores are slightly assymetrical, the *tondi* are no longer in the middle of these gores, and the little pilasters nearest the open end of the vault are narrower than all the others (Fig. 27).

When the missing dimensions are replaced, the original state of the model becomes evident (Figs. 36 and 37). In the inserted model as it is today (Fig. 27) the dimension from a plane at the edge toward the barrel vault to a plane of the base of the inside of the central window is c. 47.5 cm. This same dimension would be about 45.5 cm. if the section removed from the central gore and the slivers cut from the outer gores were replaced and the present wedge-shaped ribs at the vault's open end discarded (Fig. 36) together with the rectangular piece that now extends the half-medallion to meet them (Fig. 24). In the Sangallo model the space left for the combined areas of apse vault (c. 39.5 to 41 cm.) and salient arch (c. 8.8 cm.) varies from about 48 to 49.5 cm. The model-maker had added to the semicircle of the apse vault about 4.5 cm., resulting in the depth of about 45.5 cm., and had extended the semicircle as it passed the diameter, making it parallel thereafter to the barrel vault. Though about 2.5 cm. of space remained, the insertion of either wedge-shaped ribs or salient arch at the open end would have displaced the apse vault to a position beyond the wall below. We thus conclude that originally there could not have been in the model either wedge-shaped ribs or salient arch to divide the hemicycle from the barrel vault.

As for wedge-shaped ribs at the open end of the vault, besides not including them originally, the inserted model did not presuppose them. In the model as originally built the outer edges of the gores at the open end of the vault, when projected in plan, formed a straight line perpendicular to the axis of the transept.[22] The straight line testifies that, when the model was first made, it was not in Michelangelo's mind to have wedge-shaped ribs to mark the transition between the apse vault and barrel vault.[23]

It is impossible, however, that Michelangelo intended no transitional element. The salient arch planned by Sangallo and seen in the building today follows, of course, a straight line perpendicular to the axis of the arm. Michelangelo could only have expected to include such a salient member in the phase of the design represented by the model's first state. Without it, not merely would transition between apse vault and barrel vault have been lacking, but the model could not have corresponded vertically with the membering below.

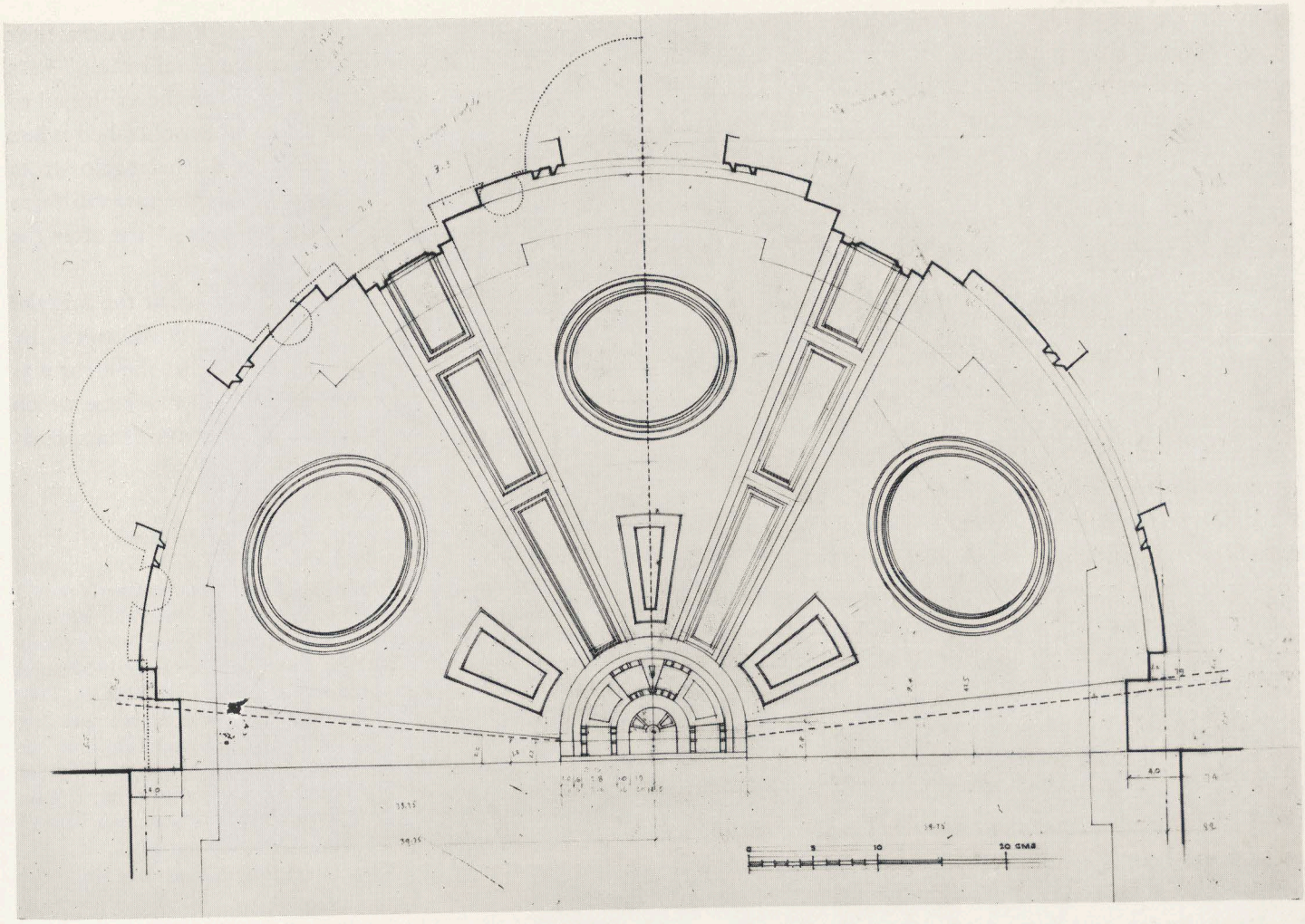
The giant salient pilasters between apse and arm and the wall strips next to them, integral to Michelangelo's design of the apse (Fig. 9), required continuation above by members of corresponding width (Figs. 9 and 38) – wide members over the two salient pilasters, narrow ones over the wall strips. But in its reconstructed original state (Figs. 36 and 37) the vault model had only a single vertical element at either side adjacent to the arm, and this was the small narrow pilaster (supporting the segmental arch under the gore) which stood over the much wider salient pilaster below. Vertical correspondence was lost practically everywhere else as well: only the elements exactly on axis in the central bay – window, *tondo*, trapezoid – corresponded vertically with the elements below. This was because the gores of the inserted model were wider than they should be, filling the area that the salient membering would have occupied. Thanks to the wider gores, the two ribs of the vault right and left of the central bay were displaced. The two side windows were not over the windows below them. All related elements were similarly displaced. Again the evidence is that the original arrangement of the model can only have been due to a mistake.

The mistake, incidentally, adds indications for dating. So gross an error is only likely to have been made before construction of the vault on the building began. Also, the subsequent changes involving, as we shall now observe, the introduction of wedge-shaped ribs into the design to

are the frame of the new *tondo* and much of the moulding around all three of the windows. The center unpainted *tondo* frame, added after the alteration, is narrower than the other two. Its dimensions in *palmi* would be: inside 15.8, outside 19.0. In *palmi* the *tondi* frames on the left and right would measure as follows: (left) inside 17.2, outside 21.9 – (right) inside 16.6, outside 21.4.

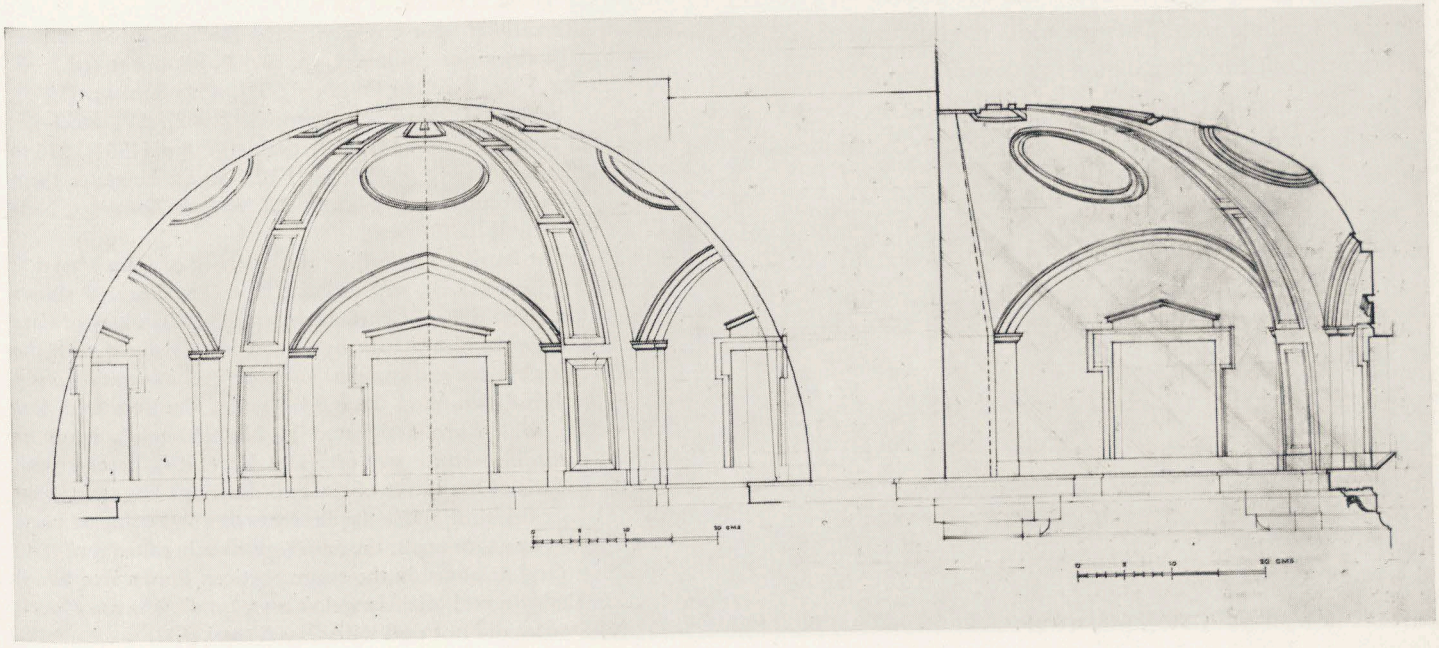
22 In the reconstructed plan (Fig. 36) there is a slight angular difference between the two sides. Probably this is due to our assumption in drawing this reconstruction that the two small pilasters from which the slivers were cut were both originally the same width as three of the four untouched small pilasters, *i.e.*, 2.8 cm. This need not have been the case. One of the four little pilasters measures 3.2 cm., and there could have been a small variation in the widths of the two altered pilasters.

23 There is no reason not to assume that the outer consoles in the half-medallion of the inserted vault model were present originally. To be sure, they are extended onto the rectangular piece that meets the wedge-shaped ribs (Fig. 24), but in the building today they are present in the half-medallion without wedge-shaped ribs at the vault's open end (Fig. 29).



27. Model of Michelangelo's apse vault in present state, plan

28. Model of Michelangelo's apse vault in present state, elevation and section



make the transition between apse vault and barrel vault, would have been worth considering only prior to construction. We know the work of building the apse vault began either in the second half of 1556 or early 1557.[24] Thus neither state of the model could be later than early 1557.

The alterations made to the model all contributed to correcting the error. For the model to serve its purpose, it had to be changed, as we can now see, both in order to include a salient transition between the apse vault and barrel vault and in order to bring the membering of the apse vault over the corresponding members below.

The simple slicing of about 8.6 cm. off the open end of the model to make room for a salient arch would not have been satisfactory. It would have sacrificed most of the half-medallion and parts of two gores, leaving the model an incomplete fragment, and it would not have brought about correspondence between the membering in the vault and the membering in the elevation. In fact, there was no way at all of making room to incorporate a salient arch such as Sangallo envisioned without spoiling the model.

But when salient wedge-shaped ribs were introduced as the transition between the apse vault and barrel vault instead of a salient arch, a change in the model was effected that put the membering of the vault over the corresponding membering below. All that was needed was the removal of a wedge-shaped section or sections, accomplished, as we observed, by taking a large wedge from the central gore and narrow slivers from the side gores.

Hence it appears not only possible but probable that it was when Michelangelo saw the vault model in place, lacking a salient arch and correspondence with the membering below that he thought of trying the wedge-shaped ribs instead of a salient arch. They would have been suggested as an element of the design by the impossibility of introducing Sangallo's salient arch without sacrificing the model and by the relative ease of adapting the model to salient wedge shapes while achieving vertical correspondence.

Having tried the wedge-shaped ribs in the model, Michelangelo originally decided to keep them, according to the testimony of his illustration in the letter he wrote Vasari on 1 July 1557 (Fig. 22).

Michelangelo began to build the vault on the south hemicycle in late 1556 or early 1557, and at the end of April 1557 the flaw in the construction came to light. It was due to an error of the foreman in making the curvature of the centering. By Michelangelo's own account the mistake was first realized as construction of the vault "began to draw near the half-medallion that is in the crown of said vault."[25] As a result, completion was delayed because the vault had to be dismantled. The dismantling was still not finished as late as 17 August, according to the letter Michelangelo wrote to Vasari on that date. The rebuilding of the apse vault was completed only in early June 1558, over a year after the discovery of the error.

Michelangelo's two letters to Vasari about the mistake – dated 1 July and 17 August 1557, both illustrated by drawings (Figs. 22 and 23) – explained that the error was due to the foreman's misunderstanding of the shape which the curvature of the centering should have.[26] The explana-

24 See Millon/Smyth (1969), 484, note 2.

25 For the translation of the full text, see note 29 below.

26 The two letters are in Arezzo, Casa Vasari, Archivio Vasariano, Codex 12 (46). The letter of 1 July 1557 (hereafter Casa Vasari I) is folio 22 *verso* (alternative pagination 14 *verso*), the letter of 17 August 1557 (hereafter Casa Vasari II) is folio 24 *recto* (alternative pagination 16 *recto*). For the texts see respectively Milanesi (1875), 546, no. CDLXXXIII and 547, no. CDLXXXIV; Frey (1923), 481, no. CCLIV and 484, no. CCLV with accompanying illustrations; also Barocchi (1962), IV, 1693 and 1694. For our translation of the letters see note 29 below. The drawings of Casa Vasari I are catalogued in Dussler (1959), 49, no. 1 (Casa Vasari II is omitted). For large illustrations of both Casa Vasari I and II, see Portoghesi/Zevi (1964), pls. 520 and 521.
The drawings of Casa Vasari I are upside down relative to the text.
Vasari was the first to comment on the authorship of the drawings in Casa Vasari I and II (Vasari-Milanesi, VII, 247). He specifically stated that Michelangelo "sent drawings by his hand" in the first letter ("Michelangelo, come amico e confidente del Vasari, gli mandò di sua mano disegni, con queste parole scritte e piè di dua: 'La centina segnata di rosso ...'."), and "drew the plan" in the second ("E seguitando nell'altro disegno, dove egli aveva disegnato la pianta...").
Most later authors have not questioned Michelangelo's authorship of the drawings (Milanesi, *op. cit.*; P. Pecchiai (ed.): *G. Vasari, Le Vite...*, Milan [1929–30], III, 459; Schiavo [1949], fig. 119; Schiavo [1953], 213; Barocchi [1962], IV, 1693–95; Ramsden [1963], II, nos. 437, 438; Barbieri/Puppi [1964], 916 to 917; Ackerman [1964], 96, 101, and 103, where he states them to be by Michelangelo; F. Hartt, *Michelangelo Drawings*, New York [1970?], 352).
On the other hand, while calling the drawing of Casa Vasari II *eigenhändig*, Frey (1923), 483 claimed that Casa Vasari I shows two hands. He said that Michelangelo had both drawings of Casa Vasari I drawn in black chalk by one of his assistants with the help of straight edge and compass and then in the lower drawing added with his own hand the red lines (*i.e.*, the lines with less curvature), which are designated in Michelangelo's letter as showing the incorrect curvature. Dussler (1959) agreed with Frey's analysis of the lower of the two drawings but stated that in the upper drawing, while the straight edge and compass parts were drawn by an assistant, the *tondi* (mistakenly called *oculi*) and windows (and presumably the other portions drawn free hand) "unmistakably reveal Michelangelo's own hand". (As mentioned above, Dussler did not deal with Casa Vasari II.)

29. St. Peter's, south apse vault from below

30. Model of Michelangelo's apse vault (inserted in west apse of Sangallo model), central window. Before 1557 (St. Peter's)

tion presents a difficulty of interpretation. To know precisely what the foreman's mistake was is not essential for the purpose of considering the stages of Michelangelo's design, but it will be helpful in understanding an important element of the design, and necessary later, in Part 3, in identifying the subject of one of Michelangelo's drawings.

Michelangelo's explanation has been taken to mean that the foreman failed to provide for separate gores over the three windows and instead laid "his boards in concentric arcs over the entire span."[27] Given the existence of the model of the vault for the foreman's guidance cited by Michelangelo in both letters – probably a later model than ours, as we shall observe presently – a misunderstanding so great as failure to realize that the vault was to have gores would be unlikely. There appear to be two principal reasons this interpretation has been advanced. The lower of the two drawings in the first letter (Fig. 22) illustrates the correct and incorrect centering within an arc, as if to refer to its curvature over the whole span of the vault. (The upper drawing, to which we will turn shortly, simply pictures the vault, not the problem of curvature specifically.) Meanwhile, in the text of his letters Michelangelo used the same term, *la volta*, to refer both to the whole apse vault and to its individual gores – as the second letter, particularly its second sentence, explicitly shows. As a result the first letter permits two readings, lending itself readily to one in which the curvature in question appears to pertain to the whole span.[28] But the explanation of the *nature* of the error given in the first letter and its lower drawing, and again in the second letter and its drawing (Fig. 23), can only apply to the curvature of the single gores, not to the whole vault, despite the shape of the lower drawing in the first letter, showing the curvature of the centering.

The drawing of the curvature of the centering (Fig. 22) is an elevation, not a plan. It shows the incorrect curvature, the letter says, with red lines (those of less curvature), the correct curvature with black lines (those of more curvature). The red lines are all drawn with equal radii but from different centers on the vertical line, resulting in a surface that always has the same curvature instead of a changing one. The black lines, showing the centering as it should be, are drawn with different radii from the same center at the top of the semicircle, resulting in a curvature that constantly increases as the crown of the vault is approached. This changing curvature, far from having anything to do with the whole span of Michelangelo's vault, coincides with the curvature of its individual gores as built (Fig. 7) and as illustrated in Michelangelo's second letter (Fig. 23). Indeed, the second letter, where the curvature in question is made clear, sounds as if prompted by Vasari's having found the first drawing and description difficult to grasp.

The two curvatures of the earlier drawing (Fig. 22) can be pictured properly by superimposing the central pair of ribs from the drawing above on the lower drawing. The portion of the red and black lines between the ribs gives the two different curvatures at various heights of one gore. The difference between the incorrect and correct curvatures becomes substantial and more apparent as the construction begins "to draw near the half-medallion that is in the crown of said vault", where the smaller radius of the correct vaulting produces a sharply increased curvature. This is why the mistake was discovered only as construction approached the half-medallion.[29]

The upper drawing of the first letter pictures the whole vault (Fig. 22). It is also an elevation, but not a true one. It is flattened, to show the three gores of the vault roughly

There is little stylistic variation among the three drawings. Within individual drawings there are the obvious differences between mechanically and freely drawn lines, noticed by Frey and Dussler, but these differences seem to us best understood as due to the use of instruments. In the upper drawing of Casa Vasari I particularly, it is the mechanically drawn lines that convey the intent of the drawing. We see no reason to disagree with Vasari's contemporary view and consider all three drawings likely to have been done by Michelangelo himself.

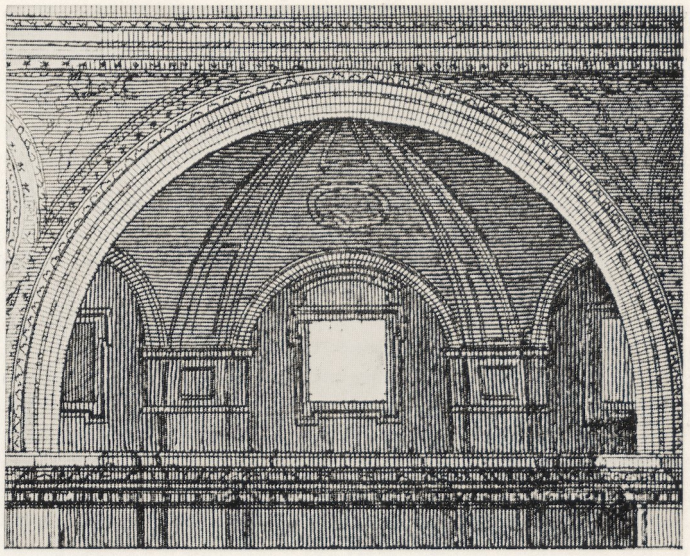
It seems clear in any event that Michelangelo had the drawings under his eyes when he wrote the letters. Frey (1923), 483 observed that the text of Casa Vasari I was "crammed into the remaining space" after the drawings were done and that Michelangelo's writing is smaller than usual. This coincides with our view. When Casa Vasari I is rotated for reading, it is clear the address was placed above the text in space left free by the drawing. The first line of the text starts high on the left. While writing, Michelangelo dipped the line so that it would clear the drawing. In Casa Vasari II the first line of text also dips slightly to clear the drawing. The drawings in both Casa Vasari I and II were laid out on a vertical center line extending well into the area of the writing, which suggests again that the drawings preceded the text. In addition, both letters refer to the drawings as if they were visible, so that, even if one supposed the drawings were done after the text, one would need to postulate a previously prepared sketch made for copying later on the letter.

27 Ackerman (1964), 96. For the same view see also Tolnay (1965), 250. So far as we know, the technical aspect of Michelangelo's explanation has not been considered elsewhere.

28 Ackerman's interpretation may have stemmed in part also from Michelangelo's phrase in his letter of 17 August 1557 concerning the vault: "One should never presume so large an error as to wish to shape all three of those gores with only one centering." As will become evident, this must mean "to shape each of those three gores with one curvature only." (See the translation of the second letter in the following note.)

29 The pertinent portions of the two letters are then, in our translation, as follows. The letter of 1 July 1557:

equal in width.[30] The half-medallion at the crown is drawn flat, showing its junction with the two central ribs *and also* with two *outer* ribs. The striking fact is that, besides the two central ribs, the drawing shows at the vault's open end



31. St. Peter's, transverse section (north apse). Ferrabosco [1620], pl. XIV (detail)

the two wedge-shaped ribs which we have encountered in the vault model as revised. The drawing thus testifies that when Michelangelo wrote this letter he was thinking in terms of the outer wedge-shaped ribs. It offers confirming evidence that the revision of the model was indeed Michelangelo's and that the model represents considered stages in the evolution of the vault design.

As in the lower drawing, all the elements that were necessary to illustrate the text or were mentioned there are drawn with compass and straight edge: the gores, rising between ribs;[31] the half-medallion at the crown; the segmental arches below (to convey the curvature and base of the gores); and the *tondi*[32] (giving the scale of the elements, since the letter mentions their size). The remaining elements

"The *capo maestro* took the curvature of the centering marked in red for the body of the whole vault [*i.e.*, gore]. Then as it began to draw near the half-medallion that is in the crown of said vault, he became aware of the error that the said curvature was causing, as one sees here in the drawing, because it [*i.e.*, the gore] was being shaped with one curvature only, where they have to be infinite, as the marks in black are here in the drawing. The vault had gone so far with this error that a great number of stones have to be dismantled, because no rough masonry fill [*muro*] goes into said vault, but it is all travertine. And the diameter of the *tondi*, without the cornice that encircles them, is 22. This error, though I had the model made for the purpose, as I do of everything. But it happened through my not being able to go there often, owing to old age. And where I thought that the whole vault would now be finished, it will not be finished in the whole winter. And if one could die of shame and grief, I should not be alive."
For an alternative translation, see Ramsden (1963), II, 178, no. 437.
Michelangelo was evidently inaccurate in saying that the diameter of the *tondi* is 22 "without" the cornice around them. He would have been approximately correct if he had said "with", in which case the measurement would correspond with the dimension in the vault model and possibly with that in the building, though we lack on-site measurements and the available representations do not agree (see note 3).
The letter of 17 August 1557:
"So that the difficulty of the vault, which I sent you in a drawing, may be better understood, I send you the plan of it because I did not send it then, namely [of] said vault, in order to [let you] observe its beginning from the ground [*i.e.*, from its spring point]. It was necessary to divide it [*i.e.*, the whole vault] into three vaults [*i.e.*, gores] in place of the windows below [*i.e.*, above the windows below, as explained in note 32], divided by pilasters [*i.e.*, ribs], as you see, which go pyramidally to the half-medallion of the crown of the vault, as makes [*i.e.*, so as to make] the depth and sides of the vaults [*i.e.*, gores]. Further, it is necessary to shape them with an infinite number of curvatures; and so much do they change and through so many directions from point to point that one cannot hold there to a firm rule. And the *tondi* and frames that go in the center of their depths have to diminish and increase through so many directions and go to so many points that it is a difficult thing to find the correct method for them. Nevertheless, having the model, as I make of all the other things, one should never seize upon [*i.e.*, fall into] so large an error as to wish to shape all three of those gores [*i.e.*, each of those three gores] with one curvature only. Whence it comes that it is necessary – with shame and loss – to undo and demolish still a large number of stone blocks. The vault, both the dressed stone and spaces [*i.e.*, surfaces of gores and walls], is all of travertine like the other things below, something not done in Rome."
(Having through most of the letter used the term *volta* for the gores as well as for the whole vault, Michelangelo finally turned to the specific term *gusci* for the gores in his last reference to them, in the third sentence from the end.)

30 The center gore is only about 23% wider than the two side gores, whereas in a true elevation the center gore would be about 60% wider than the other two.

31 The surfaces of the central and outside ribs contain mechanically drawn lines that run from the half-medallion to the base defining the outer edge of the panels on the face of the rib. Inside these lines the interior borders of three rectangular panels are sketched.

32 The central *tondo*, about 50% of the width of the gore, is close to the relative size of the *tondi* on the building which fill about 62% of the width of the gore at their level.
Ackerman (1964), 103–104 and (1970), 335 thought that the *tondi* of this drawing of July 1557 were meant to represent windows, constituting a second order of windows above the rectangular ones. He based this assumption (1) on Vasari's account of a conference in 1551 (Vasari-Milanesi, VII, 232) apparently reporting Michelangelo as saying that above the windows in the vault were to go three others and (2) on his belief that Michelangelo's words "le finestre da basso" in the second letter of 1557 to Vasari refer to the rectangular windows at the vault level and should be translated as the "lower windows", thus implying there were windows above them, which could only be the *tondi*.

were drawn free-hand and unassertively, the least assertive being the windows and the bases of the ribs. Both are small and sketchily done, and their inclusion looks like an afterthought.[33] These elements, indeed all the elements between the ribs, are placed too low. The windows are below the diameter of the semicircle instead of above; the segmental arches and *tondi* are correspondingly low.[34] This explains an inconsistency of the drawing. There is room for an extra trapezoid in each gore: the additional element fills the space left at the top by the misplacement.

The misplacement and added trapezoids are not of consequence in respect to Michelangelo's principal intent to show the gores of the hemicycle vault, the ribs supporting

Michelangelo's second letter was not written to explain the upper drawing of the first letter (Fig. 22), but to accompany a new drawing (Fig. 23). It explains how the whole vault was divided into three parts by ribs and says the three parts corresponded to the placing of the windows below. In the context the words "le finestre da basso" mean the windows below the vault area. No relation to other windows seems implied, and in any case, as we read it, the windows referred to are those of the main order. Thus there seems no implication here that the *tondi* were meant to be windows. Moreover, in the same letter Michelangelo refers to the *tondi* as *tondi*, not as windows. When Michelangelo rebuilt the vault shortly after writing the letter, the *tondi* certainly were not windows. And the *tondi* are not windows in the wooden vault model, which must be at least as early as the beginning of 1557 and thus antedates the letters and drawings.

As for Vasari's account of the conference of 1551, its meaning concerning the placement of the windows depends on the inflection given in reading his quotation of Michelangelo's statement (Vasari-Milanesi, VII, 232). It can be read with a pause between the words *finestre* and *nella*, thus: "Monsignor, above these windows [pause] in the vault, which has to be made of travertine, go three others." In this case no extra windows in the vault need be postulated, since the words "these windows" refer readily to those of the second story and the "three others" to the windows of the vault area as built. (We are tempted to say that if Michelangelo spoke the way he wrote, his words were often unpunctuated!)

If not read this way, there is still no assurance that the reading without a pause would represent a correct report. We know that Vasari was quite inaccurate about the height the walls of the apse had reached in 1551, the year of the conference (see Millon/Smyth [1969], 497, note 54).

If we were to assume Vasari indeed accurate in reporting Michelangelo as saying in 1551 that above the windows in the vault there would be three others, these higher windows could certainly only have been envisaged where the *tondi* are. But it is clear from a section of St. Peter's (Fig. 9) that in this case they would have had to open through the vault, as Sangallo's do in Salamanca's engraving (Fig. 4), *not* through the attic order of the exterior elevation. They would not have resulted in fenestration at two levels in the attic on the exterior, as Ackerman assumed (1964), 104. Hence they would not have changed the design of the exterior elevation of St. Peter's. Michelangelo could decide whether to have them or not in relation simply to the interior design. But if he did ever seriously entertain the idea of a second order of windows in the vault, he had certainly left it behind when he had our wooden vault model built, in 1556 or early 1557 at the latest.

Vasari seems to have used the subject of the windows to demonstrate the disdain with which Michelangelo handled the Cardinal Deputies. According to the story, they had complained to the Pope that there would be insufficient light in the building. When, in the presence of the Pope, Michelangelo explained about the windows in the vault, the Deputies said, "You never told us that". The words seem to imply, not only that Michelangelo had not mentioned to them the windows at the upper level, but that the Deputies had not looked at, or were unable to look at, Michelangelo's model.

Ackerman argues that the Deputies would have seen Michelangelo's Model II, that they would thus have known of windows in the attic (in the model as depicted by Passignano [Ackerman (1961), pl. 58a] there are arched windows at the attic level on one of the corner chapels) and that therefore Michelangelo must have been referring to additional windows. But other interpretations are possible. The Deputies might have seen Michelangelo's Model II when it was first made and approved, in 1547, and not again. In this case they might have forgotten, more than three years later, the attic windows on the exterior. None of them were architects. Or possibly the attic level of the building was not included in Model II as first built in 1547, but added only later as construction of the building began to reach that level. (For this possibility, suggested by Howard Saalman and in part also by Christof Thoenes, see our Appendix II concerning Michelangelo's Model II.)

Vasari's account of the 1551 controversy does appear to illustrate what a closed shop Michelangelo ran and the difficulty the Deputies had in knowing what was going on in the building while it was under his direction. But in our view Michelangelo never intended any windows other than those now at the vault level and in 1551 was merely citing windows planned from the beginning.

Just before this paper was completed Howard Saalman very kindly gave us a draft of a paper in which he also reaches the conclusion that the *tondi* could not have been windows. (See now H. Saalman, "Michelangelo: S. Maria del Fiore and St. Peter's", *ArtBull* LVII [1975], 396.)

33 If the width of the hemicycle is used to determine the scale of the drawing (the width of the arm is 104 *palmi* according to Ferrabosco [1620], pl. VIII, not including the salient pilasters), the windows were drawn only 8 *palmi* high by 9 *palmi* wide – scarcely larger than half their actual size.

34 Michelangelo was early aware that he was misplacing the *tondi* and corrected himself, but not sufficiently. He began a *tondo* in the right gore one half diameter lower and abandoned it before it was half drawn, moving it up. Moreover, the three *tondi* are on different levels. The lapse probably started with the segmental arches, since these were necessary to indicate the curvature of the gores. Only the center and right-hand segmental arches are drawn mechanically.

The portion of the drawing below the base line of the semicircle had probably been intended to show the zone under the windows, since it is about the right height. It would be 10.6 *palmi* high in the drawing (measured using the width of the hemicycle to determine a scale) as against about 9 *palmi* on the building today. The lower zone occupies 17% of the total height of the vault. This same zone occupies 14.5% of the height in Letarouilly (1882), pl. 11 and 16.1% in Ferrabosco (1620), pl. XXIV (Fig. 9).

them, and half-medallion at the crown. They do evince inattentiveness, enough perhaps to raise a doubt as to whether Michelangelo could have discarded the wedge-shaped ribs before construction began and been inattentive enough afterwards to let them remain in his drawing; in our view this is out of the question.

Not only were the wedge-shaped ribs drawn mechanically as part of the essential demonstration; the change from them to the salient arch involved, as we shall observe in Part 3, such an alteration in the effect of the whole design that it seems impossible to assume Michelangelo could forget about the change if he had decided on the salient arch previously and begun to build with it. On the contrary, since he still visualized the wedge-shaped ribs as integral to his design when he wrote this letter at the beginning of July 1557, we conclude that he must have begun the vault with these ribs originally and only in the second campaign rejected them in favor of the salient arch.[35]

The decision to build the apse vault with wedge-shaped ribs probably did not require dismantling any of Sangallo's structure. Although the south arm had its salient pilasters, the evidence is that the salient arch had not been built. In Sangallo's model, as we saw, the barrel vault is constructed separately and ends before the area of the salient arch; the area of the salient arch is constructed as part of the unit of the apse vault. It seems likely that Sangallo's construction of the building conformed with that of his model, and views depicting Sangallo's vault over the south arm of the building itself before the addition of Michelangelo's apse vault accord with this assumption, though none is photographically exact.[36]

The upper drawing of the 1 July letter shows cornices crossing the faces of the ribs as in the building as built (Figs. 22, 26 and 11). But, in contrast to the building, the

35 It is not possible to read the upper drawing in Casa Vasari I as assuming the existence of a salient arch and showing the wedge-shaped ribs in addition. Long before Michelangelo took charge at St. Peter's the two main pilasters of the apse had been placed so that the spaces of the three bays would be of equal width. The arches and window openings above were to be placed on the center line of each bay. Michelangelo's windows of the second story were so placed. To achieve vertical correspondence, the windows at the upper level would have to be placed on the center line as well. (With the salient arch of the final design the gores at the third level correspond to the bays between the pilasters below, and the windows are above one another. Each gore of the vault as built is slightly less than a 60 degree section.)
If both a salient arch *and* wedge-shaped ribs had been built, either the two central ribs would have had to be greatly increased in width, to keep the three gores equal in size, which would have meant the ribs no longer corresponded to the pilaster/pier combination below, or both ribs would have had to be shifted towards the central window. Again, they would have lost correspondence with the members below. Meanwhile, it should be obvious that there would have been no member below the main entablature to correspond with the wedge-shaped ribs if they had been in addition to, and next to, the salient arch.

36 The anonymous drawing Uffizi 4345 (Egger [1911], pl. 36), showing St. Peter's from an elevated position to the southeast and executed in 1553 while Michelangelo's apse was under construction (Millon/Smyth [1969], 497, note 54), depicts the south vault before the apse vault was built. A curved line sketched on the under-surface of the barrel vault shows the change to a lower level above the pilaster pair, corresponding to the step in the exterior surface of the vault above. But no salient arch is shown, nor is there a second step on the exterior of the vault that would correspond to it, as there was on the exterior of the east vault in the anonymous drawing at Frankfurt of 1580/81 (Millon/Smyth [1969], fig. 16), where it corresponded to the salient arch built there in keeping with a special circumstance (see the explanation in the text above and in Part 1, note 12). The Uffizi drawing thus gives strong testimony that the salient arch had not been built. (The drawing of 1553 is inaccurate in a related respect. It does not show salient pilasters though they had been present since 1527 [Part 1, note 13].)
Vasari's fresco in the Cancelleria showing St. Peter's from the southwest in 1546 (Ackerman [1961], pl. 52b) may or may not indicate different levels in the top surface of the vault. The inner surface is obscured by formwork. Here again the salient pilaster was omitted, but the entablature appears to extend beyond the plane of construction of the barrel vault.
The anonymous drawing of 1547/48 added to the Heemskerk sketchbook in Berlin (Egger [1911], pl. 35) represents the exterior of the south apse from ground level. It shows the under-surface of the vault without delineating level changes or indicating the break in the entablature over the interior pilaster pair on the west side. In the east side the capital and entablature of the salient pilaster is shown, but on neither east or west is it possible to determine the relation of the plane of the vault to the plane of the salient pilaster. (To the east, at the second level, the concentric arches of the entrance to the upper ambulatory level of Sangallo's design are shown completed. In Sangallo's plan these arches correspond laterally to the location of the salient pilaster on the interior east wall.)
The drawing of 1556 from the southwest added to the same sketchbook (Egger [1911], pl. 37; Millon/Smyth [1969], fig. 27) does not show a salient arch, nor any changes in the level of the vault. The drawing on the reverse, picturing the building from the north in 1556 after Michelangelo built his barrel vault there (Egger [1911], pl. 38; Ackerman [1961], pl. 53a), also shows no sign of a salient arch either on the south or north. The degree to which the cylindrical masses of Michelangelo's *lumache* are exposed suggests that the construction of the vaults on both north and south was terminated before the salient arch.
This is a convenient place to add something about the *exterior* of the vaults. It may be observed that after Michelangelo finished the apse vault on the south arm, there was a second step on the exterior making three levels, as can be seen in the anonymous drawing at Frankfort of 1580/81 (Millon/Smyth [1969], fig. 16). Abutting the two levels of the exterior surface of the barrel vault (corresponding, as we have seen, to the two interior levels made by the barrel vault proper and the lower portion of vault over

drawing places these cornices, and also the spring point of the segmental arches supporting the gores, at about the height of the window heads instead of well below them. Although not shown in the drawing, the capitals of the little pilasters carrying the segmental arches would thus have to have been at the same height as well.

This again is like our model of Michelangelo's vault (Fig. 30). There, though cornices are lacking across the ribs, the little pilasters and the spring points that these pilasters provide for the segmental arches form a continuous horizontal with the tops of the windows. In the vault as ultimately constructed, however, rib cornices, little pilasters, and spring points are all markedly lower than the window heads, giving a notably different effect (Fig. 26).

the pilaster pair), the exteriors of the apse vault and salient arch together made only one more level. This is no doubt because on the interior the surfaces of the vault's half-medallion and of the ribs, where they meet the half-medallion, are at the same level as the interior surface at the highest part of the salient arch. When the apse vault was finished later on the north arm, the exterior was the same there, as can be seen in the profile view of the completed north arm in the drawing at Stuttgart by the so-called Anonymous Fabriczy, showing St. Peter's from the northwest (Egger [1911], pl. 40).

The exterior surfaces of the vaults of St. Peter's are visible today under the present tile roofs, which are elevated on brick piers. (The exterior vault surfaces are no longer alike on the north and south arms. While on the north there are still two gabled sections, one stepped lower than the other, plus a lower level for the apse vault, as in the Frankfort view of the south and the Anonymous Fabriczy's view of the north, the exterior profile of the south arm has been changed. Evidently added there after the Frankfort drawing was done is a narrow and elevated gabled section adjacent to the apse vault, producing an eccentric exterior surface of three, rather than two, levels before the level of the apse vault. [On both north and south, the upper end of the tile vault now *over* the apse vault is supported by a slender brick wall rising from the junction of apse vault and nave vault.] The measurements of the height of the steps of the exterior also differ on north and south. On the north, the step in the nave vault is 30 cm. high and that down to the apse vault 60 cm. On the south, the first step is also 30 cm. down, the second 30 cm. up, and it is then 125 cm. down to the apse vault. On the south, therefore, the distance between the nave vault and apse vault [excluding the later narrow raised section] is 35 cm. greater than on the north. Without archeological soundings and precise measurements taken at this level, which we have been unable to take, the history of these differences and changes remains unclear. On the east, finally, since Maderno removed the salient arch at the junction of Sangallo's east arm and his own new nave, the vault surface in that location has also been changed.)

Michelangelo's intentions for the outer surfaces of the vaults will be examined in a study in preparation. As to Sangallo's intentions for them, they are not indicated by the Sangallo model made by Labacco, since there the upper surfaces of all the arms were left unfinished (Fig. 35). The Salamanca engraving of the section (Fig. 4) shows no change of level throughout the length of the barrel vault, but a step at the plane of the junction of salient arch and hemicycle vault. We do not know where Salamanca's information for these details was obtained.

The drawing thus adds to the evidence of the model its confirmation that Michelangelo once intended the continuous horizontal. It testifies that, as in the case of the wedge-shaped ribs, he still thought in terms of it as late as 1 July 1557. Moreover, unless inattentiveness on his part let him retain the horizontal relationship in the drawing though discarded in the building, Michelangelo must have adhered to this relationship in the vault as he originally constructed it before he made the drawing.

As with the wedge-shaped ribs, we believe there is no choice but to assume that, however quickly and unassertively he drew the horizontal relationship, Michelangelo showed it in the drawing because it belonged to the design he had begun to build. The change from the horizontal relationship, once made, introduced, as we shall see, such a marked increase in the actual depth of the gores and such a novel design that it must have had great importance for Michelangelo, too much importance for us to assume without reason that he had already made the innovation in the building but ignored it in the drawing.

Tending to support this conclusion is the fact that the drawing agrees with the revised vault model in showing the horizontal relationship *together* with the wedge-shaped ribs. It is thus consistent with a distinct stage of the design known from the model. Also, as we shall observe in Part 3, both Etienne Dupérac's print of a section of St. Peter's and a drawing in the Metropolitan Museum, evidently made in preparation for the print, show the horizontal relationship and point to its having been incorporated in the initial construction of the vault.

A long time elapsed between the discovery of the foreman's error about 1 May 1557 and the completion of the vault around the beginning of June 1558, longer than the time taken to build much of the vault plus much of the exterior of the building at the attic level in the initial campaign. Major changes such as those from the wedge-shaped ribs to the salient arch and from a higher to lower springing for the arches of the gores must have required extra time. The length of time spent is in accord with our conclusion that more than merely correcting the foreman's error was involved.[37] There is no reason meanwhile to doubt

37 From the beginning of September 1556, the earliest date we find that the vault can have been begun (Millon/Smyth [1969], 484), until the time the mistake was discovered, the archives reveal 4368 man working-days including both manual and skilled laborers. Work on the vault may have begun even later; the total would then be less. For the period from the discovery of the mistake until the apse vault was completed, the records list 4742 man working-days, *i.e.*, 374 man working-days more than the

that Michelangelo had the opportunity to make these major changes. Since all the centering for the gores was begun on the wrong basis, it was necessary, as Michelangelo wrote Duke Cosimo in May 1557, "to take down a great part of what had been done", to dismantle the vault to a level, in fact, that allowed consideration of a new design.

By 17 August 1557, when Michelangelo wrote his second letter to Vasari and before the dismantling of the vault was completed, he had decided to return to a design that included Sangallo's salient arch. This is the testimony given by the drawing in the second letter.

Evidently because Vasari had had difficulty in understanding the drawing of the incorrect and correct curvature in the first letter, Michelangelo sent him the new drawing (Fig. 23). "So that the difficulty of the vault, which I sent you in a drawing, may be better understood, I send you the plan of it because I did not send it then ..."[38] This time he drew a reflected plan of the vault, showing the two center ribs, half-medallion, and, in flattened sections,[39] the curvature of the gores.

But this plan does not agree with the upper elevation in the previous letter. It does not have the large wedge-shaped ribs. Also, the half-medallion is contained *within* the semicircle of the hemicycle, whereas before, with the wedge-shaped ribs in the drawing of 1 July (Fig. 22), the half-medallion had necessarily to extend beyond the semi-circle into the area now occupied in the building by the salient arch – because the wedge-shaped ribs had to abut the half-medallion. When he returned to the salient arch, Michelangelo had to pull the half-medallion back within the semicircle (Fig. 29), as it is in his new drawing. (As we shall see in Part 3, when it came to rebuilding the vault it was necessary to redirect and redesign the ribs to meet the half-medallion in its new location.) The only possible conclusion is that Michelangelo contemplated returning to Sangallo's salient arch when he made this drawing. In accord with

maximum needed to bring the vault on both interior *and* exterior to near completion in the first campaign. (See note 44 for the greater number of liftings of stone to and from the top of the apse after the mistake was discovered than before.)

38 For the letter, see note 29 above.

39 The vault is shown in reflected plan. Each of the section lines of the gored vaults is formed by the intersection of the inner surface of the gored vault and a plane perpendicular to the plane surface of the plan. Each section line is then rotated 90°, that is, flattened, to lie on the plane of the plan. Since the gores change their curvature from wall to half-medallion, many such sections had to be drawn at different points along their length and flattened on the plan to show the changing curvature. Michelangelo chose to rotate the section lines towards the exterior so that they would be between, rather than on top of, the ribs. The ribs, *tondi*, and trapezoidal panels were projected to the plane of the plan.

The circle that describes the inner surface of the hemicycle was mechanically drawn as were the half-circle that suggests a wall thickness, the half-medallion, the transverse line in the area of the salient arch, the ribs and their mouldings, portions of the *tondi*, and some of the section lines of gore curvature.

It is possible the drawing was done roughly to scale. If the diameter is taken to be 104 *palmi* (Ferrabosco [1620], pl. VIII), the ribs scale at their base 13.4 *palmi* – instead of about 10.5 *palmi* (8.0 cm.) on the model, 9.85 *palmi* in Letarouilly (1882), pl. 7, and 10.1 and 11 *palmi* in Ferrabosco, pls. XIV and XI respectively. (We do not have measurements of the ribs on the building.) In the drawing the ribs taper to a width of 2.7 *palmi* at the half-medallion, where Ferrabosco (pl. VIII) shows the width to be 3 *palmi*.

The diameter of the half-medallion on the drawing is 18.3 *palmi*, smaller than any of the dimensions shown in the standard views (22 *palmi* in Ferrabosco, pl. VIII; 22.4 *palmi* in Letarouilly, pl. 11), but close to the model dimension, 18.8 *palmi*. The half-medallion in the upper drawing of 1 July 1557 (hereinafter Casa Vasari I) scales 19.6 *palmi*.

The plan in the present drawing (hereinafter Casa Vasari II) was taken below the level of the springing of the ribs (the thickness of the ribs at the wall, however, was not indicated, perhaps since it was not important to the purpose of the drawing) and does not show the attic window openings into the walls. The three gores are roughly equal, the center one slightly narrower than the other two.

As in Casa Vasari I, each of the vaulted gores contains two trapezoidal panels (unlike the vault as constructed) and one *tondo*, but in Casa Vasari II the *tondo* is shown between the two panels instead of beneath them.

The scaled distance from the half-medallion to the outside moulding of the lower trapezoid in Casa Vasari II is about 43 *palmi*, which corresponds in the building to the distance from the half-medallion to the outside edge of the *tondo* moulding (44.6 *palmi* in Ferrabosco, pl. XXIV [Fig. 9]; 42.35 *palmi* in Letarouilly, pl. 11), measured along the surface of the vault, not in projection. That the panels and *tondi* were drawn in the wrong place is probably because the *tondi* were placed almost correctly for a simple reflected vault plan, without compensating for the flattened section lines of the gore that should have carried them away from the half-medallion as the section lines were flattened. The embarrassingly empty space remaining between the misplaced *tondi* and the flattened section line at the wall was filled by the lightly sketched additional second panels. (The second panels cannot be read as windows because the interior attic window would be shown in plan in the thickness of the wall, not in elevation in the vault, and in addition the panels in the drawing conform to the curvature of the gore, not to that of the wall. Ackerman [1964], 106 thought the lower panels indicated windows.) As in Casa Vasari I, the additional decorative element in the gore must be there, not to indicate an alternative scheme, but merely the general arrangement and placement on the curved surface of the vault.

The central *tondo* is slightly oval and larger than the *tondi* of the side gores (13.5 and 15.1 *palmi*, inside dimensions of the oval; 18.3 and 19.9 *palmi*, its outside dimensions, versus 11.3 *palmi* inside and 16.9 *palmi* outside for the other two).

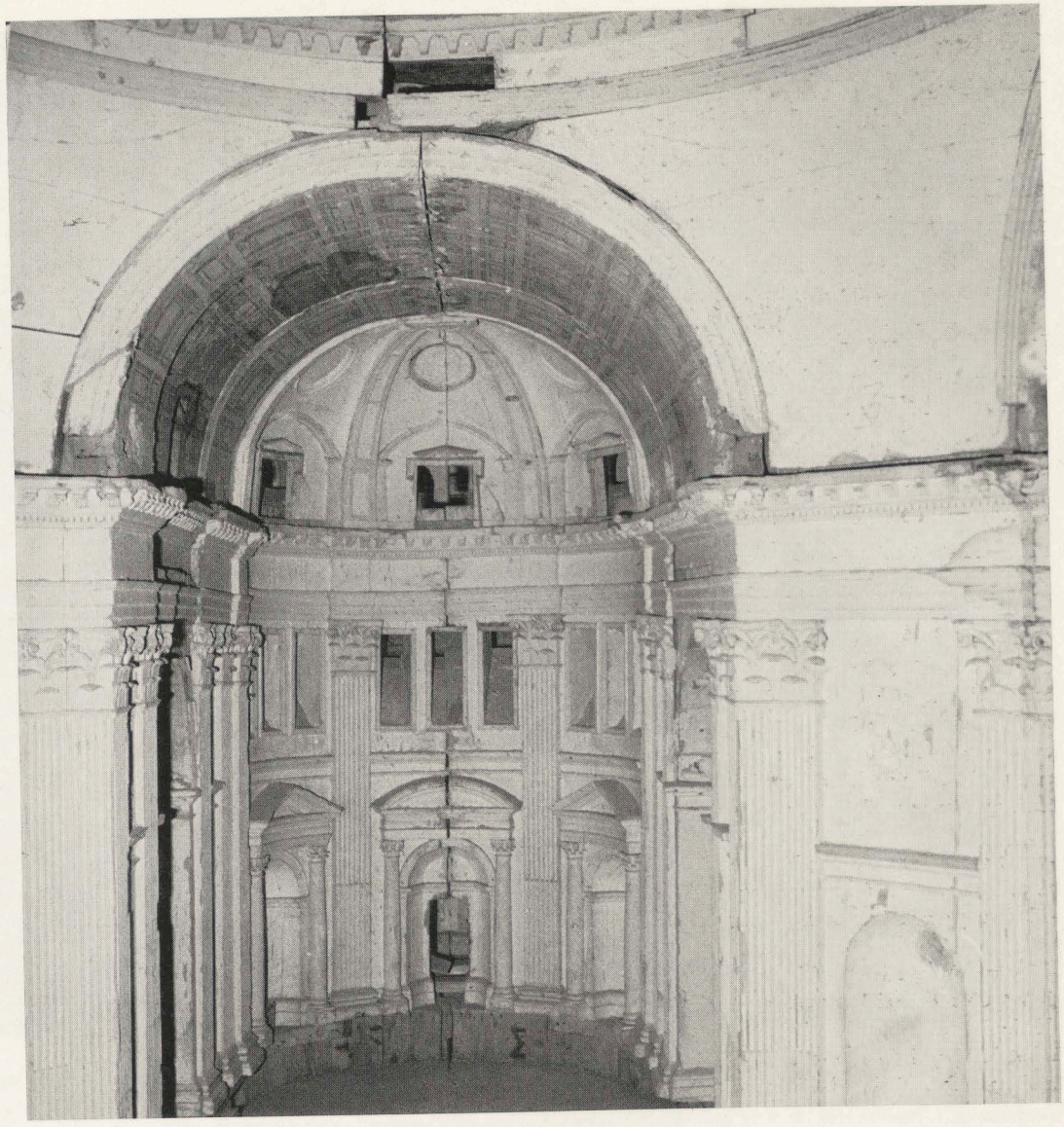
The difficulty of describing the centering for the *tondi* and panels is specifically cited in Michelangelo's second letter, and the drawing indicates the constantly changing angles of intersection lines.

32. St. Peter's, area under dome and south transept

this conclusion is the lack of any line marking a separation between the half-medallion and the area where the salient arch was to be, an indication that half-medallion and arch are at the same level, as in the building today.

But the new drawing shows narrow mouldings at the junction of the side gores with the salient arch, mouldings similar to those outlining the central ribs in the drawing. The building as Michelangelo finally constructed it does not have them. They might be smaller, vestigial versions of the wedge-shaped ribs.[40]

40 The two central ribs are defined by pairs of lines, indicating either the edges of ribs and the panels on their surface or mouldings at the edges of the ribs. The drawing may represent a trial stage in redesigning the ribs, the rib width being temporarily increased by the addition of the moulding lines at the sides. The width of the central part of the ribs alone scales 9.15 *palmi*, close to the measurement of the ribs on the building, which scale 9.85 *palmi* (Letarouilly [1882], pl. 7). If the additional width accorded to the ribs in the drawing by the mouldings on either side had been given instead to the space of the gore between the ribs, the center bay would have been 43.8 *palmi* wide, as it is in the building *(ibid.)*. The panels seen in Ferrabosco (1620), pl. IX (Fig. 11) and, in an altered state, on the building itself (Fig. 26) would be within the central area of the ribs alone if placed on the drawing. The indications of mouldings at the junction of the side gores and the area of the salient arch are similar. In this location it would seem that they are somewhat related to the wedge-shaped ribs of the first campaign. Also, above the right gore there are lightly drawn lines within the area of the salient arch that suggest a possible consideration and rejection of the old wedge-shaped ribs found in the model and the drawing of 1 July 1557.
The horizontal chord drawn above the center of the circle in the area of the salient arch cannot be intended to represent that arch. Its displacement from the center of the circle is too great for it to be the edge abutting the apse vault and too little for it to be the edge toward the barrel vault. Michelangelo may have been considering momentarily either a narrower salient arch with a member paralleling it or two narrower concentric salient arches, but neither alternative seems likely since neither would have found corresponding members below.



33. Antonio da Sangallo: Model of St. Peter's. Interior view of west arm with inserted model of Michelangelo's apse vault (St. Peter's)

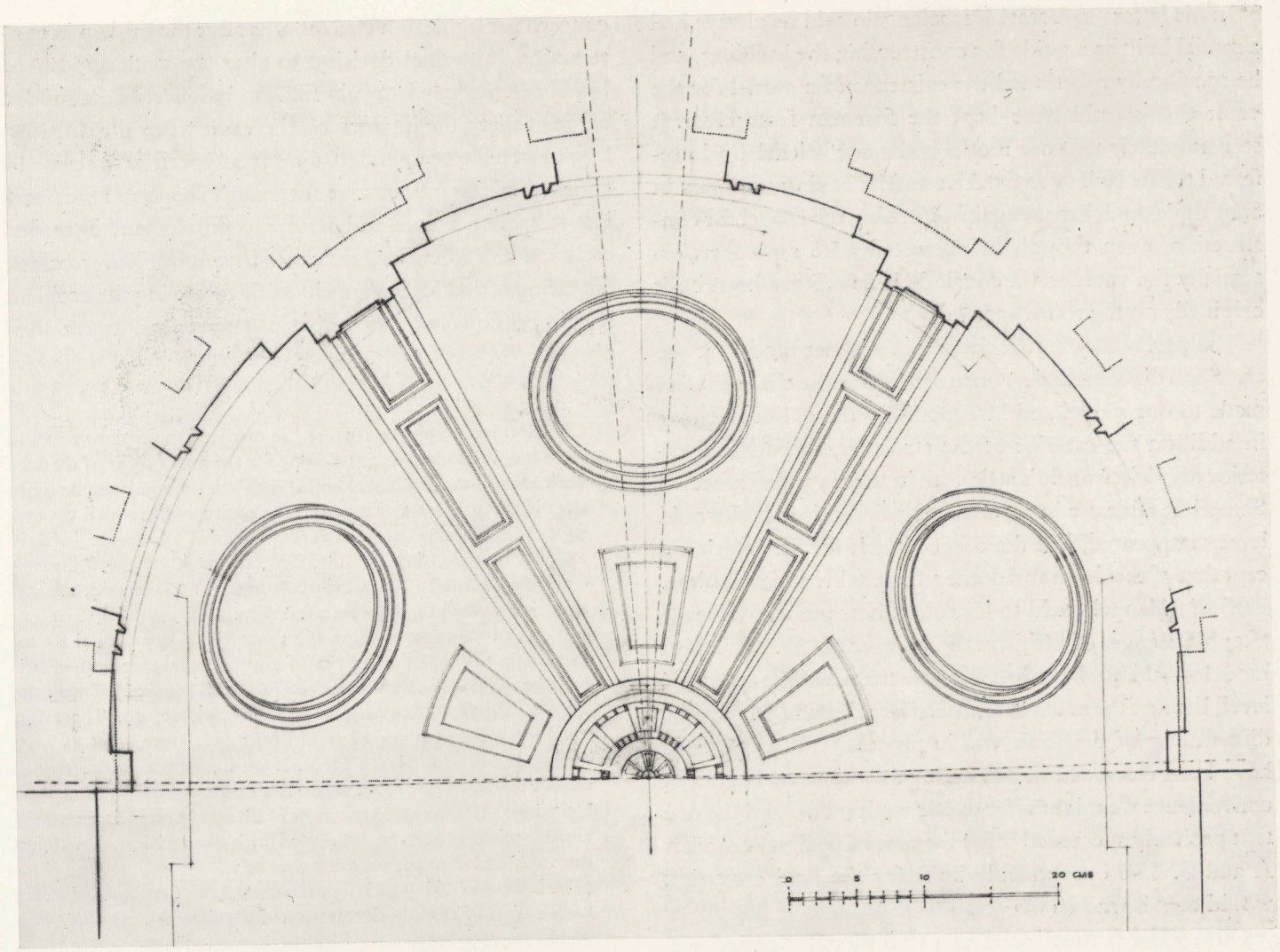
The drawing of 17 August also testifies that by this date Michelangelo had decided to deepen the gores and abandon the horizontal relationship of elements at the window level.

The section lines in the drawing indicate gores with a curvature approximately the same as that found in the building today, significantly greater than in the vault model (Fig. 25) and upper drawing of the first letter (Fig. 22). On this evidence the new drawing post-dates Michelangelo's decision, not only to deepen the gores, but to lower the height of the little pilasters supporting the segmental arches. For when the crown of the segmental arch is kept at the same level, it is the height of these pilasters that governs the curvature of the gore. The indication is that this second change in the vault design also took place during the month and a half between the two letters to Vasari. It meant a fundamental modification of the form of the vault, which we shall consider in Part 3.

The wooden model of the vault inserted in Sangallo's model has brought to light the information contained in Michelangelo's drawings for Vasari. That this model was not lost as were almost all of Michelangelo's other models must be because it was protected by its unusual location. Apparently it was left in Sangallo's model and forgotten after it had served its purpose.

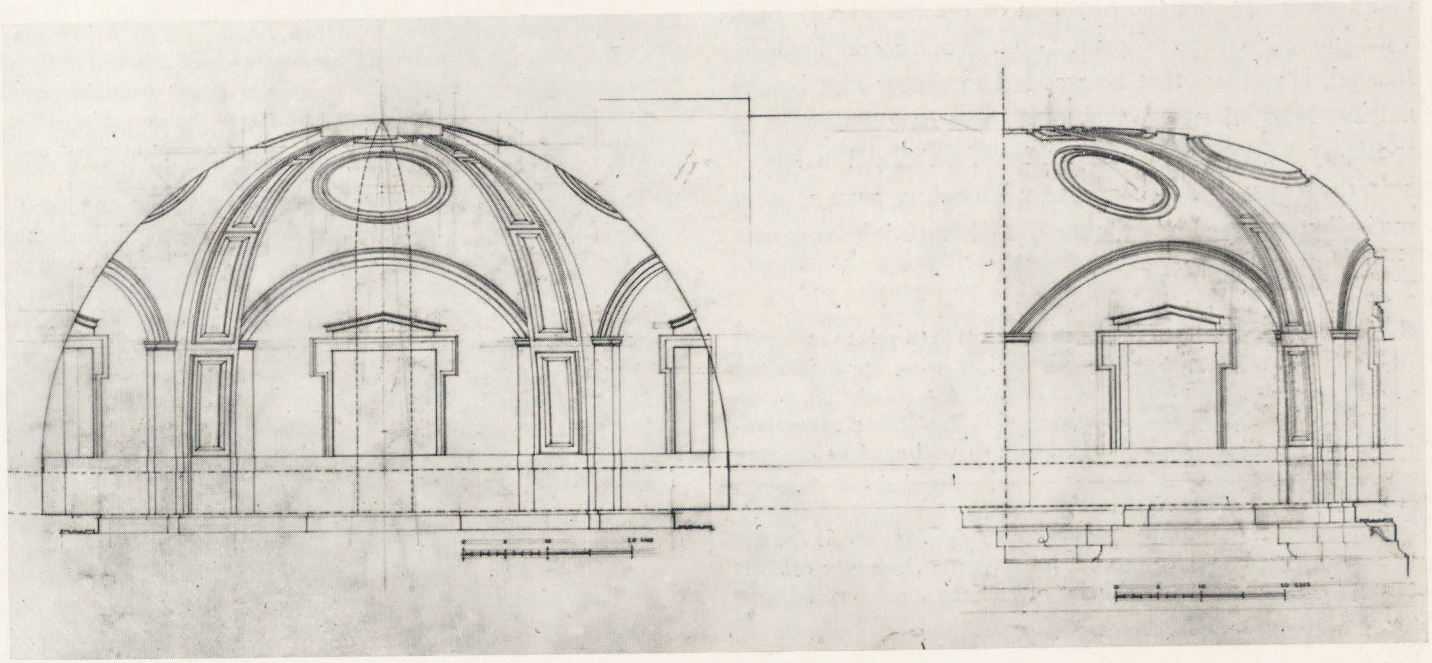
34. Model of Michelangelo's apse vault (inserted in west apse of Sangallo model), right-hand window. Before 1557 (St. Peter's)

35. Model of Michelangelo's apse vault (inserted in west apse of Sangallo model). View from behind and above (St. Peter's)



36. Model of Michelangelo's apse vault, plan. Reconstruction of original state

37. Model of Michelangelo's apse vault, elevation and section. Reconstruction of original state. (The horizontal dashed lines show the base removed when the model was inserted in the Sangallo model)



In his letters to Vasari Michelangelo said he always had a model built as a guide for constructing the building, and he specifically mentioned the existence of a model for the vault that should have kept the foreman from error. It seems unlikely that our model is the one Michelangelo referred to. Its lack of an exterior and its having remained in Sangallo's model argue against its being the model for construction, even though its corrected state represents essentially the vault as we conclude it must have been built originally on the south apse.

The probability is that there was another model, at the same or a different scale, constructed after the changes were made to our model and incorporating them, but showing in addition the exterior of the structure, the original exterior of Michelangelo's attic with its three vaulted spaces.[41] Sometime after use in the first campaign this model would have disappeared, like the other models for St. Peter's except that of the drum and dome and ours in its hiding place.

If Michelangelo held to his rule, a new model was made after his changes of design in the summer of 1557. The third model would not have had to show the exterior at the attic level, because the exterior had been largely completed while dismantling of the vault was in process.[42] It, too, would have been discarded in Michelangelo's time or later. For convenience we might refer to our vault model and the one that probably succeeded it for the first campaign as models A and B. The one possibly built for the final campaign would then be model C.[43]

Our model A functioned as a trial model. Studied and altered at one stage in the evolution of the design for the vault, it gives a glimpse of Michelangelo at work, evidently making use of a chance inspiration. One would assume he could have ignored the problem of the mistakenly built vault model, perhaps ordering a second one correctly made. Instead, it appears that he was led to a new idea by the nature of the mistake, was diverted to a new design, so to speak, by the mechanical difficulties of the model-maker.

In the explanatory drawings for Vasari we have another such glimpse, this one showing Michelangelo's intense new concern for his design two months after the mishap in construction. The final decision to alter the vault appears to have been made in late July 1557, to judge from the sudden surge at that time in work on the vault when the dismantling must have been underway.[44] It may well have seemed a considerable step to change the vault's shape and membering at so late a date and return to an element discarded earlier, not of Michelangelo's own invention. Nevertheless, the changes that Michelangelo made following the accident had important and innovative consequences, as we shall observe.

41 It is conceivable that workmen would have been able to construct the vault and exterior at the attic level by using our model and Michelangelo's wooden model of the building (Model II), showing the exterior of the attic (according to Passignano's representation of it [Ackerman (1964), 58a]), as well as drawings and verbal statements.

42 Millon/Smyth (1969), 484, note 2.

43 We have not found documents of payment for models for the construction of the apse vault. As we have seen, however, Michelangelo's letters refer to at least one of the models considered here.

44 Dismantling simply to correct the error of the foreman would have involved removing the stone for the gores most of the way back toward the segmental arch. The decision to dismantle more than just the gores and redesign the entire vault, which the evidence of the letters dates between 1 July and 17 August, is likely to have occurred late in July 1557, to judge by the following data. According to Michelangelo's letter of 17 August, the dismantling was still in process even then.

Liftings of stone to or from the top of the Cappella del Re increased in the first two weeks of August. The numbers of liftings for each of the eight weeks in July and August 1557 were 16, 18, 22, 13, *63* (6 August), *43* (13 August), 16, 18. Thereafter until the vault was completed liftings only once went as high as 24 per week (in March 1558). If we look back all the way to the previous August 1556, we do not find a week with more than 25 liftings. The very large number of liftings in early August 1557 would appear then to be connected with the decision to redesign the vault and dismantle a great part of it.

(The increased lifting activity in the first half of August coincides with a time of slightly decreased activity for the *scarpellini*, who would presumably have had less to do while the stone was being lowered. The numbers of *scarpellini* during the same period are as follows: 38, 40, 41, 42, *38*, *26*, 20, [missing]. *Manuali* and *muratori* decreased in mid-August, but not significantly before then. They would have been needed to dismantle the vault and move materials about. Their numbers for the weeks of July and August were as follows: 59, 67, 64, 63, *61*, *58*, 46, 44. By mid-October the weekly average for *manuali* and *muratori* had returned to its previous level, about 60, and this level was maintained until mid-March 1558. By mid-October many of the *scarpellini* had returned and their numbers never fell below 34 until the last week in March 1558.)

The evidence from the time sheets prior to August seems to indicate that after the mistake was first discovered at the end of April 1557 work on the vault had continued, partly to finish the exterior (see also Millon/Smyth [1969], 484, note 2) and partly, we assume, to begin dismantling the gores. Accelerated lifting early in August appears to mark the decision to redo the whole vault.

Liftings to (or from) the top of the apse up to the time the mistake was discovered totalled 712; thereafter there were 862 such liftings. Comparison of these totals makes clear again (see also note 37) that an immense amount of work was done after the vault had been near completion – all the more so since the liftings for the initial period included liftings to construct the entablature. The large total number of liftings for the second period is further evidence that a major design change and dismantling took place.

3

Two contemporary representations of Michelangelo's apse vaults help confirm some of the conclusions we reached in Part 2 about the evolution of his design. One is the well-known print of a section of St. Peter's by Etienne Dupérac dating probably from about 1569 (Figs. 5, 39 and 40),[1] the other an unpublished drawing in the Metropolitan Museum – picturing one window of the vault with flanking elements (Fig. 41). We shall find that the drawing was made on the basis of more than one source, evidently in preparation for the print. The pertinent fact is that both representations depict elements belonging to earlier stages of Michelangelo's design, not to his final one.

It seems to have gone unnoticed that Dupérac's print of the section (Fig. 5) fails to represent either Michelangelo's apse vaults or, as we shall see shortly, the barrel vaults of St. Peter's as they were built (Fig. 32). The apse vaults in the print (Figs. 39 and 40) show the original horizontal relationship we have become familiar with from Michelangelo's early model of the vault (Fig. 30) and from his drawing of 1 July 1557 for Vasari (Fig. 22). Window heads, rib cornices, spring points for the segmental arches under the gores, and the capitals of the little pilasters supporting these arches – all are at the same height (Figs. 39 and 40), not at two different heights as in the building (Figs. 32 and 38). A smaller detail: over the central window of the apse vault the print shows a triangular pediment (Fig. 40). This is like Michelangelo's vault model in its revised state (Fig. 30);[2] the finished building had instead segmental pediments over the central windows (Figs. 11 and 31). Next to the salient arch that divides apse vault from barrel vault, the print shows a slender and tapering vertical member extending from the main entablature to the half-medallion at the top of the vault (Fig. 39). This element has no counterpart in the completed building (Figs. 38 and 42). It looks like a narrow version of the wedge-shaped ribs known to us from Michelangelo's revised model (Figs. 24 and 28) and from his drawing of 1 July 1557 (Fig. 22). Even though Dupérac shows the salient arch, which in Michelangelo's final design replaced the wedge-shaped ribs entirely, he has not, so it appears, let the arch banish the wedge-shaped ribs entirely from his print. (In this respect Dupérac's representation somewhat recalls Michelangelo's drawing of 17 August 1557 for Vasari, which we examined in Part 2 [Fig. 23].)

1 For the date, see note 10 below.

2 For Michelangelo's revision of the vault model, see Part 2.

Long considered by many authoritative as to Michelangelo's intentions for St. Peter's,[3] Dupérac turns out here to be wrong, even though he made his print more than ten years after the apse vault on the south was finished in 1558. Instead of following the finished apse vault attentively, he must have relied on an obsolete source or sources for Michelangelo's design, which he apparently thought preserved the final design. We have a confirming indication here that Michelangelo considered seriously a design for the apse vault that included the horizontal relationship, as the evidence given in Part 2 testified.

John Coolidge has shown that Dupérac drew on a variety of sources for his prints of St. Peter's.[4] The drawing in the Metropolitan Museum (Fig. 41) provides clues as to Dupérac's sources in the case of the apse vaults.

An error in the representation of the segmental arch shared by the Metropolitan drawing (Fig. 41) and Dupérac's print (Fig. 40) indicates a connection between the two. To understand this error we must first turn to a still more fundamental mistake on the part of Dupérac that has escaped notice.

Dupérac omitted in his print the 6-foot 7-inch vertical zone at the bottom edge of the barrel vaults, just as Labacco had omitted it in Sangallo's model of St. Peter's, as we found in Part 2. For this reason Dupérac began the coffering of the barrel vaults too near the cornice and left out the undecorated area beneath (Fig. 5).[5] He made the error when initially laying out the plate and did not correct it

3 For a summary of the usual views on Dupérac's reliability and references to earlier discussions, see Coolidge (1942), 71, 99, note 61, and 112ff. See also, more recently, Wittkower (1964), *passim*, and Ackerman (1964), 115. Coolidge questioned Dupérac's prints as trustworthy representations of Michelangelo's intentions in view of his own observation that the design of the little domes shown by Dupérac is not Michelangelo's *(ibid.)*, but concluded that, while Dupérac had to draw on various sources for information as to Michelangelo's intentions (see note 4 below), he was conscientious and meticulous in trying to set down "the form in which it was expected that St. Peter's would appear when it was completed" (*ibid.*, 119).
As will be evident from our observations in both this and the first article in this series (Millon/Smyth [1969]), we find Dupérac's representations of St. Peter's unreliable in important ways on both exterior and interior. In studies in preparation we shall have occasion to show his unreliability in other crucial aspects of Michelangelo's design.

4 Coolidge (1942), 112–119.

5 In contrast, as we saw in Part 2, Salamanca did not leave out the 6-foot 7-inch zone in his print of the section of Sangallo's St. Peter's, and he shows the undecorated area (Fig. 4).

even though it had serious consequences when he arrived at the apse vaults. This suggests he did not begin to work on the vaults until other parts of the plate had been developed to such a degree that he could not change them.

When it came to the apse vaults, Dupérac did include the 6-foot 7-inch zone below the windows, comprising the string course and area beneath it above the main entablature (Figs. 5, 39 and 40); but by doing so he had to lose that dimension elsewhere, largely within the upper curved portions of the apse vault itself. The ribs, indeed the whole vault, had to be depressed (Fig. 39). The ribs are thus misshapen and intrude into the vault space more than they do in the building today.[6]

How did it happen that Dupérac is unreliable with respect to the height of the vaults of St. Peter's as built? Obviously he did not follow the building closely. The omission of the 6-foot 7-inch zone was due, in all likelihood, to dependence for the height of the vaults on the model built for Sangallo.

Undoubtedly as another consequence of the compression of the vault area in the print, Dupérac depressed the crowns of the segmental arches over the windows. They are significantly lower than in the building, the vault model, or the drawing of 1 July 1557.[7] The defect meant a lessening of the curvature of the gores.

In the drawing in the Metropolitan Museum (Fig. 41), the segmental arch is again depressed. Moreover, the dimension there between the cornice of the main entablature and the crown of the segmental arch is the same as in the print. In all their vertical scaled dimensions both print and drawing prove to be smaller than the same dimensions scaled in the representations of Letarouilly and Ferrabosco, or on the vault model.[8] It is on these grounds that we conclude the drawing was done in preparation for the print. We assume Dupérac or an assistant drew it after the plate was begun, because it appears that the depressed arch of the drawing and the adjustments it necessitates stem from the initial error in laying out the plate. The draftsman, preparing a representation of the windows for the plate, evidently tried the depressed arch in the drawing in an effort to see how best to proceed in compensating for the error in the plate.

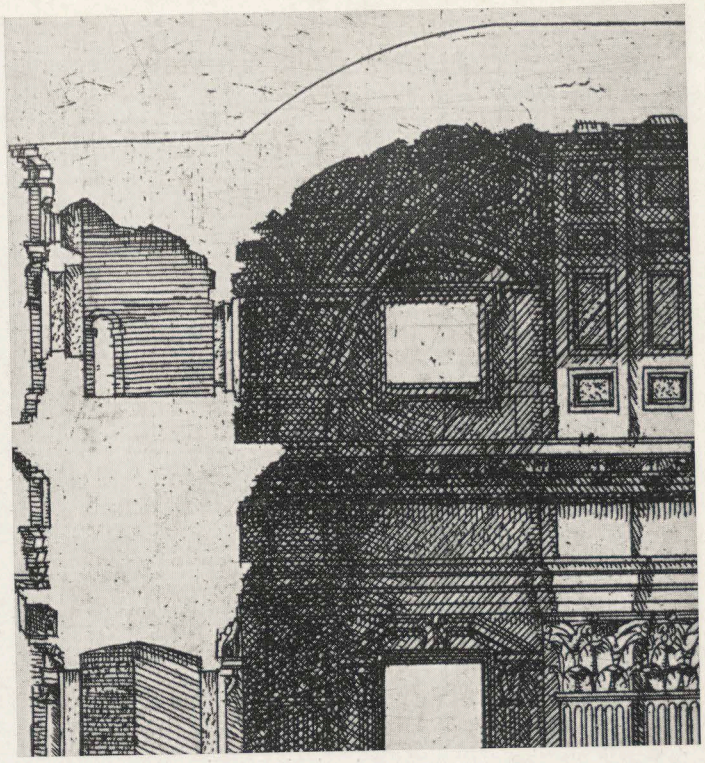
The drawing in the Metropolitan Museum (Fig. 41) is one of a group of architectural drawings from a scrapbook given to the Museum by Janos and Anne Bigelow Scholz. Drawings of the group have already been associated by Janet S. Byrne and Rudolf Wittkower with Dupérac, and

6 In preparing his print, Dupérac had to show the entire height of the apse vault in a space that scales almost 9 *palmi* too low. To the vertical zone below the windows (about 9 *palmi*), Dupérac accorded 8.5 *palmi* and squashed the remaining vault height (about 50 *palmi*) into a space only 41.5 *palmi* high. To do so, Dupérac made the ribs arch sharply toward the half-medallion.

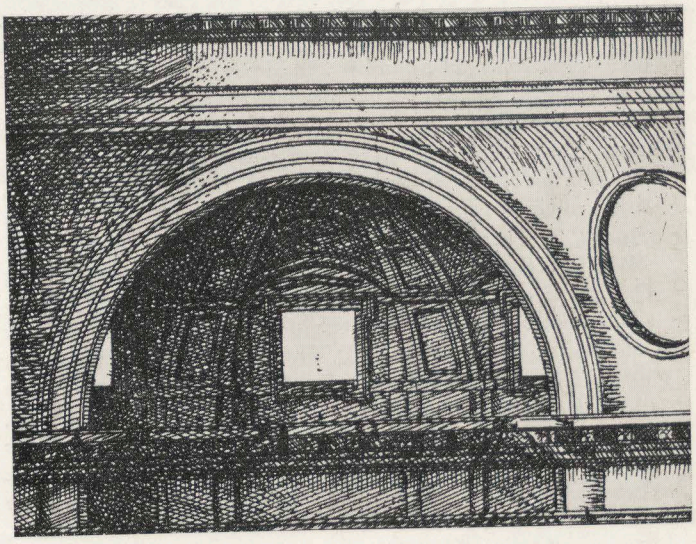
7 Depressing the rise of the segmental arch made it possible to show something of the gores, so that the trapezoids and *tondi* might be indicated. In the print the soffit of the arch scales about 32.5 *palmi* above the cornice as compared to about 35.4 *palmi* in the building, as scaled from Letarouilly (1882), pl. 11, and 36 *palmi* in Ferrabosco (1620), pl. IX. (The soffit of the arch scales 23.5 *palmi* above the sill of the window in the print as compared to 25.5 from the same plate in Letarouilly, and 27 in Ferrabosco [1620], pl. XXIV; it scales 10.5 *palmi* above the soffit of the window, only $^1/_2$ a *palmo* less than in Letarouilly, and .7 *palmi* less than in the same plate in Ferrabosco. Dupérac compensated for the dimensional differences by small changes in each of the parts. These dimensions are also smaller than in the vault model. There the corresponding measured dimensions from the soffit of the arch of the two side bays [which were undamaged in the revision] to the sill of the window is 27.6 *palmi*, and to the soffit of the window, 12.6 *palmi*. The height from the main cornice to the soffit of the arch cannot be measured because the base is missing, but if a base of appropriate proportion is postulated the dimension would be c. 36.6 *palmi*.)
In addition Dupérac made other slight adjustments. As scaled on the print they include lowering the height of the rib cornice about 2 *palmi* (to a height about 25 *palmi* above the main entablature), lowering the height of the window opening about 1 *palmo*, and reducing the height of the base.

8 Our catalogue entry for the drawing in the Metropolitan Museum is in note 9.
In the drawing the height of the soffit of the arch above the main cornice is the same as in the print, 32.5 *palmi* (if one adds the inscribed dimensions available up to the soffit of the window to the scaled dimension, not inscribed, from there to the soffit of the arch). The entire dimension when scaled is 33.9 *palmi*, larger than in the print but still smaller than in Letarouilly (1882), pl. 11, Ferrabosco (1620), pl. IX, or the vault model, supposing it had an appropriate base. (The dimension in the drawing between the soffit of the segmental arch and the window sill scales 24.9 *palmi* as compared to 23.5 in the print, and the dimension between the soffit of the arch to the soffit of the window scales 9.53 as compared to 10.5 in the print. The window height, although inscribed as 15 *palmi*, scales only *palmi* 14 *oncie* 8. Hence the drawing compresses these relationships more than the print while according the difference to the height of the base.)
Another connection linking the print and drawing is that the scaled dimension of the string course and base in the drawing is 8.66 *palmi*, smaller than in any other representation, but close to that scaled from the Dupérac print, 8.5 *palmi*. (The drawing compresses this zone slightly more than its inscribed dimension of *palmi* 8, *oncie* 11, *minuti* 4 [6 feet $6^1/_4$ inches – $2^3/_8$ inches less]. Scaled from Letarouilly [1882], pl. 11, the dimension of base and string course is 8.95 *palmi* and, from Ferrabosco [1620], pl. IX, 9.0 *palmi*. Our measurements on the building show a variation in the height of the base below all nine attic windows from 6 ft. $5^3/_4$ in. to 6 ft. 11 in. [1.95 m. to 2.11 m.; 8.74 *palmi* to 9.45 *palmi*].)
The correspondence between drawing and print and their relative differences from the building and the model connect them positively.

38. St. Peter's, south apse vault (southeast window)



39. St. Peter's, longitudinal section (west apse).
Etching by Etienne Dupérac (detail). Circa 1569



40. St. Peter's, longitudinal section (north apse).
Etching by Etienne Dupérac (detail). Circa 1569

Wittkower concluded that those of the drum and dome of St. Peter's were preparatory to Dupérac's prints of the building. Dates have been suggested for the group from the middle and later 1560s.[9] Because it appears to have been made after the print was begun, our drawing should date from about 1569.[10]

The drawing represents the lower part of one bay of the vault. A finished studio drawing, it was done to scale, 1 to 30, and with evident attention to detail.[11] It includes the window mouldings, the lugs at the top and base, open slots for light within these lugs (narrower at the top corners), and, in the inner part of the window frame, the set-back interior frame. At the height of the window sill is shown the string course, and beneath it is the base, with a horizontal line indicating the top of the main cornice. Above the window are the pediment and supporting pedestal and half of the segmental arch. On the left are one little pilaster and the lower part of one of the ribs with its panelling. Included also are many inscribed dimensions.[12]

The attention to detail only makes more noteworthy the fact that the drawing shows the horizontal relationship of elements that had belonged, as we saw, to Michelangelo's design before his final changes: window head, rib cornice, spring point for the segmental arch, and capital of the little pilaster are all at the same height.[13] We may add that the drawing is unlike the final design – but like the revised vault model (Fig. 21) and print (Fig. 40) – in showing a triangular pediment over the window in what appears to be the central bay. It seems likely the drawing does represent the window of the central bay because, in addition to having the little pilaster and lower part of a rib with its panelling on the left, it has construction lines for a rib of the same width on the right. Also, the central window is the only window shown in elevation in the Dupérac print.[14]

9 Metropolitan Museum of Art, 49.92.89 *recto*. Gift of Janos and Anne Bigelow Scholz, 1949, in memory of Flying Officer Walter Bigelow Rosen. Ink on paper with some chalk and incised, *i.e.*, scored, construction lines. No watermark. $11^{3}/_{8}$ in. × $16^{13}/_{16}$ in. (289 × 426 mm.). The number 222 in pencil on the right probably represents the sheet number in some later arrangement of the group of drawings.

The Scholz scrapbook probably contained about 125 sheets. For citations and discussions of drawings in the group see JANET S. BYRNE, "Design for a Tomb", *The Metropolitan Museum of Art Bulletin*, XV (1957), 155–164; Ackerman (1961, catalogue volume), 99; (1964), 101–102; (1970), 334; J. WASSERMAN, "The Quirinal Palace in Rome", *ArtBull* XLV (1963), 205–244 (Wasserman dates the drawing he reproduces as probably soon after 1566 and no earlier than 1561); Wittkower (1964), Appendix II, 101–107 (Wittkower dates the drawings of the drum and dome of St. Peter's in 1564–69); Tolnay (1965), 250; Tolnay (1967), *passim* (Tolnay recounts his recognition of the importance of the scrapbook, summarizes the contents and describes some of the drawings, suggesting in general dates in the second half of the 16th century and, specifically, some soon after 1556); C. BRANDI, "La curva della cupola di San Pietro", *Problemi attuali di scienza e cultura*, Accademia Nazionale dei Lincei, Quaderno n. 123, CCCLXV (1968), 8–9; C. FROMMEL, *Der Römische Palastbau der Hochrenaissance*, 3 vols., Tübingen (1973), *passim* (Frommel dates the drawings in the decade 1560–70 and ascribes them to a French draftsman).

10 Coolidge (1942), 116 demonstrated that, of Dupérac's three plates of St. Peter's, the one showing its plan, dated 1569, was the first plate prepared. It appears the three were made to be a group, and we assume all date from about 1569/70.

11 Section lines are indicated on the rib panel (at the top) and the window frame (at the bottom). All other projecting mouldings return to the surface behind (including the segmental arch at its crown with an inscribed dimension) and are thus shown in section also. In addition the section line of the window frame includes inscribed dimensions.

12 The drawing contains 16 inscribed dimensions (the width of the window frame is twice indicated). When these 16 dimensions are compared to dimensions scaled from the drawing, several variations appear. Seven of the dimensions differ between 1 and 5 *oncie* (at a scale of 1:30 between .62 and 3.1 mm.). Two inscribed dimensions are 3 *minuti* larger than the scaled dimension (at 1:30 a difference of .372 mm.). The remaining seven inscribed and scaled dimensions agree exactly.

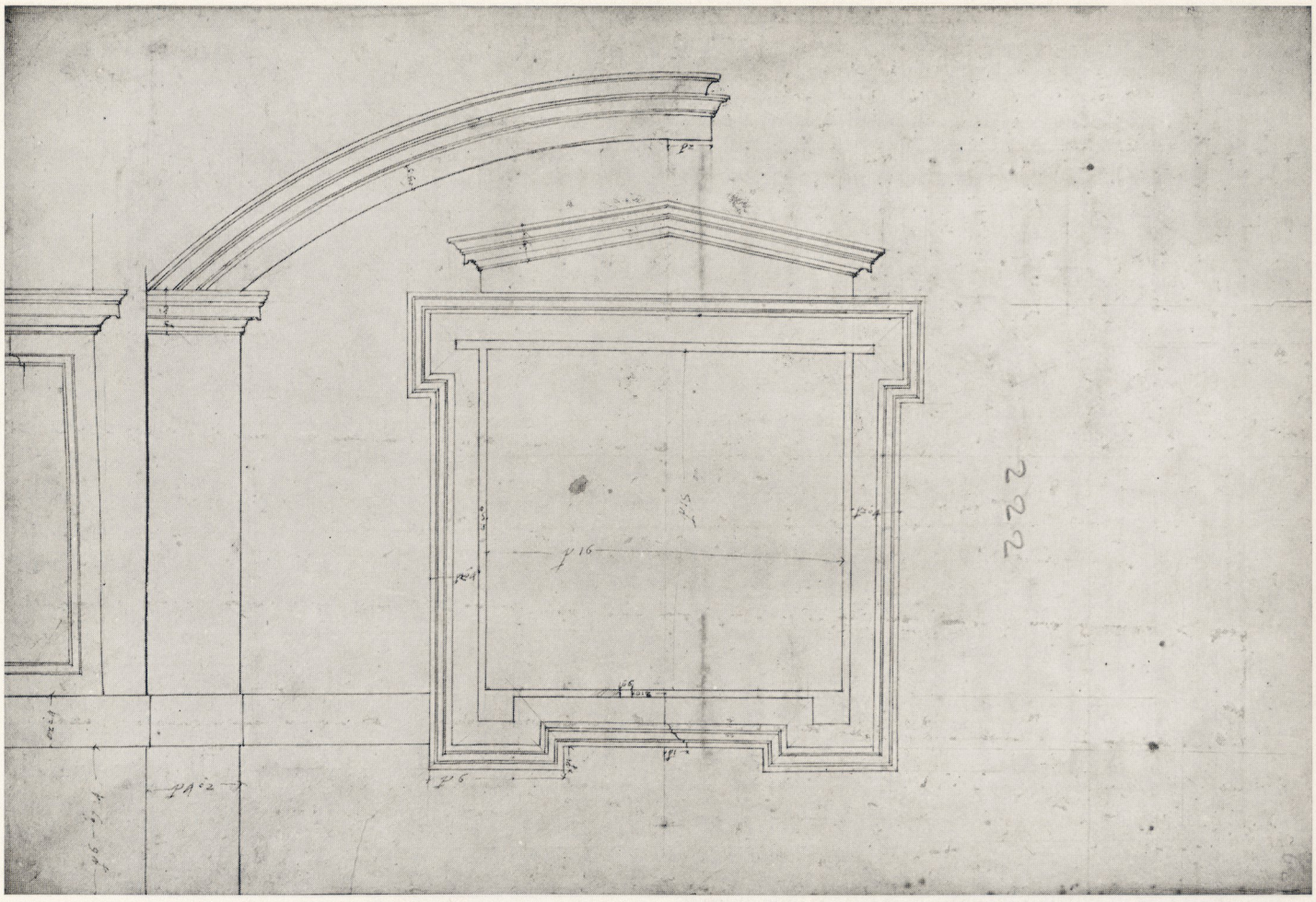
When there is a discrepancy, the inscribed dimensions are invariably larger than the scaled. Five of the larger differences are localized in the window dimensions. The smaller scaled vertical dimensions could refer to the adjustments in vertical dimension mentioned in note 8. The window is 5 by 4 *oncie* smaller than the inscribed dimension, and both the moulding framing the window and the inset frame are narrower when scaled (2 *oncie* and 1:3 *oncie* respectively). The lug at the bottom of the window moulding scales 1 *oncia* smaller. The two remaining of the larger discrepancies are in the height of string course and base.

This reduction in height of the base may be related to the adjustments made for inclusion in Dupérac's print of the section (see note 8).

Inscribed dimensions are missing for the vertical and horizontal extensions of the lugs at the top of the window, the flat and articulated portions of the frame. Dimensions are also lacking for the height of the panel underneath the pediment and the rise of the pediment (where the reduction in dimension relative to the building is greatest).

13 By comparison, the window frames in the model are slightly higher than the pilaster capitals (Fig. 30), perhaps owing to the greater window height in the model, 16.6 *palmi* (12.4 cm.) versus 15 *palmi*, the inscribed inside dimension in the drawing (15 *palmi* 11:1 *oncie* including the dimensions of the inset frame). For the dimensions of all the windows in the building and model, see Part 2, note 19.

14 It is conceivable, however, that the drawing represents the right bay of the vault from the stage of the design that had wedge-shaped ribs at the vault's open end. To the right of the window light pencil construction lines indicate the continuation of the horizontal string course, a symmetrically placed pedestal (for the segmental arch) and rib, both with the same dimensions as those on the right. It is possible that these might represent a wedge-shaped rib next to the barrel vault if the wedge-shaped ribs were to be the same dimension as the central ribs instead of smaller, as they are in the model. Construction lines that would indicate a panel on the face of the rib (as on the left) are missing.



41. St. Peter's, elevation of part of interior of apse vault. Drawing by Etienne Dupérac or assistant. Circa 1569 (Metropolitan Museum of Art)

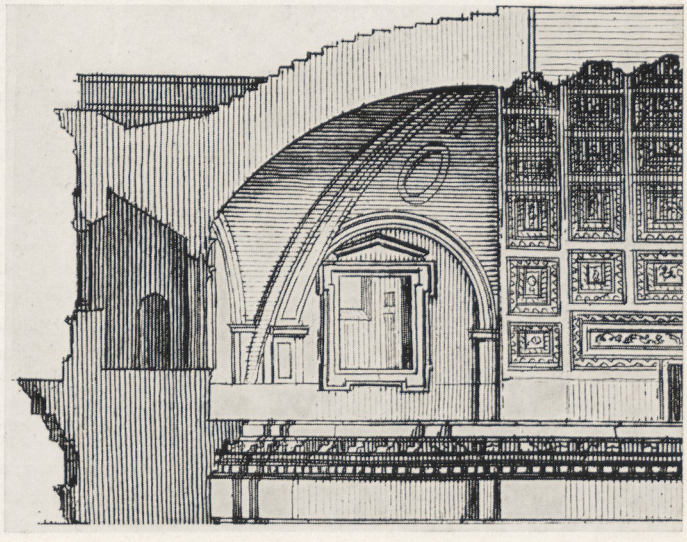
The Metropolitan's drawing evidences dependence on several sources. As far as we know, one dimension can only have come from the central bay of our vault model. The inscribed dimension for the width of the pilaster at the left of the window (*palmi* 4 *oncie* 2) is unusually large, and only

The edges of the ribs in the drawing are vertical and do not taper as does the rib panel on the left. In a true elevation (*i.e.*, projection) the left rib would lean to the right, the other to the left, as, for example, in the north hemicycle elevation in Ferrabosco (1620), pls. IX and XIV (Fig. 31). In a flattened elevation the rib edges should taper parallel to the rib panels. The vertical edge may be either a technical or drafting error.

Half of the rib width on the left and right scales *palmi* 5 *oncie* 11 to the center line, making a total rib width of *palmi* 11 *oncie* 10, larger than that found in any other source except the Dupérac print (cf. Letarouilly [1882], pl. 7:9.85 *palmi*; Ferrabosco [1620], pl. XI: 11.0 and pl. XIV [Fig. 42]: 10.1 *palmi*; the vault model: rib on left 10.6 *palmi* [7.9 cm.], on right 10.7 *palmi* [8.0 cm.]). In the print the rib width scales 14 *palmi*.

The source for a rib of *palmi* 11 *oncie* 10 remains unknown. But the width approximates the scaled widths of the salient arch (Letarouilly [1882], pl. 11: 11.2 *palmi*; Ferrabosco [1620], pl. XXIV: 12.6 *palmi*; the Dupérac print: 11.2 *palmi*; the Salamanca print: 12.0 *palmi*). All representations, except the Dupérac print, agree in showing the rib widths to be narrower than the width of the salient arch.

42. St. Peter's, longitudinal section. Ferrabosco [1620], pl. XIV (detail)



the pilaster to the left of the central window in the vault model has a dimension close to it, *palmi* 4 *oncie* 5 (all other pilasters in the model are *palmi* 3 *oncie* 8 or smaller).[15] In this connection it is of interest that the drawing is at the same scale as the vault model. Reference to the model should not be unexpected, since Dupérac evidently took the height of the main vaults from Sangallo's model, where we assume our vault model was at the time.

But the drawing cannot stem wholly from our model. It includes under the window the base, which, if it ever existed in the model, must already have been removed (Fig. 21) by the time the drawing was done. It has some inscribed dimensions that must come directly or indirectly from the building, because they contain *minuti*, ascertainable only from the building.[16] And not least, there are details in the drawing that differ from what we find in the model and at the same time from what we find in the building. Neither source accounts for several features of the drawing: rectangular window intermediate between the practically square windows of the model (Fig. 37) and the rectangular windows of the building (Figs. 7 and 26),[17] upper window-frame lugs that are smaller than in the model (Fig. 30) and building (Fig. 26), and slots in the upper corners of the window narrower than in the building (Figs. 26 and 38) or any other representation (for example, Fig. 11) and not present in the model at all (Fig. 21).[18] Another such element may be the rib cornice in the drawing. It is only the width of the rib panel, not the full width of the rib as in the building (Fig. 26) and the Dupérac print (Figs. 39 and 40). The cornice is absent today in the model, as we have seen.[19]

The testimony of these details is that the draftsman had a source besides our model and the building. A reasonable guess is that he used a model or drawings seemingly authoritative while in fact preserving stages of the design earlier than that of the completed vault. One source could have been the model to which we assumed Michelangelo's words in the letters to Vasari referred, hypothetical vault model B, a model that would have been made after ours and followed in constructing the vault during the first campaign (late 1556/early 1557 to around 1 May 1557).[20]

The drawing in the Metropolitan Museum calls our attention to the development of the open slots at the corners of the windows in the vault. These, we saw, were not present in the vault model (Fig. 21). Comparison of the model, drawing, and finished building (Fig. 38)[21] indicates that Michelangelo came to the slots in the later stages of his design and that at one point they may have been thinner in

15 We do not have measurements taken from the building for the width of the little pilasters supporting the segmental arches, and there is no plan at a sufficiently large scale to provide accurate scaled measurements. From the plan of the attic level on the multi-level plan in Ferrabosco (1620), pl. VIII, the little pilasters scale c. 3 *palmi*. Scaled from the elevation shown in Ferrabosco (1620), pl. IX (which shows the pilasters obliquely, not in true elevation) the dimension is c. 3.5 *palmi*. Both seem to indicate that on the building the little pilasters are somewhat smaller than the normal width for the model (3.64 *palmi*) and significantly smaller than the unusually wide one to the left of the central window in the model (4.28 *palmi*). The width of the little pilasters in the model, from left to right, in centimeters, is as follows: 2.3 (3.4 *palmi*); 2.8 (3.65 *palmi*); 3.3 (4.42 *palmi*); 2.8 (3.65 *palmi*); 2.8 (3.65 *palmi*); and 2.2 (2.95 *palmi*).

16 At the scale of the model and drawing, 1:30, 3 *minuti* (the smallest inscribed dimension) would be .372 mm. (1/20 in.). The smallest unit of measurement commonly used in building in Rome was the *decimo*, equal to $^1/_2$ of a *minuto*. The *decimo* was the equivalent of 1.86 mm. (c. $^1/_4$ in.). 3 *minuti* at 1:30 would have been five times smaller than the smallest dimension in use and virtually unmeasurable on a model or drawing. See also Millon/Smyth (1969), 488–491, note 12, where dimensions in Roman, metric and foot/inch systems are compared.

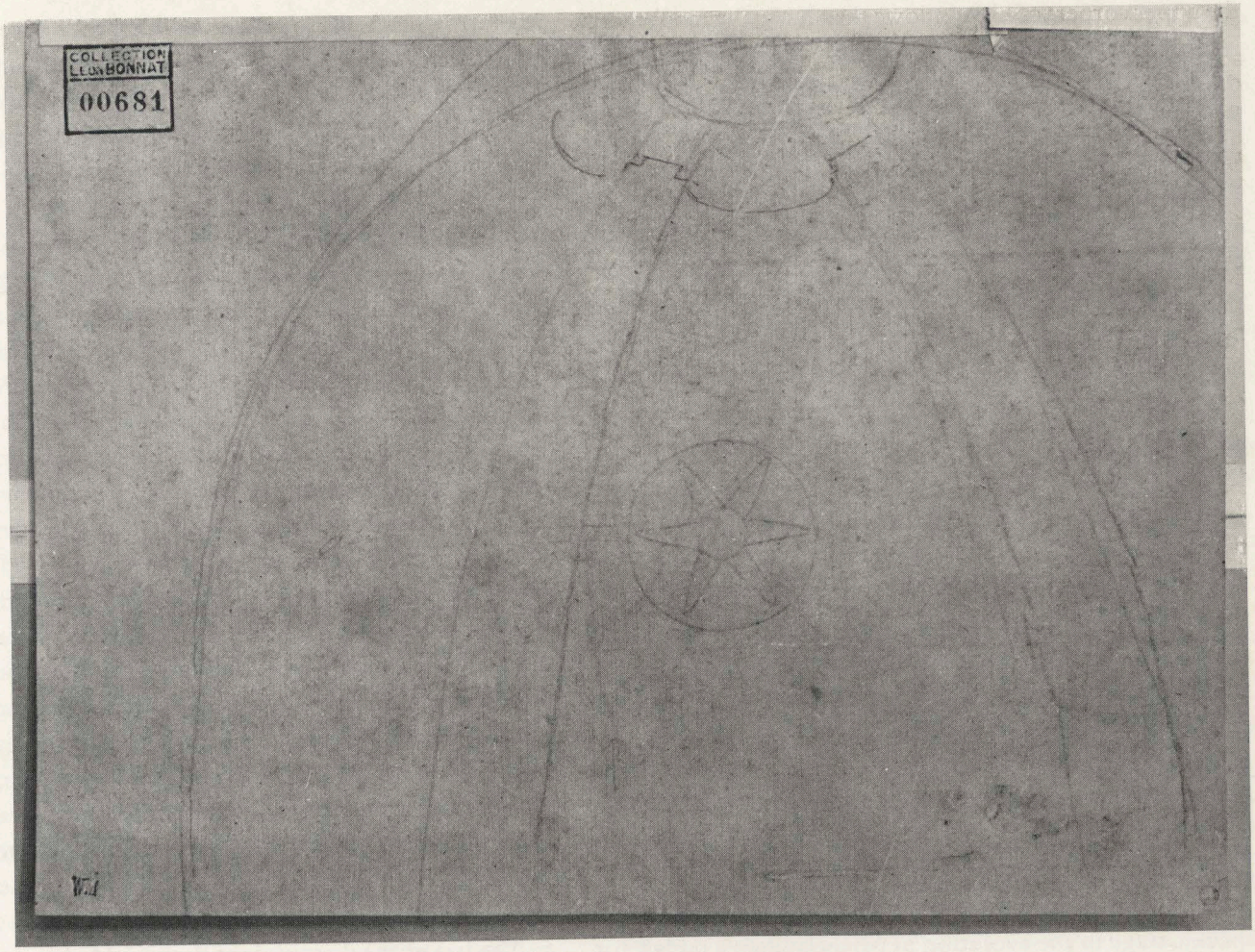
17 As in the building, the window is a slightly horizontal rectangle with the inscribed dimensions 15 × 16 *palmi*. (It scales, however, only 14.7 × 15.6 *palmi*.) On the building the central window on the south is 15.6 × 17.4 *palmi* and that on the north, 15.3 × 18.2 *palmi*. (For the measurements of all the windows in the apse vaults of the building, see Part 2, note 19.)
(The inscribed dimensions of 15 × 16 *palmi* are those of the rectangular frame set back 18 *oncie* inside the main frame. This inset frame opens on the space under the formerly coffered attic vaults on the exterior, whereas the main frame opens on the interior of the building. The dimension of the main opening in the drawing [roughly *palmi* 16 × 17] may be found by adding the inscribed dimension of the inset frame [*oncie* 5:3] to the dimension of the inset opening [*palmi* 15 *oncie* 11:1 by *palmi* 16 *oncie* 11:1].)

18 The lugs at the bottom have an inscribed width of 6 *palmi*, the same as that inscribed in plate IX of Ferrabosco's volume. On the contrary, at the window head the height of the lugs, when scaled, is 4.66 *palmi*, inexplicably small as compared to the scaled dimension from the same plate in Ferrabosco. This dimension scales in the model 6.03 *palmi* (4.5 cm.), in Letarouilly (1882), pl. 11, 5.83 *palmi*, and in Ferrabosco (1620), pl. IX, 6.5 *palmi*. The slots in the upper corners are correspondingly narrow. The upper window lugs and slots may, therefore, derive from another source. See below note 20.

19 The short rib cornice exists, however, in plates XIV (west apse only) and IX (Figs. 42 and 11) of Ferrabosco (1620). See text below.

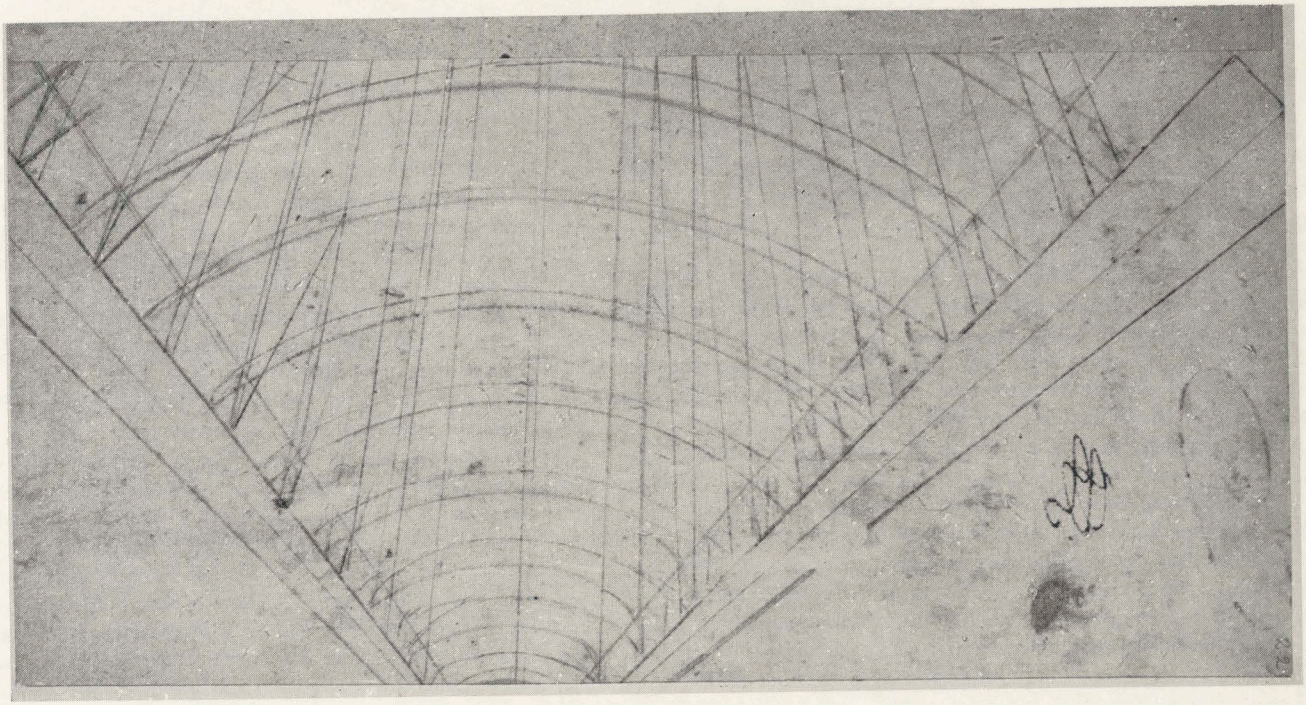
20 For possible models of various stages of the design see Part 2. That the drawing may represent a stage later than our model is suggested by the presence of the rib cornice, since today it is missing on the model but present on the building, where, however, it extends across the whole face of the rib (see below). Also, the rectangular window is closer to those on the building than to the almost square windows of the model. On the other hand, the smaller lugs might refer to an earlier stage since they are larger on the model and building.

21 At some point after Michelangelo's apses were finished, the slots in the upper corners of the *central* windows of the vault only, were filled with small setback consoles (Fig. 26). These are not present in the representations of Ferrabosco or Letarouilly.



43. Sketch of vault of south apse of St. Peter's, by Michelangelo. Probably 1557 (Musée Bonnat, Bayonne)

44. Study of angles of junctions between gores and ribs of south apse vault of St. Peter's. Probably 1557 (Cabinet des Dessins, Musée du Louvre)



the upper corners of his windows than he finally made them. Michelangelo's introduction of the slots had to do with one of his chief concerns in the apses, the behavior of incoming light. We shall come to this at the conclusion of our discussion.

In his print (Fig. 40) Dupérac agrees with the drawing, except in two details that are closer to the building. He enlarged the upper window lugs, and he extended the rib cornice across the entire face of the rib.[22] But he neglected to alter the major discrepancy, the height of the pilaster capitals and rib cornice. Nor did he change the central window pediment from triangular to segmental. In these respects sources preceding the final design prevailed.

In view of his sources, it should not surprise us greatly that Dupérac included, next to the salient arch, the narrow tapering member extending from the main entablature to the half-medallion, articulated only by the string course (Fig. 39). Conceivably he was reflecting, in a wider version, the mouldings next to the salient arch similar to Michelangelo's drawing of 17 August 1557 (Fig. 23).[23] But it is more likely that in a confused and conflated way he was depicting a narrow version of the wedge-shaped ribs belonging to the altered model (Fig. 24) and to the building's first construction, *together* with the salient arch.

In our view the print probably does not represent any specific stage in the evolution of Michelangelo's design for the vault. But it and the drawing testify that a source or sources for earlier stages of the design in addition to our model still existed when Dupérac prepared his prints, accessible to him and carried so far as to seem to him reliable.

There are two more drawings by Michelangelo showing his apse vault for St. Peter's besides those we considered in Part 2. Both were first attributed to him and connected with St. Peter's by Charles de Tolnay. It appears likely that Michelangelo drew them as a result of the foreman's error in building the vault on the south apse in 1557, the error that gave Michelangelo the chance to make final changes in his design. They both illustrate aspects of the vault that the error particularly concerned, and they give two more glimpses of Michelangelo at work – one less, one more informative.

One of these drawings, in the Bonnat Museum at Bayonne (Fig. 43), is a quick free-hand sketch of part of the vault's interior elevation.[24] It could have been drawn to explain the results of the error in a very summary way. The draftsman's interest is concentrated at the top. The part drawn most emphatically is the section line showing the curve of the gores near the half-medallion together with the profile of the ribs.[25] This line could well be where construction was halted. We saw in Part 2 why it was that the foreman's error was first realized as construction "began to approach the half-medallion" at the top of the vault. It was because near the half-medallion the difference between the constantly increasing curvature of the gores intended by Michelangelo and the flatter, unchanging curvature of the foreman's mistaken construction could not have gone unnoticed any longer. The drawing's emphasis on a profile near the top of the vault suggests that Michelangelo may have drawn it after the discovery of the flaw and when considering its consequences, perhaps as he talked to someone about the mishap. In this case it dates from around the end of April or early May 1557, a relic of the time when Michelangelo first confronted the prospect of dismantling and rebuilding.[26]

The last of the drawings we have by Michelangelo of the apse vault, a drawing in the Louvre (Fig. 44), concerns a specific problem imposed by the unusual use of travertine masonry as the sole material for building the vault.[27] As Michelangelo wrote Vasari, "... no masonry fill goes into

22 Dupérac indicates slots, but omits their light (see note 42). The print shows, in the vertical base under the ribs, that Dupérac added a salient portion in the center corresponding to the width of the panels. This salient element does not appear in the drawing, which shows the base as it is on the building (Fig. 38). The only other representation that shows the salient portion below the rib panel is our model. There, but on the left rib only, the string course at the base has a salient element (Fig. 30). (The string course at the base of the rib to the right of the window is like the building.) For the print, Dupérac apparently drew from either the model or another source showing this detail.

23 For discussion of these mouldings see Part 2, note 40.

24 Bonnat Museum 681 *verso*. Tolnay (1965), 251, note 13, pl. 58.4. Tolnay first cited the drawing in *Michelangelo*, V, Princeton (1960), 185, no. 174, without associating it with St. Peter's. Also noted by J. Bean, *Les dessins italiens de la Collection Bonnat*, Paris (1960), no. 68 *verso*. On the *recto* is a sketch for the *Last Judgment* of the Sistine Chapel (Tolnay [1960], fig. 138). We are most grateful to M. P. Bazé of the Musée Bonnat, Bayonne for permission to publish this drawing.

25 The ribs are shown with raised central panels as in the building today, the vault model, the drawing of 1 July 1557 (Fig. 22), and perhaps that of 17 August 1557 (Fig. 23).

26 Since the edge of the vault in the drawing cannot be interpreted to indicate either wedge-shaped ribs or salient arch, it offers no further indication of date.

27 Louvre 842 *verso*. Cited as by Michelangelo, but not yet associated with St. Peter's, in Tolnay (1960), 221, no. 248, fig. 220; identified with the south apse in Tolnay (1965), 250, n. 13, pl. 58.3, and Tolnay (1967), 73, n. 6. F. Hartt, *Michelangelo Drawings*, New York (1970?), 352, no. 513 follows Tolnay. Dussler (1959), 193, no. 358, believed the drawing to be by another hand. On the *recto* is one of Michelangelo's late drawings of the *Crucifixion* (Tolnay [1960], fig. 222).

said vault, but instead it is all travertine", and again, "The vault, both the dressed stone and spaces, is all of travertine like the other things below, something not done in Rome."[28]

The blocks of travertine had to be cut precisely in order to form the surfaces of the gores. Vasari wrote admiringly about the perfection Michelangelo achieved by the exact cutting and fitting of the individual blocks in the vault as finally completed.[29] Because of the gores' ever-changing curvature, the angles of the faces of each block had always to be slightly different from one block to the next. The original foreman's failure to comprehend the way the curvature of the gores should change meant that the blocks were wrongly cut, increasingly so as construction approached the crown.[30] As Michelangelo wrote, "... a great number of stones [*i.e.*, blocks] had to be dismantled."[31] They could not have been used again without recutting.

In the drawing at the Louvre, which pictures the width of the ribs in plan, the thickness of the gore, and perhaps the depth of the ribs, Michelangelo appears to have been working out empirically by eye a way to visualize the constant change in the angles for the joints between the travertine blocks of the gores and the ribs.

The masonry gore, supported partially by the ribs and partially by itself, acts as an arch, spanning the distance between the ribs. Ideally the plane of each joint should be perpendicular to the weight of the main thrust of the gore. As the curvature of Michelangelo's vault increases toward the crown, sections through it will show lines of thrust tending more and more to the vertical where they meet the ribs. The plane had to change slightly with each block, the angle becoming more acute as the curvature increased toward the crown.

In the drawing, the lines connect a series of sections through the thickness of the ribs to three and possibly four different trial-points, which are off the sheet. Each of these points produced different angles for the planes of the joints. One of the points, the farthest removed, has more lines drawn to it than the others, particularly from the rib on the right, and therefore may be the one chosen by Michelangelo. The plane of the joint is the acute angle between the lines drawn to the point and the edge of the face of the rib (shown within the thickness of the rib and gore).[32]

Michelangelo's observation to Vasari that making a vault of travertine was "something not done in Rome" implies there was no local tradition for the fashioning and building of cut stone vaults. Probably no foreman, unless trained in the north, would have been able without instruction to supervise correctly the shaping and erection procedures required by a stone vault of double curvature.[33] Michelangelo may well have had to rediscover the principles for himself as well as find ways to convey them to the builder. He may have made this drawing in order to understand the problem more thoroughly or to provide information to the foreman. Had such a drawing been available before the first construction campaign, it is less likely the original foreman would have erred. Thus the drawing could have been done with the second foreman in mind and could date, then, be-

28 For our translation of Michelangelo's letters of 1557 to Vasari, see Part 2, note 29.

29 Vasari-Milanesi, I, 123. (See Part 1, note 26).

30 See Part 2.

31 For the letter, see Part 2, note 29.

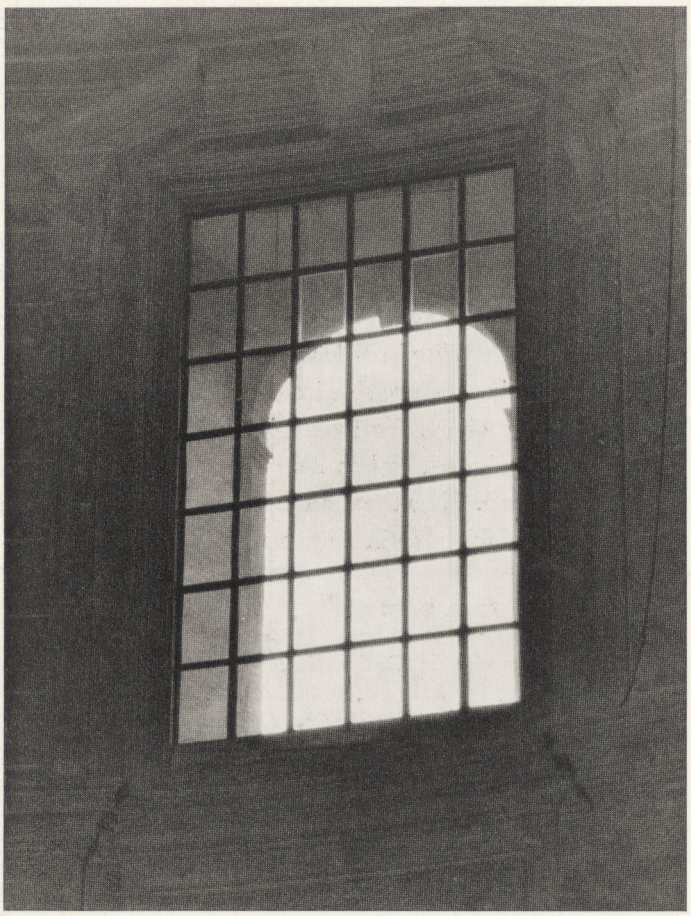
32 The trial-points suggest Michelangelo was experimenting with a trial-and-error representational technique unfamiliar to him. Geometrically derived drawings, on the other hand, examining this kind of problem in the mid-sixteenth century were common in France (see, for example, Philibert de L'Orme, *Le Premier Tôme De L'Architecture De Philibert De L'Orme*..., Paris, 1567), where they were a continuation and elaboration of medieval stereometric techniques.

The arcs in the drawing do not show the curvature of the gore. They are drawn from a single point and are probably construction lines intended to connect points of equal distance along the ribs, so that lines from the trial-points could be drawn to the same point on each rib. To be sure, in the lower drawing of Michelangelo's letter of 1 July 1557 (Fig. 22) Michelangelo drew the lines indicating the curvature of the gore from a single point (see Part 2), but it is an elevation, not a plan. To show a gore in plan the arcs would need to be drawn as in the letter of 17 August 1557 (Fig. 23), *e.g.*, with center points moving along the center line of the gore.

Michelangelo has shown the ribs with too great an angle between them. The angle between the center line of the ribs is a degree or two less than a right angle, whereas, in the building, the angle between the center lines of the ribs flanking the central gore is slightly more than 60 degrees. (The angle is slightly more because, in order to make all three gores equal, the ribs and pilasters below were shifted apart about 1.5 *palmi* each.) By making the angle between the ribs in the drawing about 30 degrees larger than in the building Michelangelo added about 15 degrees to the angle of intersection of the gores and ribs. An increase in curvature of the gore, such as Michelangelo planned after the foreman's error, would result in an increase in the angle of intersection of rib and gore. He may have spread the ribs in the drawing to examine the increased angle that would result from increasing the gore's curvature.

(It is conceivable that Michelangelo may instead have been working out a way to represent the angle of the centering as it abuts the rib or rib centering during construction. But this would mean that he was at pains to show the depths of the rib centering and the angles between the centering for the rib and gore. This alternative seems less likely because these planes are not as critical for centering as they are for stone joints.)

33 Vaults of double curvature in cut stone occasionally occur in mid-sixteenth century Italy, *e.g.*, the pendentives in S. Biagio in Montepulciano (Fig. 13). But brick was the traditional material for webs in rib-vaulted structures and vaults in general.



45. St. Peter's, interior view of north apse, northeast window

46. St. Peter's, interior view on axis of north apse, central window

tween the discovery of the error in late April 1557 and the beginning of the final construction after mid-August.

The drawing in the Louvre is the only drawing known to us that shows Michelangelo grappling with a complex engineering problem and therefore has a special interest. He does not appear to be working with any set of standard geometrical principles. He appears instead to have a partly intuitive understanding of the structural principles of vaults of double curvature and to be using the drawing to test this intuition in a visual representation. He rejects several trial points. He apparently judges the points and angles by eye. His perception of the problem alters as he draws. He selects the final point because it accords with his new understanding of the structure.

The history of Michelangelo's apse vault shows his openness to change and improvement as he worked. As we saw in Part 2, it was the assistant's mistake in executing the model of the vault that apparently led him to a major innovation. The error of the foreman in constructing the vault itself, for which Michelangelo felt partly to blame and which was both embarrassing and expensive, gave him an unexpected chance to consider the design again.

When the second mistake was discovered late in April 1557 and dismantling was necessary, Michelangelo thought it a disaster. As late as 1 July he wrote Vasari: "If it were possible to die of shame and sorrow I should not be alive." But, as we saw in Part 2, it was after writing this that he took the opportunity offered by the mistake to make crucial changes. It is not often an architect has a chance to dismantle, rework, and rebuild after a design has been almost entirely achieved. In the end, he must have welcomed it.[34]

Gregory Hedberg has recently found that on occasion Michelangelo used the design of a detail from an earlier architectural project as the basis for improvisation leading

34 We are reminded of Ackerman's supposition that Michelangelo would have welcomed the chance to destroy and rebuild finished parts of his buildings "as he did with his later sculpture" (Ackerman [1961], 9).

47. St. Peter's, interior view of south apse from below

to a quite different and fresh design for a detail in a new architectural project.[35] Evidently it was congenial to him to work toward a new design from a previous one, however satisfied he may have been with the earlier solution originally. In this spirit he capitalized on the errors of assistants in the model and on the building.

The design of the apse vault as first constructed with wedge-shaped ribs at its open end emphasized the separateness of apse from arm. The wedge-shaped ribs belonged visually to the apse even though they were above the salient pilasters (Fig. 24). They appeared independent of the barrel vault and formed a unit with the other two ribs. They made a half dome of four ribs reminiscent of the idiom of Tuscan ribbed domes,[36] in contrast to the massive Roman vaulted spaces of Bramante's and Sangallo's St. Peter's.[37] Also, they were consistent with the vertical skeletal structure of the apse. Wedge-shaped ribs over the salient pilasters meant that, in relation to the vault, the salient pilasters themselves appeared part of the apse and thus partially detached from the walls of the arm. In this aspect they acquired something of the character of the pier-pilasters of the apse and contributed more vertical emphasis at its beginning. By wedge-shaped ribs Michelangelo thus apparently intended discontinuity between the earlier building and his new apses. They

35 Gregory Hedberg, "The Farnese Courtyard Windows and the Porta Pia: Michelangelo's Creative Process", *Marsyas*, XV (1972), 63–72.

36 As in Brunelleschi's Old Sacristy of San Lorenzo, Florence and Giuliano da Sangallo's Santa Maria delle Carceri, Prato.

37 In a stage of Sangallo's design for St. Peter's earlier than the one represented in Salamanca's engravings from 1549, his apse vault was more reminiscent of Tuscan domes, as witnessed by the section of St. Peter's shown in the drawing Uffizi *Arch.* 66 (G. Giovannoni, *Antonio da Sangallo il Giovane*, Rome [1959?], II, fig. 71). Here the ribs were placed against a semidome punctuated by lunettes with *oculi*. In Sangallo's model of 1539 (Fig. 3) the *oculi* were changed to *thermae* windows. (For discussion of Sangallo's windows at the vault level in his model, see Part 1.) Shallow gores replace the semidome in the Salamanca print of 1549 (Fig. 4).

would certainly have enhanced awareness of the fundamentally different conception of his apse design.

Again in the design of the vault as first constructed, Michelangelo united horizontally all the elements that are at the level of the windows. As we have seen, a horizontal was formed by the window head, the spring point of the segmental arches under the gores, the pilaster capitals and – to judge from the drawing of 1 July 1557 (Fig. 22) and the Metropolitan's drawing (Fig. 41) – the cornices on the ribs. On a lower level, the window sills, string course, and bases of ribs and pilasters also formed a continuous horizontal line, as they still do in the building today. The result was a linear emphasis on horizontal relationships (Fig. 33). If executed in stucco and *pietra serena*, the effect might well have recalled the interiors of some of Michelangelo's Florentine work. The horizontal emphasis at the vault level presented a contrast to the predominant verticality below. In the earlier stages of the design, Michelangelo evidently desired this contrast in his apses between the vault level and the elevation of the main order, a contrast somewhat analogous to that on the exterior between the original attic and the main order.

Why did Michelangelo not simply rebuild the vault as he intended it at the time of its first construction? Why did he change the design after the foreman's mistake? Why did he return to a salient arch, which he had planned when the inserted vault model was first made (Fig. 37)[38] and then rejected? Why did he change the horizontal relationship and deepen the gores?

The reasons for abandoning the wedge-shaped ribs for the salient arch and redesigning the vault after the foreman's error may have been both structural and formal. The structural reasons may have been two.

The foreman's error had resulted in making the gores too shallow toward the summit, shallower even than Michelangelo intended as seen in the vault model (Fig. 21) and the drawing of 1 July 1557 (Fig. 22). In re-examining his vault, Michelangelo may have thought that it might make construction easier if he were to deepen the curvature, concentrating more vertical load on the ribs.

As the vault was first built, with the wedge-shaped ribs at its open end, the half-medallion was located in the same place as the crown of the salient arch today. The gores were not, therefore, regular sectors of a circle. Either the bases of the two ribs dividing them could not be parallel to the faces of the main pilasters below, or the ribs had to curve in plan along their length. The stereometric problems must have been compounded as a result. Returning to the salient arch and a semicircular plan for the vault, and thereby shifting the half-medallion to a new location inside the apse itself, simplified construction.[39] To make this change the entire vault had to be dismantled and the two ribs redirected to the half-medallion in its new position.

The formal reasons for the final major changes in design appear to have been concerned with the relation of the apse to the arm and the relation of the vault area of the apse to the elevation below.

Once he considered deepening the curvature of the gores, which he was to do by lowering the spring points of the segmental arches, Michelangelo may have perceived that it was no longer so necessary to seek discontinuity between apse and arm by means of the wedge-shaped ribs. Sufficient contrast to the massive Roman vault of the arm would be inherent in the new form of the apse vault. Confident of this, he could afford to give more importance to integrating apse and arm. By reintroducing the salient arch he could achieve more integration and yet at the same time reinforce the contrast.

The salient arch we see today in St. Peter's (Fig. 7), although in the same place in the building as the wedge-shaped ribs of Michelangelo's model (Fig. 24), belongs visually to the barrel vault, not to the apse. But at the same time it is clearly an indispensable supporting member for the apse vault. The salient arch is the termination of the barrel vault, and the whole apse including the half-medallion abuts it, not merely the adjacent gores (Figs. 15 and 29). Even though the salient pilasters divide the apse from the arm, they must also be read partly with the pilasters of the apse (Fig. 15). This double duty of salient arch and salient pilasters both integrates and separates apse and arm.

Michelangelo achieved the deepening of the gores by keeping the crown of the segmental arches at the same height and lowering their spring point about 4 ft. 5 in. (1.38 m.; 6 *palmi*) to a level about three-quarters of the height of the window opening (compare Figs. 11 and 37). This shortened the radius of curvature of the arches which, in turn, deepened the curvature of the gores throughout their length.

With the deepening of the gores came a new emphasis on the ribs (Figs. 11, 37, 7 and 21). They appeared to take more of the load. As the load concentrated on the ribs, the gores and vault appeared lighter. With the greater depth

38 For the reconstruction of the original state of the model, see Part 2.

39 For the change in location of the half-medallion, see the discussion in Part 2.

of the gores, larger portions of the gores at the sides were hidden behind the salient arch (Figs. 15 and 10), increasing the appearance of lightness. The infill of the window wall, apparently relieved of load, looked more independent of the vault, and consequently more easily penetrated and more continuous with the exterior. The result (except for the presence of ribs) recalls more sharply than before the articulated and gored vaults of Hadrianic and later Roman structures, such as the vestibule of the Piazza d'Oro of Hadrian's Villa.

As part of the change, the ribs became less like linear elements against the surface of the vault. They gained in three-dimensional substance and massiveness. Before, as the vault model shows (Fig. 21), the three gores had tended to look like parts of one continuous surface. Now they became strikingly independent of each other and at the same time more monumental (Fig. 7). Meanwhile, the skeletal structure emerged with new clarity (Fig. 2). The ribs carried the vertical upward more dramatically; the window walls were more decisively separated from the vertical structure. The vertical organization of the apse below was thus continued more emphatically in the vault.

With the lowering of the spring points of the arches under the gores, the earlier continuous horizontal of pilaster capitals, rib cornice, and window head was, of course, broken (Figs. 38, 7 and 21). The horizontal bond that had tied the structure and the infill of the window wall was interrupted and the contrast between horizontality at the vault level and verticality below decreased.

The greater differentiation between support and infill in the vault, enhanced by the apparent lightening of the gores and their undulating rhythm, was in keeping with the dramatic emphasis on differentiation between support and infill below, which we observed in Part 1. Michelangelo achieved in the apse vault a dynamic relationship between structure and infill that had the effect noted in Part 1 on later vault and dome design. He must have realized what this would do to increase vertical continuity, integrating the upper level with the lower.

Important to the effect of the vertical structure in the building we see today is the way the little pilasters and ribs are bound together at the new lower level. A cornice of identical profile is continuous over the pilasters and the sides and face of the ribs (Fig. 26). Little pilasters and ribs are thus linked by their cornices as the *ressauts* linked the wall strips and pilasters in the second story. Hence, although the cornice is continuous, its breaks emphasize the vertical continuities leading from the lower to the upper level.

It is not entirely clear that Michelangelo is responsible for the binding. At the stage of the design represented by the vault model the rib cornice, we have seen, may not have been included at all (Fig. 30). In the Metropolitan Museum's drawing (Fig. 41) the binding is not shown: the rib cornice is no wider than the panel on the face of the rib. The binding may have been achieved, however, in the first construction of the vault, since the drawing of 1 July 1557 suggests it (Fig. 22). Also, it is seen in Dupérac's print (Figs. 39 and 40) and in one of Ferrabosco's plates (Fig. 8). But in two other representations of Ferrabosco (Figs. 11 and 42) the rib cornice is no wider than the panel of the rib. This makes it impossible to be sure that Michelangelo was responsible for the way the ribs and pilasters are bound at present.[40]

Michelangelo's changes reinforced vertical continuities through all three levels. In his new conception of continuous verticals linked, if not bound, together at their top by cornices at the same level, well below the window heads – and splaying from this level to become the ribs and segmental arches (Fig. 8) – Michelangelo could well have realized that he had achieved something of the vertical unity of gothic structure. His new conception was of particular interest to architects of the 17th and 18th centuries.[41]

We have seen evidence that in the later stages of the design Michelangelo made changes in the windows of the apse

40 The west apse vault as shown in a drawing at Windsor (I. Lavin, *Bernini and the Crossing of St. Peter's* [1969], fig. 34; H. Hibbard, *Carlo Maderno* [1971], fig. 73c) appears to have a continuous moulding across little pilasters and ribs. (The drawing represents incorrectly the relation of window head and the moulding across the face of little pilasters and ribs.)
If the short sections of moulding that link the rib to the little pilasters were not placed by Michelangelo, they were most likely an addition made when the apse vaults were decorated for the 1750 Jubilee (see Part 1).

41 Ackerman (1961), 39–41; 63–65 and (1970), 42, 47–52 and L. Moretti, in an article we have read since writing this section ("Le strutture ideali della architettura di Michelangelo e dei barocchi", *Atti del Convegno di Studi Michelangioleschi*, Rome [1966], 444–454), apply the logic of structure and expression of structure to Michelangelo's vestibule of the Laurentian Library, the Palazzo dei Conservatori, and the Sforza Chapel, as we have attempted to do in Parts 1 and 3. In the studies in preparation we extend our discussion to the exterior of the apses and to the relationship between exterior and interior.
Moretti's conclusions about the relation between real and visual structure in the buildings he examines are similar to ours about the apses of St. Peter's. His dramatic cut-away models demonstrate his view of Michelangelo's conception of the actual and visual structural systems in the buildings studied. When considering the Palazzo dei Conservatori, however, he did not indicate in his model and drawings the structural and formal function of the piers behind the main pilasters, discussed by Ackerman (1961), 64–65. In the Laurentian Library vestibule, neither he nor Ackerman consider the pilasters placed in the sides of the walls between the column pairs of the main order, which must be there partly to indicate a preferred directional relation of column to wall.

vault. He widened them slightly, and he introduced slots at their corners – ultimately all of the same size, though at one stage apparently the slots in the upper corners were narrower than those in the lower.[42] These were small changes compared to those we have just considered. Both gave greater importance, however, to the window opening, and one, the introduction of the slots, points to a significant aspect of Michelangelo's concern with light in the apses of St. Peter's.

Michelangelo showed as much concern, we believe, for the openings in the apses and the behavior of the light they admit as he did for vertical continuities and the contrast between structure and infill. He thought in terms of the effect of light on all the elements of the apses and on those who view and use the building. Indeed, he appears to us to have transformed incoming light into a tangible and active compositional element with religious implications.[43]

In Part 1 we observed that Michelangelo rejected Sangallo's fragmented, indirect light and turned to single large openings admitting much light directly, sometimes including the direct rays of the sun. His loggia-light boxes with their large plain surfaces accorded a major role to reflected light as well. The quality and quantity of incoming light gained greatly in importance. In the second story we saw that his treatment of the openings affected the walls to a greater degree than Sangallo's. The way he recessed and articulated the windows in the thickness of the walls seems to underscore the determining effect he wanted openings, and the light they admit, to have on the walls.

When Michelangelo introduced slots in the corners of the upper windows, he added, on the one hand, a note of complexity. The slots make the window frames appear to be composed of four separate members, joined only at the periphery, the two jambs seemingly having slipped downwards. On the other hand, he also added points of light where there should be corners. He thus increased the diffusion of light at the edges of the window. In so doing he showed his consciousness of, and purposeful interest in, a phenomenon that all his apse windows exhibit.

When any of the windows at either level is viewed against direct light (Figs. 2 and 15), the contrast between the intensity of incoming light and the relative darkness of the frames surrounding them causes light to spill over, or diffuse, upon the dark surfaces, partially obscuring them. The diffusion of the light makes it difficult to distinguish detail in the area near the windows, tending to dematerialize parts most adjacent to them. The window edges are eroded and the window walls lose some of their substance. This is true in the apse on the north (Fig. 15), but still more in that on the south (Fig. 2), where the light is brighter. The effect is particularly marked at the windows of the upper level, both because they are relatively larger with respect to their walls and because they have the light slots that Michelangelo introduced at the corners. Moreover, the effect at the upper level would have been much more pronounced when the attic exterior still had its original arched openings. From the crossing of the church, no part of the exterior attic vault of the central window would have been visible to obstruct the sky.

But the light of the windows of both levels alters as one moves from place to place. When the large lower windows are viewed obliquely, as those at the sides are by an observer on axis in the transept arm, or as the central one is by an observer standing at one side, they are dominated by the lighted sides of the loggia-like light boxes, not by direct light (Figs. 45 and 14). In this case, reflected light from the sides of the boxes reveals the thickness of the piers and also details of the apse interior – the mouldings of the window frames, the pedestals below the sill at each side of the frames, the broken pediment and cartouche above the windows, and the deep soffits of the architraves. Walking in the transept and apse, one experiences continuously changing transitions, from light that reveals to light that dissolves and obscures (Fig. 16). To the complex interplay of the membering its varying degrees of intensity can lend an impression of

42 We have observed that the windows, when completed, were slightly wider than in our vault model, the Metropolitan drawing, and Dupérac's section (see note 17 above and Part 2, note 19). We have also seen that slots are not shown in the vault model, although the dimension of the lugs is sufficient to allow for slots the size of those on the building. In the Metropolitan drawing the slots are present but unequal in size (Fig. 41). In Dupérac's section they are certainly present in the lower corners and probably in the upper, and they may be of equal size (Fig. 40). We cannot tell whether the windows themselves were dismantled and rebuilt with the rest of the vault. Since they were independent of the vault structure, there would have been no reason to touch them unless Michelangelo wanted to change their design. If changes were made in this last stage, they were in matters of detail such as the light slots.
(When finished, the central window of the apse had a segmental pediment. We saw that in earlier stages – represented by the vault model as altered, the Metropolitan drawing, and the Dupérac section – the pediment was triangular like those of the side windows. Whether the segmental pediment was introduced in the first or second construction of the vault, the change prefigures the well-known change later on the drum of the dome: between the making of the drum model and the construction of the drum windows the pediments on the drum's interior and exterior were changed from uniform to alternating.)

43 Ackerman (1961), 8–9, has observed that "light, for Michelangelo, was not merely a means of illuminating form; it was an element of form itself". Michelangelo did not express himself on light in architecture and, so far as we know, little has been written as to his views on the significance of light in religious structures.

fragmented accents of brightness, shade, and deep shadow, now emphasizing structure, now obscuring it. The changing conformations and complexities plainly occur, however, in the context of the bold, firm structure over all and of severe precision in handling to the last detail.

We may add that as one moves toward and into the apse, the windows at vault level become hidden behind the main entablature (Fig. 47). Direct and reflected light bathes the vault from the less visible source, giving it new buoyancy. With the wider, higher openings of the original attic, the attic floor would have reflected still more light on the vault.

That in making his design Michelangelo was indeed sensitive to the observer's position with reference to the windows and to the light they admit is shown by a remarkable circumstance which is of interest in its own right. The windows on the exterior and interior of the apses are not in alignment. To our knowledge, students of Michelangelo's St. Peter's have not made reference to this displacement. While in both the north and south hemicycles the *interior* openings of the central windows are on the axis of the transept, the *exterior* openings of both windows are displaced several feet to the east (Fig. 46, showing the central window of the north apse). In fact, all the windows of the exterior of the north and south apses are similarly shifted in relation to the interior, as if the outside walls of both had been rotated slightly toward the east with respect to the inner walls.

The non-alignment of interior and exterior windows had to be allowed for early in construction. It must, therefore, have been of much importance to Michelangelo. The reason for it will become clear to one who stands where the Pope stands as celebrant at the high altar, more than ten feet west of the center of the crossing, just above the tomb of the apostle. From this place, and this place alone, the central windows of both levels on exterior and interior are aligned. In this place, moreover, no direct light is visible from any of the four main side windows of the second-story level of the two apses. The same is true of the side windows above, at the level of the apse vault. (Although the present exterior openings of these upper windows belong to the revised design of the attic, they are placed directly above the windows below.) At any location other than that of the celebrant the central windows of the second and third stories are not aligned and some direct light may be seen from one or more of the side windows.

The Pope, celebrating at an altar over St. Peter's tomb, is the one person who can sense himself (and the tomb) to be at the "center" of the church insofar as the windows and their direct and indirect light are concerned. Bramante had not been free to place the four piers of the main dome so that the altar of old St. Peter's would be at its center,[44] and the tomb, therefore, at the center of a cosmic analogue. Although we can offer no documentation of his intention, it appears inescapable that Michelangelo manipulated those portions of the building under his control to regain the sense of centrality for the most significant site in St. Peter's.

Besides being at the "center" of the church with respect to north and south windows, the celebrant, situated on the east-west axis, would also have been aligned with the windows in the two other apses, as Michelangelo planned them. He would have been at the one location where uninterrupted light from all the central windows of all four apses converged. The celebrant would have seen, in all the central windows, uninterrupted light from the sky, the light that dematerializes adjacent forms. He would have felt that all the visible direct light in the building was oriented toward the altar before which he stood, marking its religious significance. The concern to have the direct light from all the central windows and the location of the altar coincide suggests that for Michelangelo light in religious architecture was more than illumination and an element of form.

Although he was free in the interior of St. Peter's to shape only the apses, corner chapels, and dome, Michelangelo had, through them, entire control over the lighting of the building. In using the apses to admit light, he accorded their light a richer value and a more active role than heretofore in Renaissance architecture. Instead of conceiving light and building as having a reposeful complementary relation in which light illuminates harmonious forms with equanimity and impartiality, Michelangelo accorded light an active, formative value. In his hands it intervenes as moulder, modulator, and modifier of solid materials. The observer is conscious of light as actively conditioning the shapes and modifying them, as light conditions change and as the observer moves. Light and form are interactive. In consciously directing light toward the principal point of religious signi-

44 Bramante used some of the pre-existing foundations made for a new choir and transept dating from the time of Nicholas V. For the history of the early transept and choir project see G. URBAN, "Zum Neubauprojekt von St. Peter unter Nicholas V", *Festschrift für Harald Keller*, Darmstadt (1963), and T. MAGNUSON, *Studies in Roman Quattrocento Architecture*, Stockholm (1958), 163 to 214; for the new basilica see H. VON GEYMÜLLER, *Les projects primitifs pour la basilique de Saint-Pierre de Rome*, Paris–Vienna (1875); D. FREY, *Bramantes St. Peter-Entwurf und seine Apokryphen*, Vienna (1915); T. HOFMANN, *Entstehungsgeschichte des St. Peter in Rom*, Zittau (1928); O. FÖRSTER, *Bramante*, Vienna–Munich (1956); and A. BRUSCHI, *Bramante architetto*, Bari (1969). See also now the plate volume of FRANZ GRAF WOLFF METTERNICH, *Die Erbauung der Peterskirche zu Rom im 16. Jahrhundert*, Vienna–Munich (1972).

ficance in the building, Michelangelo also gave new affirmation to the traditional association of light with divinity. We are tempted, therefore, to see his dynamic use of light to mould, reinforce, and reveal substance as testimony to what he may have felt to be the relation of divine light to earthly existence.

In Michelangelo's apses skeletal structure, vertical continuity, and concern for light as a positive architectural element of meaning all bespeak interest on his part in medieval architecture – even as the massive structural piers supporting articulated vaults recall Roman vaulted architecture. It has been suggested before that as architect Michelangelo was concerned with medieval traditions as well as ancient.[45] Amalgamating them and treating the new product as more malleable than classical Renaissance architecture,[46] he laid the basis for an alternative architecture with new expressive qualities.

45 Ackerman (1961), 101, has said of Michelangelo's main dome of St. Peter's that it "fused the forms of antiquity and the Middle Ages" and that "Michelangelo absorbed certain medieval forms into the predominantly Roman character of Bramante's basilica". Tolnay (1967), 68, has perceptively referred to the "ambulatory" within the walls of Michelangelo's apses at the second-story level (what we would call the corridor within the walls at the second-story level – see Millon/Smyth [1969], fig. 19) as serving, "together with the large windows, to lighten the structure between the solid skeleton of the pillars – a device which recalls Gothic architecture". F. Hartt, *Michelangelo Drawings*, New York (1970?), 352 mentions both vertical unity and revival of Gothic vaulting principles in the apse.

46 For a recent study of Michelangelo's views on invention in architecture, stressing his independence of strict classical precedent and conducive to new combinations, see David Summers, "Michelangelo on Architecture", *ArtBull* LIV (1972), 146–157.

APPENDIX I

Documents

I. 4.–10.IX.1546

Dadi 4 de settembre per tuto di 10 deto [1546] abiamo recieuto in S. pierro da M° Pedro dalochio fornaciaro migliara quatro de Teghole acompagnata con sua canalle qual deveno servire a coprire la volta grande verso le fornacie a scudi duodecj per migliaro posti in S. Pierro dico mja 4 monta ▽ 48

Archivio della Reverenda Fabbrica di San Pietro, Serie Prima, vol. 50, fol.18 (hereinafter: AFP, I, 50, 18)

II. 9.VII.–5.VIII.1547

Dadi 9 di luglio per tuto dj 5 de agosto [1547] espese minute fate per il modelo de santo P.o che si fa in casa di m.ser michelangelo buona rota e primeramente

La tornitura de colone 55 monta	▽ 1.34½
tavoloni 4 de tiglio montano	▽ 1.20
cola ceruna libre 2 montano	▽ –.08
Suma	▽ 2.62½

Jo. Batista architeto
per Jac Computista
Melius Pandolphinus

AFP, I, 54, 615

III. 2.V.1598

Mastro Pasano da Carrara e Scarpellini devono dare a di 2 di maggio ▽ vinti di moneta havutone mandato a bon conto del quadro di mischio che fanno per l'altare verso palazzo... ▽ 20

AFP, Armadi, 162, 6

Payments begin on 2.V.1598 and run until 28.VIII.1598 for a total of ▽ 1707:26. The final payment on the facing page reads as follows:

Mastro Pasano e di contro deveno havere a di 28 di Agosto V mille settecento novanta sette baiocchi 71 sono che tanto monta il ½ altare che hanno nella tribuna de morti et incrostatura di detto altare, e colonne e pietre di mischio del quadro di detto altare, e l'arco di pietre mischie nella nichia di mezzo di detta tribuna, e doi triangoli sopra detto arco come appare per le misura e stima fatte del S. Jac.o della Porta architetto, de quali defalcato ▽ 89:85 per l'aggio restano ▽ 1707:26

IV. 29.V.1598

Mastro Giulio Coltrice Scarpellino deve dare a di 29 di maggio ▽ trenta di moneta havutone mandato a bon conto del ½ altare che fa nella capella verso palazzo ▽ 30

AFP, Armadi, 162, 7

Payments begin on 29.V.1598 and run until 19.XII.1598 for a total of ▽ 1287:11. The final payment on folio 32 reads as follows:

Mastro Giulio Coltrice deve havere a di 19 di Xmbre ▽ mille trecento cinquanta quattro baiocchi 86 sono per il ½ altare che ha fatto nella tribuna verso palazzo cioè l'ornamento, intaglio, incrostatura, fondo di mischio dell'altare, arco, angoli, e scalini secondo la misura e stima fatta dal S. Jac.o della Porta architetto, che levatone ▽ 65:75 per l'aggio restano ▽ 1287:11

V. 31.VII.1598

Mastro Geronimo da Vanagone muratore deve dare a di 31 di luglio ▽ quindeci di moneta a bon conto della muratura delli altari con fatura delle nichie dell tribuna delli morti e della tribuna a verso palazzo a uscita ▽ 15

AFP, Armadi, 162, 17

Payments begin on 31.VII.1598 and run until 18.XII.1598

for a total of ▽ 256:50. The final payment on the facing page reads as follows:
Mastro Geronimo di contro deve havere a di 18 di Xmbre ▽ ducento settanta di moneta sono che tanto monta la mettitura in opera e muratura delle altare fatti nelle doi tribune verso palazzo e verso la piazza levato ▽ 13:50 per l'aggio restano ▽ 256:50

VI. 7.VIII.1598
Mastro Rocco Ruggia stuccatore deve dare a di 7 di Agosto ▽ dieci di moneta havutone mandato a bon conto della stuccatura della volta della nichia a man dritto nella tribuna delli morti ▽ 10
AFP, Armadi, 162, 18
Payments begin on 7.VIII.1598 and run until 30.X.1598 for a total of ▽ 167:90.

VII. 21.VIII.1598
Mastro Mario Panvinio e Mastro Rosato Parasole indoratore deveno dare a di 21 di Agosto ▽ dieci di moneta havutone mandato a bon conto delli indoratura della nichia di mezzo verso palazzo ▽ 10
AFP, Armadi, 162, 20
(Additional payment of ▽ 15 on 28.VIII. and final payment of ▽ 9:75 on 4.IX.1598 for a total of ▽ 34:75. Payments for gilding of the second niche on the north begin on 18.IX. 1598 and continue until 20.XI.1598 for a total of ▽ 34:75 – AFP, Armadi, 162, 20 and 30. A single final payment was made for a third niche on 18.XII.1598 for the same sum.
AFP, Armadi, 162, 30

VIII. 4.IX.1598
Mastro Lutio e Mastro Guerra da Cassaria scarpellini devono dare ▽ trenta di moneta havutone mandato a bon conto del $^0/_3$ altare che fanno nella capella verso palazzo ▽ 30
AFP, Armadi, 162, 12
Payments run until 23.XII.1598 for a total ▽ 1261:40. The final payment on folio 24 reads as follows:
Mastro Lutio e di contro deveno havere a di 23 di Xmbre ▽ mille trecento vintisette baiocchi 28 sono che tanto monta l'ornamento, intaglio, incrostatura, fondo di mischio, del quadro, arco, angoli e scalini del $^0/_3$ altare che hanno fatto nella tribuna verso palazzo misurate e stimate dal S. Jac.o della Porta architetto che levato ▽ 66:38 per l'aggio restano ▽ 1261:40

IX. 18.XII.1598
Mastro Rocco [Ruggia] di contro deve havere a di 18 di Xmbre ▽ cento ottanta di moneta quali sono per la stuccatura di tre nichie delle tribune cioè doi nella tribuna verso palazzo e una nella tribuna delli morti che levato ▽ 9 per l'aggio restano ▽ 171
AFP, Armadi, 162, 29

X. 23.XII.1598
Mastro Pasano [da Carrara] e Mastro Cesare [Bascape] devono havere a di 23 di Xmbre ▽ mille trecento settantadoi baiocchi 84 che monta l'ornamento, intaglio, incrostatura, fondo di mischio del quadro, arco, angoli, e scalini, del $^0/_3$ altare che hanno fatto nella tribuna verso palazzo misurate e stimate dal S. Jac.o della Porta architetto che levato ▽ 68:64 per l'aggio restano ▽ 1304:20
AFP, Armadi, 162, 27

XI. 8.I.1599
Mastro Pasano da Carrara e Mastro Cesare Bascape scarpellini devono dare a di 8 di gennaio ▽ cento di moneta havutone mandato a bon conto della terza parte dell'incrostatura fatte fra le colonne e pilastri delli sei altari delle tribune ▽ 100
AFP, Armadi, 162, 34
Final payment on 12.II.1599 for a total of ▽ 608:33

XII. 8.I.1599
Mastro Giulio Coltrice e scarpellini devono dare a di 8 di gennaio ▽ cento di moneta a bon conto della terza parte della incrostatura fatta fra le colonne e pilastri delli sei altari delle tribune ▽ 100
AFP, Armadi, 162, 34
Final payment on 12.II.1599 for a total of ▽ 608:33.

XIII. 8.I.1599
Mastro Lutio de Santi e scarpellini devono dare a di 8 di gennaio ▽ 100 di moneta havutone mandato a bon conto della terza parte della incrostatura fatte fra le colonne e pilastri delli sei altari delle tribune ▽ 100
AFP, Armadi, 162, 35
Final payment on facing page on 12.II.1599 for a total of ▽ 608:33$^1/_2$ reads as follows:
Mastro Lutio e di contro deve havere a di 12 di febraro ▽ seicento trenta nove baiocchi 33$^1/_2$ sono per la terza parte di ▽ 1918 che monta le incrostature fatte fra le colonne e pilastri delli sei altari delle tribune e fregi sopra dette colonne come appare per li misure e stima fatte dal S. Jac.o della Porta levato ▽ 31 per l'aggio restano ▽ 608:33$^1/_2$

XIV. 8.I.1599
Mastro Geronimo da Vanagone muratore deve dare a di 8 di Gen.o ▽ trenta di moneta havutone mandato a bon conto della mettitura in opera delle incrostature fatte fra le colonne e pilastri delli altari delle tribune ▽ 30
AFP, Armadi, 162, 35
Final payment on facing page on 12.II.1599 for a total of ▽ 145:77 reads as follows:
Mastro Geronimo di contro deve havere a di 12 di Febraro scudi cento cinquantatre baiocchi 44 per la mettitura in opera e muratura delle incrostature fatte fra le colonne e pilastri della sei altari delle tribune e fregi sopra detti colonne che levato ▽ 7:67 per l'aggio restano ▽ 145:77

XV. 31.III.1749 (Dal 31 marzo a tutti li 26 luglio 1749)
Due manuali falegname ... anno dato di mano a gl'altri manuali in fare li Ponti alla Tribuna sopra la catedra (one of a number of items grouped together for a total sum of ▽ 63:70)
Diecisette altri manuali ... anno fatto li ponti alla Tribuna sopra la catedra, ed 'un altro al voltone accanto ... (one of a number of items grouped together for a total sum of ▽ 486:89$^1/_2$)
AFP, Armadi, 42, 130

XVI. 22.XI.1749
Mastro Domenico Zannacia Indoratore scudi ottocento di moneta a conto de lavori fatti, e da farsi di sua arte per li tre catini della crociera della Basilica Vaticana con fenestroni grandi, e piccoli della med.a per servitio della Rev. Fabrica... ▽ 800
AFP, Armadi, 426, 130

XVII. 28.VII.1749 (Dal 28 luglio a tutti li 6 Dec. 1749)
Due manuali falegname ... ha fatto diversi cavaletti, e sparavieri per li scultori, e stuccatori, che lavorano alle Tribune della Chiesa di S. P.ro... (one of a number of items grouped together for a total sum of ▽ 97:40)

Diecisette altri manuali anno fatto li Ponti alla Tribuna de SS.ti Simone e Giuda per commodo de scultori, stuccatori, e indoratori accio possino lavorare, anno fatto l'altri Ponti a piedi il voltone della chiesa per fare li stucchi ... anno guastato li Ponti alla Tribuna sopra la Catedra, anno incominciato a fare li Ponti alla Tribuna de SS.ti Processo, e Martiniano ... (one of a number of items grouped together for a total sum of ▽ 582:00½)
AFP, Armadi, 431, 59

XVIII. 16.VIII.1749
A spesa delli tre catini, e finestroni, che si fanno nella Basilica di S. Pietro: pag.to a Gio. B.a Maini scultore a conto ▽ 400
AFP, Armadi, 412, 613

XIX. 8.XII.1749 (Dalli 8.XII.1749 a tutti li 21 marzo 1750)
Tre manuali falegnami ... ha fatto dodici telari al fenestrone di mezzo sopra la catedra tiratovi la tela d'altro (one of a number of items grouped together for a total sum of ▽ 79)
Diecisette altri manuali anno guastato il Ponte che stava alli fenestroni a piedi la chiesa, anno fatto un Ponte di nuovo alla Tribuna de SS.ti Processo, e Martiniano ... anno guastato li Ponti alla Tribuna di SS.ti Simone, e Giuda (one of a number of items grouped together for a total sum of ▽ 421:76)
E più a Caterina Rubbi moglie del fu g.m Pietro Rubbi morto per caduta fatta dalli Ponti della Tribuna della Catedra dato con rescritto SS.mo per elemosina di giornate lavorative no. 77 alla ragione di baiocchi 27½ il giorno ▽ 21:17½
AFP, Armadi, 431, 60v and 61

XX. 22.XII.1749
A spese delli tre catini, e finestroni, che si fanno nella Basilica di S. P.ro ▽ 600.– moneta pagato a Gio. Batt.a Maini scultore a conto delli ▽ 1900.– prezzo cosi d'accordo ▽ 600
AFP, Armadi, 412, 616

XXI. 13.IV.1750
A spese delli tre catini e finestroni nella Basilica di S. P.ro ▽ 900.– moneta pagati a Gio. Batt. Maini scultore per resto, e saldo di ▽ 1900.– di tanti importa un suo conto esibito nella lista delli 22 Dec.bre 1749 ▽ 900
AFP, Armadi, 412, 618

XXII. 23.VI.1750
Al S. Domenico Zannacia Indoratore scudi mille di moneta quali sono a conto de lavori fatti, e da farsi, di sua arte per la doratura dell'ultimo catino de SS.ti Crocefiso, e Martiniano, con li sei fenestroni sopra il cornicione della basilica vaticana, comprese l'oro e fattura a tutte spese del mede.o il tutto per servitio della med.a Basilica... ▽ 1000
AFP, Armadi, 426, 134

XXIII. 23.III.1750 (Dalli 23 marzo a tutti li 25 luglio 1750)
Dieciotto altri manuali anno fatto li Ponti alli sei fenestroni del voltone per comodo dell'indoratori, e stuccatori ... anno guastato il Ponte grande della Tribuna de SS.ti Simone, e Giuda, e li d.i Ponti li anno fatti alla Tribuna de SS.ti Processo, e Martiniano, e terminati li lavori li anno guastati... (one of a number of items grouped together for a total sum of ▽ 448:13½)
AFP, Armadi, 431, 62v

XXIV. 24.IV.1751
Al S. Luigi Vanvitelli Architetto della N.S. ▽ 200 di moneta quali gli si fanno pagare in recognitione d'alcune straordinarie operationi fatte dal sud.o, cioè nel disegno dell'ornato delle Tribune nella Cappella del SS.mo Crocefisso esistente nella sacrosanta Basilica di S.to P.ro, restauratione delle sacre grotte, e confessione della med.a Basilica... ▽ 200
AFP, Armadi, 426, 138

APPENDIX II

Michelangelo's Model II for St. Peter's

Michelangelo's first model of St. Peter's he made quickly and cheaply (Model I) in late 1546, surely too small and inadequate a model for detailed study of the interior. He had a larger, wooden model (Model II) made in 1547. (For these and later models of parts of the building see Ackerman [1964], 91–92, 100ff.; Barocchi [1962], notes 607, 610, 676–677.)

Frey (1916), 32 surmised that Model II was too small to show detail, because it cost only 87 *scudi* (so far as is known), whereas Sangallo's model cost, according to Vasari, 4184 *scudi*. (Frey [1913], 23 concluded on the basis of documents published by him that the total cost of the Sangallo model was between 5500 and 6000 *scudi*.)

The indications of the evidence are that Model II showed at least half the building from ground level through the attic and was built at a scale about 1:72 at the largest and we believe probably 1:96 (see below).

If, as Coolidge (1942), 118 suggested, the engraving of Luchino (Millon/Smyth [1969], 492, fig. 17) was taken from Model II, it shows that the exterior of the model had at least one full hemicycle and two angled walls. But new evidence testifies that it must also have shown considerable interior detail and that it must have been for a large portion of the building. Doc. II, in Appendix I, is a payment of ▽ 1.34½ for the turning of 55 columns for Model II. This shows that there must have been columns on the interior, since – if one relies on Dupérac's plan (Ackerman [1961], pl. 59b) – on the exterior there could not have been more

than 48 columns at most, 34 small ones flanking the exterior windows of the second story and 14 large ones in the portico. Dupérac indicates 72 small columns on the interior at pavement level.

It is easy to see that architectural historians will enjoy speculating on the possible location of the 55 columns and the consequent extent and scale of the model – particularly since the document does not indicate whether the columns are all the same size or not. In Dupérac's St. Peter's there are columns of three different sizes: in the façade, flanking the exterior second-story windows, and at pavement level on the interior. Moreover, the document for the turning of 55 columns does not rule out the possibility that other columns were made for which documentation does not exist or is yet to be found.

In our view, the neatest solution from the evidence now available is to assume a model of one half of the building like the model Michelangelo made for S. Giovanni dei Fiorentini, to judge from the depiction of that model by Jacques Le Mercier (Ackerman [1961], pl. 71a; Portoghesi/Zevi [1964], fig. 720). This choice, requiring the 55 columns to be of only two sizes, is for a model cut longitudinally from the entrance through the opposite apse (like the model of S. Giovanni dei Fiorentini) and terminating at the east, or entrance, end without a façade, since we believe Michelangelo never intended a "façade" for the building. (We shall argue in another place that Michelangelo's east end was to be an apse like those on the north and south, as shown in the drawing of the plan of St. Peter's at Windsor Castle [A. Noach, "The Tomb of Paul III and a Point of Vasari", *BurlMag* XCVIII (1956), 378, fig. 40].) One half of the model in this case would contain on the interior 36 columns of equal height. (In the building, 32 of these are Corinthian with smooth shafts and 4 Composite with fluted shafts; both orders are unfluted in Sangallo's model, which was constructed at about three times the scale we shall propose below for Model II, and are thus likely also to have been unfluted in Michelangelo's model.) On the exterior flanking the second-story windows there would have been 20 columns, Ionic with smooth shafts and slightly more than half the size of the interior columns. (Only the shafts and bases of the model's columns would have been turned, since Ionic, Corinthian, and Composite capitals cannot be made by turning.) Interior and exterior columns together would thus number 56, one more than the number turned according to the document. We can reach the number of 56 columns for the model by assuming that at least one column with turned shaft and base would have been given to the *tornitore* as a sample and was thus available for use in the model. (One sample column should have been enough if the *tornitore* were given an exact measurement for the other column size.)

The only representation, however, with some claim to show how Model II looked – in the well-known painting by Passignano (Ackerman [1961], pl. 58a) – depicts it as cut on the right at a plane passing through the space between the two pilasters marking the corner of a corner chapel. It is not a likely place for the painter himself to have chosen arbitrarily to abbreviate the model. But the location of the cut is a reasonable one to allow consideration of alternative elevations for the east end of the building.

If we assume that Passignano represents Michelangelo's model the way it was made originally, as viewed from the southeast – *i.e.*, that Michelangelo's model lacked the termination of the east end – we can take this into account along with the 55 columns plus a sample column by positing, instead of a model of half the building, a three-quarters model which omitted, besides the eastern apse, the building's northwest portion – *i.e.*, all of both the north and west apses as well as the main pier on the northwest. Such a model would have required 42 colums in the interior and 14 on the exterior: again a total of 56. It would have provided an elevation of almost one whole side of the building and a good idea of the interior. Or we could assume that the model with the abbreviated east end included the north and south apses, both flanked by their angled walls, but lacked the two western piers at the crossing and the rest of the west side of the building. This would need 40 interior and 16 exterior columns, again 56 in all. This last possibility seems less probable than either of the other two that we suggest, because it does not envisage any complete corner chapel. As we mention in Part 1, note 22, Michelangelo began corner chapels of his building. It is logical, therefore, to assume that Model II showed at least one corner chapel in full.

In our view it appears less likely that Michelangelo omitted the east end of the building in his model, than that an end of an arm was later cut off by his successors in the place Passignano shows, in order to facilitate consideration of new solutions for the east end before the nave was finally added by Maderno – all of which took place well before 1620, the date of Passignano's picture. Among proposed new plans drawn for the east end one by Maderno is particularly worth noting since a division has been made on it in the place where the model stops in the painting of Passignano (H. Hibbard, *Carlo Maderno and Roman Architecture 1580–1630*, London [1971], fig. 49c). For the purpose of studying alternative east ends, a cut could have been made across a complete arm of the original model or, if it was the longitudinal half-model we suggested earlier,

across one of the arms represented only by one side. Architects would be likely to find the latter more useful. The arm as shown by Passignano appears to have both sides. Since for the sake of neatness and finish, as we shall observe below, Passignano apparently took some liberties in representing the arm (not to mention the addition of the domes), he could also have taken the liberty of making it look as if it had a far side. On the other hand, if the cut was across the only complete arm of a longitudinal half-model, this could explain the odd fact that Passignano portrayed an incomplete arm rather than a complete one, which ought to have been more satisfactory for his purpose.

As to the scale of Model II, the only document that indicates its size is the entry found by Pollak (1915), 52, no. 18 dated 15. XII. 1546 for wooden boards, 8 *palmi* long, for the platform of the model. It reads as follows:

"E piu ebe adi 15 detto quattro Tavoloni d'abetto longhi palmi 8 l'uno per far el letto del detto modello dico tavolone no. 4." (Barocchi [1962], III, 1446, in her good summary of payments for Model II mistakenly substituted "larghi" for "longhi" in transcribing the Pollak document.) *Palmi* 8 is equal to 1.78 m. or 5.86 ft. If the four boards were to form an approximately square platform, needed for a model of the whole building, each would have been about 2 *palmi* wide. For a model showing less than the whole (and not including a ground plan for the missing parts, as the model of S. Giovanni dei Fiorentini did, according to Le Mercier's print) they might have been narrower.

To judge again from Passignano's picture, this time from the indication of scale given by the figures standing near the model, the main body of the model – without its platform or domes – would be about 65 cm. high. (Coolidge [1942], 77 has pointed out that as depicted by Passignano Michelangelo's model was flat on top and stopped at the level of the top of the attic on the exterior, and he explained why the domes shown by Passignano on top of the model could not have belonged to it. See also Ackerman [1964], 114.) This represents a scale of about 1:75, close to the standard scale of 1:72 – 1 *oncia* to 6 *palmi*.

At the scale 1:72 not even a model made originally with an abbreviated east end, and showing three-quarters of the building in the way we suggested, could quite fit on a platform 8 *palmi* square. The length from the abbreviated right, or east, end to the exterior of the apse at the opposite, or west, end (out of the picture, at left) would be about 1.77 metres, or about 7.9 *palmi*; but the dimension from the exterior of the south apse to the end of the north arm – even without the apse on the north – would be about 1.93 m., or 8.65 *palmi*. At this same scale our other two suggested solutions would both have dimensions still longer than 8 *palmi*, since the distance from the exterior of one apse to the exterior of the opposite apse (151.856 m. [680 *palmi*] according to Letarouilly [1882], pl. 1) would be a bit over 2 metres, or about 9.0 *palmi*. Hence for all these solutions, including our first one, which we favor, we have to assume a scale slightly smaller than that suggested by Passignano's picture.

If the scale selected for the model were 1:96, *i.e.*, one *oncia* to 8 *palmi*, allowing for easily reproduceable multiples of a standard unit in the building trade, the *oncia* (18.6 mm.), the model's overall length would be about 7 *palmi* (7.1 *palmi*) assuming a hemicycle at both ends. This dimension would leave about 5 *oncie* (9.4 cm. or $3\frac{1}{8}$ in.) between the exterior of the hemicycles and the edge of the model base. The model as depicted by Passignano appears to leave some room between the model and the base's edge.

A scale of 1:96 is small compared to the Sangallo model's scale of 1:30 – 1 *oncia* to $2\frac{1}{2}$ *palmi*, or 1 *minuto* = $\frac{1}{2}$ *palmo*. (See Letarouilly [1882], pls. 21, 22 of "projets divers pour la basilique de St. Pierre", but also verified by our measurements of the model. A. Schiavo, "Intervento", *Atti del Convegno di Studi Michelangioleschi*, Rome [1964], 392, mentions a model of Michelangelo's at a scale of 1:30 that cost "about 6,000 *scudi*", about which he reports he has exact information that he will publish in his new book on St. Peter's. Is he perhaps referring to Sangallo's model?)

The scale is also small when compared to that of Michelangelo's own model for S. Giovanni dei Fiorentini, as seen in Jacques Le Mercier's engraving (Ackerman [1961], pl. 71a; Portoghesi/Zevi [1964], fig. 720), though the overall size is similar. This model was placed on a base no larger than the model itself; and it measured, as the inscription tells us, $9\frac{1}{4}$ *palmi* square (c. 2.06 m. or 6 ft. 9 in.). The inscription also says that the scale of the model of S. Giovanni was one *oncia* to 2 *palmi* (1:24). The large wooden model Michelangelo made for the dome of St. Peter's (Model IV) was constructed at 1:15 – – 1 *oncia* to $1\frac{1}{4}$ *palmi*, or 1 *minuto* = $\frac{1}{4}$ *palmo*, or 4 *minuti* = 1 *palmo* (Wittkower [1964], Appendix III, note 3). (We do not know the scale of the preparatory terracotta sketch model for the dome [Model III].)

Smaller though it would have been compared to the size of these models, the scale of 1:96 is the equivalent of the standard English scale of $\frac{1}{8}$ in. to 1 ft. often employed by architects today in making presentation models. For greater detail, meanwhile, we know that Michelangelo had models made for individual parts of the building (see Part 2, note 29).

There is the question, finally, as to whether Model II included the vaults on the interior. The way in which

Passignano portrayed Michelangelo's model implies that it had vaults since it shows the attic, and yet it does not allow for the inclusion of the top of the vaults because of the flat roof. It could be that the model Passignano depicted showed the vaults at their full height, but that he took the liberty of omitting the cresting of the barrel vault between the two little domes (added to the top of the model) – just as he clearly took the liberty of lowering the height of the barrel vault's inner surface where the model is abbreviated, something Michelangelo would not have done since the barrel vault already existed on the building. If the model was cut off by Michelangelo's successors, Passignano could have felt constrained to take these liberties in the interest of neatness and finish, adding also the continuation of the attic moulding over the abbreviated end – all the more so if there was no complete arm remaining for him to depict. For the same purpose Passignano could conceivably have made the model look as though it had vaults even if it did not. The model might have shown the exterior of the attic without including vaults on the interior. Since Sangallo's vaults already existed on the building and since Michelangelo could and did use Sangallo's model to test his design for the apse vault at a suitable scale, this seems a likely possibility. Whether it showed the interior vault or not, Christof Thoenes and Howard Saalman may be right in suggesting that the attic level was not included originally when Model II was built in 1547, and as Saalman suggests, that it was added only later when that level began to be approached in constructing the building (C. THOENES, "Bemerkungen zur St. Peter-Fassade Michelangelos," *Munuscula Discipulorum, Kunsthistorische Studien Hans Kauffman zum 70. Geburtstag*, eds. T. Buddensieg and M. Winner, Berlin [1968], 332, note 9; H. Saalman, in the article cited below). These scholars each came to this view to explain why as late as 1551 the Deputies of St. Peter's did not know, according to Vasari, that there were to be windows in the vaults (see Part 2, note 33).

Just before this paper was completed Howard Saalman kindly showed us a draft of an article in which he, too, used the dimensions of the planks to calculate the scale of Michelangelo's model. His conclusion, however, differed from ours. He proposed a model showing a small part of the building at the much larger scale of 1:30. When we told him of our Doc. II, the payment for "la tornitura de colonne 55" for Model II, he concluded that they must be balusters of the balustrades on the exterior of the second-level windows. This interpretation requires that the terms "colonne" and "balustri", normally used in documents for distinctly different elements, be synonymous in this case. Balusters for the Sangallo model, round throughout their height, were termed "balustri" as payments indicate, and columns were termed "colonne" (Frey [1913], 28, 317.31). Since about half of each of Michelangelo's balusters is square in plan, it is all the more unlikely they would have been termed "colonne". If all 55 columns for Model II had been the same size, the price, 2.4 *bolognini* each, would indicate columns about one third the size of those ordered for the Sangallo model (7 *bolognini* each [Frey (1913), 28 317.21] – the scale of the model we postulate. We see no reason to doubt the meaning of the word "colonne" in Doc. II. (See now H. SAALMAN, "Michelangelo: S. Maria del Fiore and St. Peter's", *ArtBull* LVII [1975], 385–386.)

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DRAWINGS

Arezzo
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  - Codex 12(46), fol. 24r. (Michelangelo)

Bayonne
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Berlin
- Kunstbibliothek, Heemskerk sketchbooks
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Frankfort
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London
- Blunt Coll.: St. Peter's from the east (anonymous)

Modena
- Biblioteca Estense, Codex Campori I, 1, fol. 26 (anonymous)

New York
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Stuttgart
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Salamanca, A.:
longitudinal section of the model of St. Peter's by Antonio da Sangallo
plan of St. Peter's by Antonio da Sangallo

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