STRUCTURAL RATIONALISM AND THE CASE OF SANT VICENÇ DE CARDONA

PETER REED

> The highest point of Catalan First Romanesque architecture is reached in Sant Vicenç de Cardona ... for it is as logical and strictly organic in its structure as a Gothic cathedral.
>
> Walter Muir Whitehill[1]

Walter Muir Whitehill's *Spanish Romanesque Architecture of the Eleventh Century* was published in 1941 and it is still the only book in the English language given exclusively to the Romanesque architecture of Spain—though, as its title states, it does not cover the full span of the stylistic period.

Whitehill's high esteem for the church of Sant Vicenç de Cardona is based upon the fact that, in his understanding, the detailed articulations of the ground plan are carried up in a systematic way to give a consistent visual order to all the internal spatial and formal relationships of the building. Most prominently, in the nave the transverse arches of the barrel vault are seen to be continuations of giant orders that rise from ground level through the full height of the elevation (fig. 1). So, for the first time—at least in this part of Christendom—the vaulting system was clearly envisaged in the composition of the plan. As Whitehill puts it, 'it was essential to have the entire structural system thought out before laying the first stone.' Further, the nave interior is conceived as a repetition of like cellular units articulated by this vertically unifying structure. Hence we have in Sant Vicenç an 'epoch-making' archetypal model for the further development

1. Walter Muir Whitehill, *Spanish Romanesque Architecture of the Eleventh Century*, (Oxford, 1941), p. 45.

FIGURE 1. Sant Vicenç de Cardona, interior to the west (Peter Reed).

of medieval building and its 'logical and strictly organic ... structure' could be interpreted as an anticipation of the structural rationalism which influential nineteenth-century theorists, notably Viollet-le-Duc, were to identify in High Gothic architecture.

Unfortunately, when Whitehill visited Sant Vicenç he could not view the interior in its entirety. The strategic importance of the building, as part of a castellated complex dominating the valley of the Cardener (Fig. 2), meant that in the Napoleonic wars it had been converted from an ecclesiastical to a military function and so it remained throughout the nineteenth and for the first half of the twentieth century. As Whitehill records, when he saw the interior it was divided into three makeshift storeys and could only be inspected piecemeal.

Whitehill depended for his graphic illustrations (plans, longitudinal section and axonometric projection) upon the published work of Josep Puig i Cadafalch. Puig had a remarkable career—as an architect of notable buildings in and around Barcelona, as a town-planner and urban-designer, and as a Catalan patriot and politician (for some years in exile from Franco's Spain)—but it is as a

FIGURE 2. Sant Vicenç de Cardona, ensemble from north-east (Peter Reed).

historian and archaeologist that he is best known outside his native Catalonia.[2] It was Puig who promoted in the terminology of architectural history the expression *le premier art roman* to describe the manner of church-building of the late ninth and early tenth century in the lands bordering the western Mediterranean—buildings stylistically of Lombardic origin and of which Sant Vicenç is a prime example. Puig had pioneered the study and recording of the medieval architecture of Catalonia and from his extensive field-work he produced a number of publications that today would be the envy of a full-time academic. These include *L'Arquitectura Romànica a Catalunya*, written (in Catalan) in collaboration with Antoni de Falguera and Josep Goday i Casals, which appeared between 1909 and 1918 in three hefty volumes[3]—it is from the second of these that Whitehill reproduces his illustrations of Sant Vicenç.

2. Puig's career was the subject of an exhibition, centred on a collection of rediscovered drawings, mounted in Barcelona in 1989. The comprehensive catalogue *Josep Puig i Cadafalch: la arquitectura entre la casa y la ciudad* was published by the Fundación Caixa de Pensions, Barcelona, and is in both Spanish and English.

3. Josep Puig i Cadafalch, Antoni de Falguera, Josep Goday i Casals, *L'Arquitectura Romànica a Catalunya*, 3 vols. (Barcelona, 1909, 1911, 1918; facsimile edition, 1983).

In his time, Puig probably saw as much or as little of the interior of Sant Vicenç as Whitehill was to see several decades later. It is therefore not too surprising that in several highly important respects his drawings are wrong and misleading. They are also mutually inconsistent. Unfortunately it was not only Whitehill who half a century ago (and for understandable reasons) has been misled by them. Well into recent times, anglophone historians have adopted Puig's drawings, particularly his axonometric projection. Like Whitehill before them, some have endorsed the significance of Sant Vicenç in the rationalist interpretation of medieval architecture and, as is noted below, have enlarged upon it.

The first aim of this paper, therefore, is to describe the salient features of the building as it is, not as it has been assumed to be. This leads to certain conclusions about its constructional history.

The present building of Sant Vicenç was begun in (or shortly after) 1019, for in that year the Viscount of Cardona, Bremund, undertook to erect a new church on, it may reasonably be assumed, the site of a previously existing religious foundation. Bremund died in 1020, but the work was continued under the patronage of his family. The church was dedicated in 1040 by Eriball, Bishop of Urgell, who, as Bremund's brother, was also his successor as Viscount of Cardona.[4] Scholars, Puig and Whitehill included, have assumed that the dates 1019 and 1040 bound a period of undeviating construction for the entire church. More recently, following the clearance from the fabric of the accretions of time and its restoration (between 1952 and 1974) under the services of the *Patrimonio Artístico Nacional* and also the publication of more accurate drawings in *Catalunya Romànica*, the multi-volume survey of Catalonian Romanesque architecture,[5] a programme of work has been proposed that is—certainly—more complex and—possibly—more prolonged.

The church has a basilican plan of nave and aisles (fig. 3) —with the aisles being unusually narrow (width 2.90m) in relation to the nave (width 7.40m).[6] There is a transept which projects shallowly—no further, indeed, than the aisle-wall buttresses, with which (as can be seen on the exposed north side) it shares a

4. Whitehill, *Spanish Romanesque*, p. 46.

5. *Catalunya Romànica*, vol. XI: *Bages* (Barcelona). The drawings include a plan at gallery level and a longitudinal section (by A. Mazcuñan and F. Junyent), and an isometric projection (by J. A. Adell). The plan and projection have also been reproduced in a paper by M. Durliat, 'La Catalogne et le premier art roman', *Bulletin Monumental*, 147 (1989), p. 209-38 and, recently, in Roger Stalley, *Early Medieval Architecture* (Oxford, 1999) p. 135.

6. Dimensions are from Eduard Junyent, *Rutas Románicas en Catalunya/1* (Madrid, 1995), p. 82.

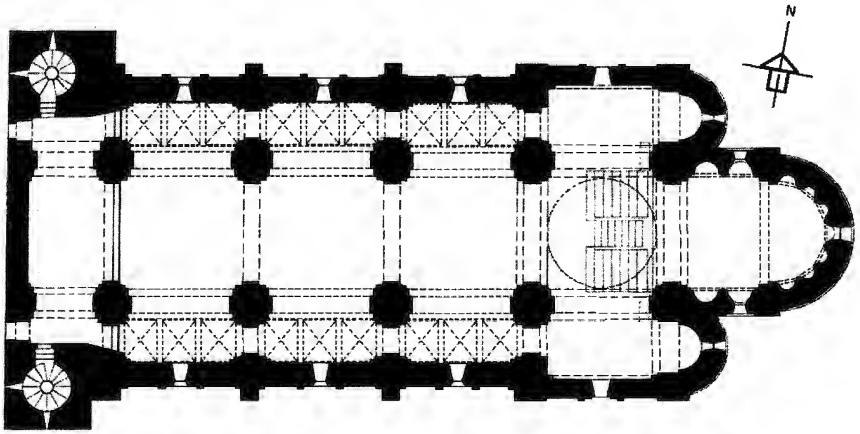

FIGURE 3. Sant Vicenç de Cardona, plan at tribune level (derived from *Catalunya Romànica*, vol. XI, p. 156).

common foundation. To the east, minor apses, on the lines of the aisles, flank a deep apsidal sanctuary which is raised over a vaulted crypt. The crypt can be firmly dated as not later than 1041, for it is referred to in the will of the Abbot Guillem, made in that year.[7]

The squarish-on-plan crossing is covered by a dome (with a central oculus) on trumpet-squinches, said to be the first example of this kind in Catalonia. Above, the walls carry up into a squat tower, octagonal in plan but uniquely oriented so that there is an arris (rather than the customary plane) towards each of the cardinal directions. The upper part of this tower is a modern reconstruction.[8] The apses have the usual half-domes. The principal apse is preceded by a barrel-vaulted bay and also barrel-vaulted are the short transept-arms. The three barrel vaults—to the east, north and south of the crossing—are of a height and span only marginally greater than their adjacent crossing arches. Since these particular arches have the stepped profile of an inner and outer order, it is a small but not inconsequential detail that where each abuts its barrel vault the outer order reads as much as the border of the vault as an element of the arch. This reading is complemented by the reciprocal profile which edges the transept

7. Whitehill, *Spanish Romanesque*, p. 47.

8. For photographs of the exterior before restoration and reconstruction see Puig *et al.*, *L'Arquitectura Romànica,* vol. 2, figures 77 and 78 (which shows considerable over-building of the north apse), and Whitehill, *Spanish Romanesque,* plates 11 and 12.

FIGURE 4. Sant Vicenç de Cardona, view of vaults from the sanctuary (Peter Reed).

vaults where they meet the gable-walls (fig. 4). These articulations, which are all rigorously carried up from the ground plan, are significant for interpreting the more ambivalent architecture of the nave and aisles.

The barrel vault of the nave rises by some four metres above those of the sanctuary and transept.[9] The extra height allows the use of clerestorey windows above the nave aisles. As already stated, the three bays of the nave are divided by giant orders and transverse arches. A further, shorter bay to the west, flanked by abbreviated towers, accommodates a gallery or tribune overlooking the nave, carried over a vaulted porch or narthex.

Before the building was restored, the nave was considered to be all of a piece with the rest of the work, but it is now apparent that it was constructed in at least two stages and that there was a significant change-of-mind during its completion. The clearest evidence for this is in the fact that the outer steps in the profile of the giant order stop not far above the height of the nave arcade. Above this level the giant order continues upward in a single rectangular section to carry the similarly profiled transverse arch (fig. 5).[10]

9. An estimate from drawings and photographs - Junyent *Rutas Romànicas*, gives the height of the nave vault as 18.80m. but gives no dimension for the transept.

10. Further evidence for the staged construction of the nave is apparent in its masonry. At the level where the giant order is simplified, a band of carefully cut stones, yellowish in colour, is carried across its stepped profile. Up to this level the wallwork is of larger blocks, fairly regularly coursed. Above it, and carrying into the barrel vault, the masonry is of smaller pieces, laid more randomly. Generally the stones are of a russet-colour that gives the interior of Sant Vicenç its distinctive, sombre glow. The stonework in the upper levels is darker and shows signs of discoloration, possibly a consequence of the military occupation.

FIGURE 5. Sant Vicenç de Cardona, view of nave vault from south-west (Peter Reed).

Puig's frequently reproduced plan (fig. 6), however, indicates, wrongly, that the stepped profile from the giant order is carried up into the transverse arch, being continuous from one wall of the nave to the other. Given Puig's viewing conditions, it is an understandable mistake. But what is impossible to understand is why his axonometric projection (fig. 7) shows a quite different system. Here the outer steps, instead of continuing into the transverse arch as he shows in the plan, peel off and become wall-arches, spanning from pier to pier in the direction of the nave arcade and encompassing the clerestorey windows. There is nothing in his text to indicate that this drawing was intended by Puig to be an hypothesis for an arrangement hidden from his view, so it may be presumed that this is what

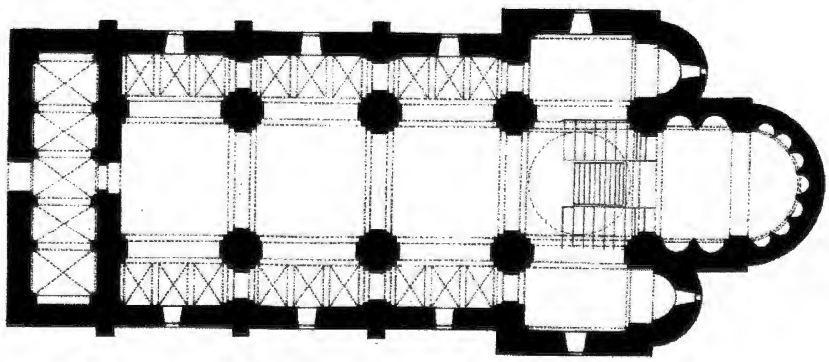

FIGURE 6. Sant Vicenç de Cardona, plan (from Puig i Cadafalch *et. al.*, *L'Arquitectura Romànica a Catalunya*, vol. II, fig. 79).

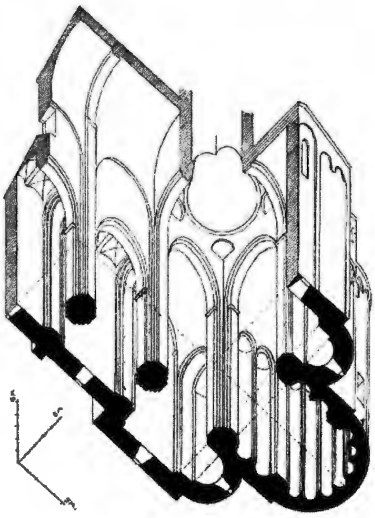

FIGURE 7. Sant Vicenç de Cardona, axonometric section (from Puig i Cadafalch *et. al., L'Arquitectura Romànica a Catalunya*, vol. II, fig. 82).

he deduced to be there from the evidence available to him.[11] The contradiction between Puig's plan and his axonometric is inexplicable, yet both figures continue to be uncritically reproduced—and together—in the literature.[12]

Another puzzle is the representation of the nave/crossing junction in Puig's axonometric. Here, by an Escher-like conundrum, he conjures from the articulations of the pier springings for *both* a wall-arch for the nave *and* an outer order for the crossing arch. His elevation would, therefore, require five edges in the angle of the nave, whereas there are only four—as indeed his plan and own plan detail (fig. 9*b*) show. What, in fact, happens here is that on the crossing side the

11. Puig's adoption of wall arches for Sant Vicenç de Cardona may have been prompted by his familiarity with the church of Sant Ponç de Corbera, a few miles to the north-west of Barcelona. This building, for which there is no documentary evidence as to its date, has a single nave, barrel-vaulted and with transverse arches carried on pilasters. From pilaster to pilaster there are deeply articulated blind wall arches, so that 'the engaged supports resemble halves of cruciform piers' (Whitehill, *Spanish Romanesque,* p. 107). Whitehill illustrates the building with a sectional axonometric (fig. 60).

12. After this paper was drafted my attention was drawn to an article by E. C. Fernie which recognizes the errors in Puig's plan and axonometric projection, and also postulates a change of plan in the building, in part along the lines advanced in this paper: E. C. Fernie: 'St Vincent at Cardona and the Mediterranean Dimension of First Romanesque Architecture' in David Buckton and T. A. Heslop (eds.) *Studies in Medieval Art and Architecture presented to Peter Lasko* (Stroud, 1994), p. 24-35, (n. 6).

stepped element remains with the crossing arch as an outer order while on the nave side it is carried up, beyond the arch, to follow the curve of the barrel vault—echoing, in this, the arrangement at the outer ends of the transept-arms (compare figs. 4 and 5).

As well as the change in the profile of the giant order, a number of other features must be taken into account in an attempt to devise a constructional sequence for the building. One is the splayed opening, formed above the western crossing-arch but below the nave vault, which is carried through to penetrate the cupola over the crossing. It is difficult to interpret this as anything other than an opening for a window originally intended to provide light in the direction of the sanctuary;[13] from which it would follow that at one time the plan was for a church with a lower nave than the present. Reinforcing this supposition is the arbitrary junction (rather, its should be said, the collision) of the nave roof with the octagon of the crossing-tower; the roofs of the transept and sanctuary are securely accommodated below the string course that marks off the octagon above its square base.

An unusual, possibly unique, feature is the vaulting system over the aisles (fig. 8). At each of the nave piers there is a (stepped) transverse arch sprung across the aisle, and between each pair of transverse arches, at a height well above the extrados of the nave arcade, there are three very shallow groin vaults, separated by corbelled-out transverse ribs. To Whitehill (following Puig), this virtually level covering to the aisles suggested that above them there may originally have been a terrace, built for defensive purposes. However, Puig did not have a clear view of things here, for, as he recorded in 1911, 'this space is filled with sand and rubble because of the modern fortification works, and this makes

13. It may be objected that if the opening were intended to illuminate the sanctuary it should be splayed towards the crossing rather than the nave. As it happens, there is also a splay (but smaller) towards the crossing (see fig. 4). Since the opening is made above the springing of the dome, a wider splay on this side might have presented structural problems. The situation, represented here in the computer reconstruction of fig. 13*b*, is shown very well in the long-section reproduced in *Catalunya Romànica*. Given the tightness of the geometry (for a window above a supposed 'roof' but below the crown of the dome), the section adopted is a reasonable compromise for allowing illumination from the west to the crossing and the sanctuary. It is relevant that the windows in the apses, in the crypt and in the straight-sided section of the sanctuary all have external splays—as can be seen in fig. 2. Indeed this feature seems to be a hallmark of what is proposed here as the first phase of construction.

As it stands, the only lighting at the crossing is through the oculus and small openings made in the dome to the north and east. It is possible that the latter were inserted after the change of plan, and that the first intention was to have only the one, much larger, window to the west.

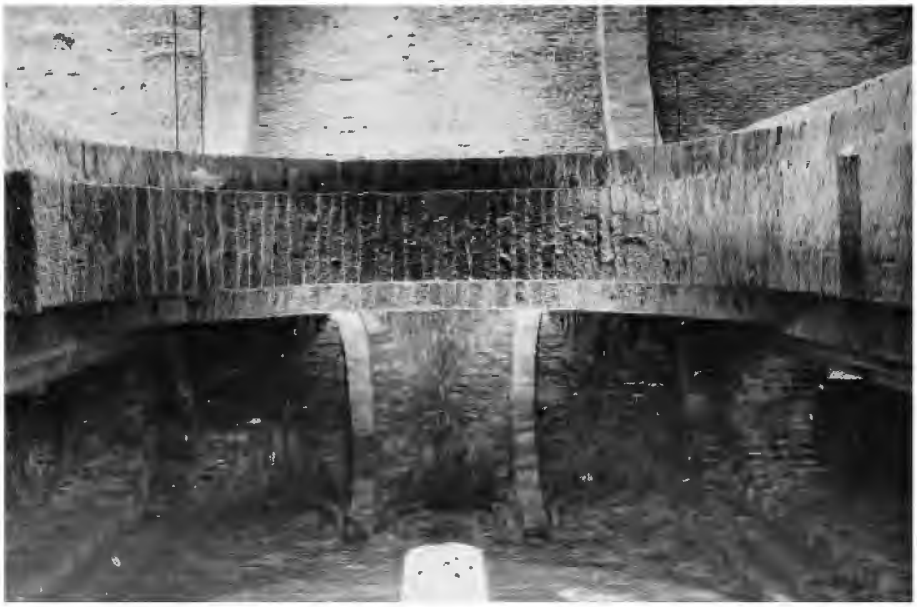

FIGURE 8. Sant Vicenç de Cardona, intrados of nave arcade, with vaults to nave and north aisle (Peter Reed).

it impossible to know for sure the arrangement of the roof over the side aisles'.[14] Whitehill's inspection was similarly obstructed.

One Catalan author, Xavier Sitjes i Molins, sees in the fabric of the building, as revealed after the restoration work, at least three phases of construction.[15] He suggests that at the consecration date of 1040 only the eastern parts of the church (that is, crypt, sanctuary, transept and crossing) were complete and in use—an arrangement that would not have been at all unusual in medieval practice. Of the nave, Sitjes argues convincingly that in this first building campaign the construction was carried up to the level at which the profile of the giant order changes. Later in the eleventh century, the vaulting of the nave was proceeded with, but at a higher level than had been originally intended so as to allow direct clerestorey lighting to the interior (hence the anomalous position of the

14. Puig *et al.*, *L'Arquitectura Romànica*, vol. 2, p. 168: 'Avuy aquest espay està omplert de terra y reble ab motiu de les obres de fortificació modernes, lo que fa impossible coneixer ab certesa la disposició de la coberta dels colaterals'.

15. Xavier Sitjes i Molins, *Esglésies Romàniques de Bages, Berguedà i Cardener,* (Manresa, 1986), p. 84-96.

blind cupola 'window' below the nave vault). And in this second phase the profile of the giant order was simplified to a single rectangular section.

It is not necessary, however, to hypothesize more than two stages in the construction of the core of the Romanesque basilica:[16] one, begun in or shortly after 1019 and ending before the dedication in 1040, which involved the laying out of the whole church, the full realization of the parts to the east of the nave and the partial construction of the nave and the western complex; the other, probably of the second half of the eleventh century, which saw the works brought to conclusion but with modifications to the design that included a higher vault than was first intended.[17] Of the aisles, the outer walls and buttresses and the transverse arches evidently belong to the first stage, although the triplets of groined vaults over the aisles could have been constructed in either the first or second.[18].

Structural rationalism, as a principle of design, requires an expressive ordering of the elements of a building—an ordering by which the self-loads of the structure are, at least, *apparently* transferred, without any discontinuity, to the ground. For materials and constructional techniques strong in compression but weak in tension—such as masonry—this transfer necessarily proceeds from above to below, from superior to inferior elements, finally to leave its imprint at the base. It is structure as it is *perceived* that is the issue here, for, as has been argued—and, indeed, as has been shown in modern-day analyses of Gothic buil-

16. Sitjes argues for a third, early twelfth-century stage of construction, in which towers, façade and atrium (with gallery over), were added at the west end of the nave. However, his longitudinal section and plan, though they support his argument, are wrong in important and relevant respects. In the section, the west side of the westernmost giant order is shown *without* the outer step that is present throughout the structural system in the nave and, similarly, there is no stepped element against the inner face of the façade. This accords with Sitjes' view that this western bay was not part of the same campaign of building as the lower parts of the nave. But, in fact, both stepped elements *are* present here and they can be easily seen, flanking the arched openings that give access to the gallery, to north and south. So it must be concluded that the western termination of Sant Vicenç was integral with and substantially built at the same time as the nave arcade; and if, as Sitjes accepts and there is no reason to doubt, the arcade was erected during the first campaign that included the complete eastern complex then it follows that the whole church as we now have it (except, perhaps the western towers) was laid out and constructed at least to a certain level before the consecration of 1040.

17. If there had been a lengthy gap between the two building campaigns it would not be possible to say whether the nave was then left open to the skies or whether it was given a temporary cover, but one interpretation of the distinctive band of masonry in the giant order (see footnote 10) is that these carefully cut stones were introduced as pad stones for seating the principal members of a timber roof.

18. Groin-vaulting is not alien to the first stage of building. It is used in the crypt and narthex.

dings—the physical structure may not behave in the way it is made to appear to the eye. It is, of course, impossible to say how the medieval architect himself understood his visible system: whether as the real thing or as a fictive representation of it. It is even possible that it was merely devised as a kind of permanent scaffold in the process of construction, a framework for the realization of the complete structure and ultimately an integral part of it.

The second part of this paper examines how Sant Vicenç has been presented in two recent accounts of the development of medieval architecture, in which the building has been promoted to a fundamental place in the emergence of the Romanesque and, by extension, its development into the Gothic. It is not the intention here to question the respective authors' broader interpretations, but to show how, through reliance on the drawings published eighty years or so ago in Puig *et al.*, they have, to some degree, *mis*presented the building. This is followed by an analysis of details of the plan which suggests that had the building, in fact, been constructed consistently on rationalist principles, it could have taken a rather different form from that which was eventually realized.

C. Edson Armi, in his paper 'Orders and Continuous Orders in Romanesque Architecture',[19] sought to redress the perceived balance between the First Romanesque of the North (in effect, of northern France) and the First Romanesque of the South (that is the Lombardic architecture of northern Italy, southern France and Catalonia) as influences on the development of mature Romanesque architecture. He argued against the view, due largely to French scholars, that southern First Romanesque was *retardataire*, folkloristic and a dead-end. This was a view, he notes, with which even Puig himself concurred.

Armi's conclusion is that the organization of the mature 'organic' Romanesque interior, with its 'additive bay units' and 'wall articulation that allowed correspondence between the pier and the vault' had its primary source in southern and not, as had hitherto been accepted, in northern First Romanesque architecture. Prominent in Armi's argument is the example of Sant Vicenç de Cardona. However, his information on the building seems to have been wholly dependent on Puig's publications. His description of the stepped articulations in the structure of the nave is based upon Puig's axonometric, which he reproduces and describes: 'Two edges arch and return to the floor one bay away, *a third climbs to the height of the vault and returns to the floor*, and the fourth turns to a vault arch and returns to the floor in the same bay but on the other side of the nave.' The words italicized here (but not in the original) apparently refer to the

19. C. Edson Armi, E., 'Orders and Continuous Orders in Romanesque Architecture', *Journal of the Society of Architectural Historians*, 34, No. 3 (October 1975), p. 173-188.

Puig's wall arches which were, in fact, never built and most probably never intended. Small wonder, then, that Armi finds in continuous orders an 'ambiguous quality' and affirms that 'it would be a mistake to insist that each continuous order is purely functional'. However, if the propositions of this present paper are accepted, then it may well be argued that Sant Vicenç as first conceived and laid out was more consistent and rational in its formal/structural logic than Armi recognized.

Ideas of logic and structural rationalism in the expression of Romanesque and Gothic architecture and their relation to the intellectual development of medieval discourse constitute the central matter of the book *Medieval Architecture, Medieval Learning: Builders and Masters in the Age of Romanesque and Gothic*, by Charles M. Radding and William W. Clark.[20] It is a theme that had been previously explored by Erwin Panofsky, who sought to establish an iconological relation between the 'visual logic' of the High Gothic architecture of the '100 mile zone around Paris' and the hierarchically ordered structure of the contemporary Scholastic treatise.[21] It is, one hopes, not too gross a simplification of Radding and Clark's sophisticated argument to say that it is broadly supportive of Panofsky, without subscribing to his causal hypothesis. They argue that what is common in cultural developments during the period from 1000 to 1200 was the formation of *disciplines* committed to the development of methods for solving new problems. For masters (i.e. theologians) this meant practice *disputandi more, non asserndi more* (by way of disputation, not assertion) which required conceptualizing the very nature of philosophical discourse. For builders it meant the establishment of an organizing principle 'based on repeating spatial modules assembled in additive sequences'[22] which, in the fullness of time, accommodated the rich variety of Romanesque and Gothic architecture. Panofsky's contribution had been to recognize the formal parallels between these modes of thinking in the period when and in the region where both came to full maturity.

For Radding and Clark, Sant Vicenç (or, in Spanish, San Vicente) de Cardona occupies a seminal position in this development. It is the first building illustrated in the book (with Puig's plan and axonometric and a photograph of the nave - all mutually contradictory!). It is relevant to quote from their description of the building:

20. Charles M. Radding and William W. Clark, *Medieval Architecture, Medieval Learning: Builders and Masters in the Age of Romanesque and Gothic*, (New Haven & London, 1992).

21. Erwin Panofsky, *Gothic Architecture and Scholasticism*, (Cleveland and New York, 1957 - first edition 1951).

22. Radding and Clark, *Medieval Architecture,* p.47.

> What makes San Vicente worthy of our attention ... is the articulation of the building's internal space. The means used were quite simple. The nave is divided into three identical bays by double pilaster strips that begin at the base of the piers, run up the wall, and finally join the transverse arches that mark the bay divisions in the barrel vault. The logic of the nave is echoed in the side aisles, where three little groin vaults appear between each pier. ... Departing from [the] aesthetic [of early medieval architecture] in favor of dramatizing the spatial units contained within the building ... meant that the builder of San Vicente set himself a complex problem of planning and design ... it is not possible that the combination of piers, pilaster strips, and transverse arches that articulate the space was achieved haphazardly or by trial and error. The effect had to be planned from the beginning. The new style of building thus implied a different kind of mental work for the builder, with new cognitive skills that he had to master.[23]

But the trajectory of the 'double pilaster strips' is not as they describe nor as their own photograph shows. And there is nothing inherently logical in the vaulting of the side aisles—indeed, if the 'logic of the nave' were to be followed in the aisles then, as will be suggested in this paper, they could possibly have had a quite different vaulting system. It is not the issue to deny the authors' claims for the innovative nature of the Cardona design and its conceptual difference from anything known to have preceded it,[24] but it is surprising to find they are based upon such a faulty reading of the building and, indeed, of their own illustrations of it.

The diachronic perspective on the Romanesque, concerned principally with its place in the evolution of architecture, tends to give prominence to just those

23. *Ibid.*, p.14.

24. Because the contemporary building of the rich foundation of Santa Maria de Ripoll displays in its nave (now rebuilt) none of the sophisticated integration of Sant Vicenç de Cardona, Puig concluded that the latter could not have been the work of local masons. He suggested that workmen were imported from northern Italy and looked there for his precedents. He cited as an example of like work the Ligurian church of San Paragorio at Noli. It is true that in this small church, as in Sant Vicenç, the walls of the sanctuary and major apse are lined with niches and that the sanctuary is raised over a groin-vaulted crypt. The nave piers, too, have stepped articulations, but there is little evidence of the role they were intended to perform. San Paragorio features in *Piémonte-Ligurie Roman*, (La Pierre-qui-Vire, 1979), with text by Duilio Citi.

Radding and Clark draw attention to the case of the cathedral at Speyer but since in the phase of that building contemporary with Sant Vicenç the giant order in the nave was not tied to a vaulting system it is not entirely relevant. For Speyer see the three volume work by Hans Erich Kubach and Walter Haas, *Der Dom zu Speyer* (Munich, 1972) and Dethard von Winterfeld, *Palatinat Roman* (La Pierre-qui-Vire, 1993).

features which might be said to anticipate the perceived structural rationalism of the Gothic. It is undeniable that in the passage of time certain ideas and forms prove to be more influential than others and one of the purposes of architectural history is 'to reconstruct their genealogical tree, and to find out their ancestors as well as their offspring'.[25] But the hindsight engendered by a 'deterministic ... view of medieval architecture as an evolutive juggernaut lumbering toward Gothic'[26] may lead us to imagine things which, as in the particular case of Sant Vicenç, are not there.

While it is perfectly reasonable to *assume* that in the cruciform pier of the arcade in Sant Vicenç the double pilaster facing the nave was *intended* to support a similarly profiled transverse arch (for one thing, by analogy with the function of the responds on the other three faces), the adoption of the wall arches in Puig's axonometric quite contradicts this reading. Moreover, it is inconsistent with the grammar of the ground plan of the building. For where a projection is carried up into a pilaster that supports an arch, such as those around the crossing (fig. 4 and fig. 9*b*), generally it is the *broad* face of the pilaster that turns into the intrados of the arch; this would not have been the case with wall arches, had they been built (or intended) along the nave.

Fig. 9b is actually taken from Volume II of *L'Arquitectura Romànica a Catalunya*[27] and it raises an intriguing point about the nature of the vaulting to the aisles, not dealt with by Puig *et al.* The issue is better illustrated by fig. 9*a*, an enlarged detail redrawn from a more accurate plan in Volume XI of *Catalunya Romànica*,[28] showing the area around a typical compound pier and the adjacent outer wall. The transverse arch spanning between wall and pier has an inner and outer order (providing, it should be noted, a further analogy for what was intended for the nave) and these orders are continuous with the corresponding responds below. However, as the plan shows, there is here not just a twofold but a *triple* advance in the wall plane. The elements of the third, outermost section stop unconvincingly under the groined compartments of the aisle vaulting. Fa-

---

More recently, E. C. Fernie's article 'St Vincent at Cardona and the Mediterranean Dimension ...' revives Puig's original suggestions of (1) a Ligurian source for the design of Sant Vicenç and, more fundamentally, (2) a Byzantine influence over both the Ligurian and Catalonian monuments.

25. Otto Pächt, 'Art Historians and Art Critics VI - Alois Riegl', *Burlington Magazine*, 105, May 1963, p. 190.

26. Jerrilynn D. Dodds, *Architecture & Ideology in Early Medieval Spain*, (University Park and London: Pennsylvania State University Press, 1989), p. 3.

27. Puig, *L'Arquitectura Romànica*, vol. 2, p. 476, fig. 405.

28. *Catalunya Romànica*, vol. XI *Bages*, p. 156.

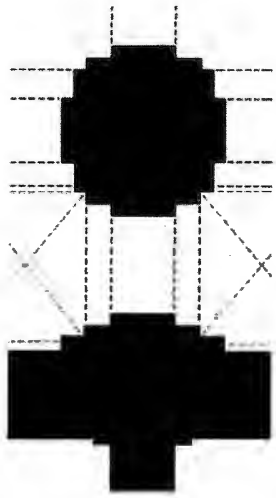

FIGURE 9*a*. Sant Vicenç de Cardona, detail of plan at nave compound pier (enlarged from fig. 3).

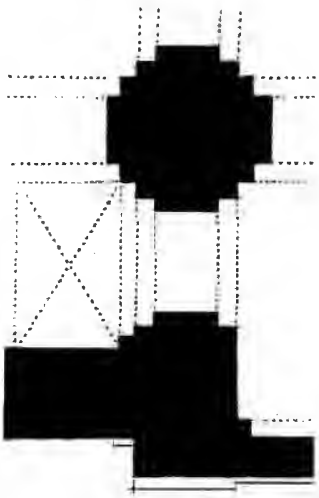

FIGURE 9*b*. Sant Vicenç de Cardona, detail of plan at crossing pier (from Puig i Cadafalch *et. al.*, *L'Arquitectura Romànica a Catalunya*, vol. II, fig. 405).

cing them, in the nave arcade, the outer orders of the arches on the aisle side are made a little narrower than their responds below (see fig. 8) and, accordingly, the residual responds are carried up vertically as thin pilasters also to meet the underside of the aisle vault.[29]

Now there is a similar three-part articulation of the wall plane in another part of the building: in the narthex below the tribune at the west end of the nave (fig. 10). Its association here with a system of groin vaults might be considered sufficient to show that in the aisles the modelling of the wall plane and the groin vaulting above were conceived as one.[30] But another interpretation is possible. Mention has already been made of the narrowness of the aisles in Sant Vicenç.

29. Note that Puig's plan detail (fig. 9*b*) is inaccurate in two respects: the face-widths in the articulation of the cruciform pier are much more differentiated than he shows (compare fig. 9*a*) and he indicates, wrongly, that the outer order of the wall articulation and the outer order of the nave arcade are linked above by an arch (again, Fig. 9a more accurately represents the situation).

30. A combination of groin vaults with a three-stage modelling of the aisle wall, similar to the arrangement found in the narthex of Sant Vicenç, is to be found at San Paragorio at Noli, which Puig proposed as a source for the Cardona building (see note 24 above).

FIGURE 10. Sant Vicenç de Cardona, narthex.

The proportion of the aisle bay in plan (measured as span of vault to centre-to-centre of piers) is about 1: 2.9. Aisles of similarly attenuated proportion occur in several Romanesque churches elsewhere in Catalonia. From the drawings reproduced in the volumes of *L'Arquitectura Romànica a Catalunya* we have San Quirze de Culera (1: 2.9), Vilabertran (1: 2.6), Sant Miquel de Fluvià (1: 2.1), Gerri la Sal (1: 2.4), Besalú (Sant Pere) (1: 2.33), Sant Pere de Rodes (1: 2.8), Lladó (1: 2.6) In all of these cases the aisles have half-barrel or quadrant vaults. If we suppose that when Sant Vicenç de Cardona was first set out it was also planned that the aisles should have half-barrel vaults, then it could have been intended that the elements of the third order in the wall articulation were to be carried up to border the vault (i.e. as formerets) along its junctions with the wallwork above the transverse arches, where they would meet up with the residual responds of the nave arcade.[31] This arrangement would have been visually consistent with the treatment at the ends of the barrel vaults over the transept

31. It may be argued against this hypothesis that in none of the other Catalonian churches listed here is there a similar association of a triple articulation of the aisle wall with a half-barrel vault. But of these, only the late church at Gerri (consecrated 1149) has a fully-developed cruciform nave pier.

(see fig. 4). By this hypothesis, the groin vaulting to the aisles would then be part of the second phase of construction, following a change of direction in the works.[32] It is pertinent to note that where groin vaults are found elsewhere in the building (in the crypt and in the narthex) they are used to support a floor above. Perhaps Puig had this reason to believe that there may once have been a platform or terrace above the aisles.

Computer-generated models[33] enable us readily to test, in interior perspective and (for comparison with Puig's diagram) in sectional projection, alternative hypotheses. Computer model 1 (figs. 11*a* and 11*b*) represents the fabric as it is, built, as argued here, in two stages. In fig. 11*a*, [A] marks the level in the nave at which the construction of first stage is supposed to have stopped. Computer model 2 (figs. 12*a* and 12*b*) illustrates a scheme that incorporates wall-arches as suggested by the Puig axonometric (but note that the computer cannot accommodate Puig's visual paradox at the nave/crossing pier). Most telling against this scheme is the fact that if it were originally intended that the wall-arches should rise from level [A], the west 'window' of the cupola would then be *below* a superimposed barrel vault, just as it is in the realized structure. Computer model 3 (figs. 13*a* and 13*b*) shows how the building would have looked if the nave had been finished with a barrel vault sprung from near level [A]. In this case, there are no clerestorey windows and the stepped profile of the giant order is continued in the transverse arches, as indicated in Puig's plan. Computer model 4 (fig. 14) has the same conditions as model 3 except that the aisles have half-barrel or quadrant vaults.

It is a reasonable deduction that Sant Vicenç, as first conceived, was laid out to take the form illustrated by computer models 3 or 4, that is with a barrel-vaulted nave not much higher than the existing crossing arches and without direct natural lighting. It is, further, a reasonable conjecture that the aisles were intended to be covered with the half-barrels represented in computer model 4. Note that here, just as with the building as it is, there is a 'correspondence between pier and vault' (Armi) and that 'the effect had to be planned from the beginning' (Radding and Clark)—indeed, in both respects, even more so. The proximity of the nave and

32. Durliat, in 'La Catalogne et le premier art roman' (p. 225-226), sees a measure of improvisation in the vaulting system of the aisles, with decisions being taken 'sur le tas'; he comments that 'tous les problèmes posés par le système architectonique de la basilique voûtée n'étaient pas encore pleinement maîtrisés'.

33. Overall dimensions are taken from Junyent, *Rutas Romànicas* (p. 82), but interpolations have been estimated from photographs. Note that in the sectional projections (as in Puig's corresponding diagram), the representation of the sanctuary does not take into account that it is raised over a crypt.

FIGURE 11*a*. Sant Vicenç de Cardona, computer model 1, interior perspective to east.

FIGURE 11*b*. Sant Vicenç de Cardona, computer model 1, isometric section.

FIGURE 12*a*. Sant Vicenç de Cardona, computer model 2, interior perspective to east.

FIGURE 12*b*. Sant Vicenç de Cardona, computer model 2, isometric section.

FIGURE 13*a*. Sant Vicenç de Cardona, computer model 3, interior perspective to east.

FIGURE 13*b*. Sant Vicenç de Cardona, computer model 3, isometric section.

FIGURE 14. Sant Vicenç de Cardona, computer model 4, isometric section.

aisle vaults in this last reconstruction suggests that in this scheme of things the latter would probably have been designed to resist the outward thrust of the former, a not uncommon configuration in *le premier art roman*. The change of direction in the actual construction of the building, which resulted in a much elevated nave

vault, would have removed the need for this abutment and permitted the use over the aisles of the more static system of groin-vaulting we see now.

This paper attempts to relocate Sant Vicenç de Cardona in the discourse on medieval structural rationalism. First it is shown that, since the pioneering work of Puig i Cadafalch, the building has been (and, by some, continues to be) inaccurately presented in the literature and that, as it stands, it has areas of inconsistency that do not fit with a logical interpretation of the structure. It is concluded that the building is the result of two phases of construction and that, with the second phase, there were introduced significant departures from the rationale of the initial scheme. Then, from a more rigorously rationalist analysis of the ground plan, it is speculated what kind of structure might initially have been in mind—much in the vein that Panofsky, in writing of the 'classic style' of High Gothic required 'that we be able to infer, not only the interior from the exterior or the shape of the side aisles from that of the central nave but also, say, the organization of the whole system from the cross-section of one pier'.[34] It is not suggested that either of the schemes represented by figs. 13 or 14 was ever fully realized on site—though a more careful inspection of the fabric might open up some such possibility.

It remains to account for the enduring appeal of Sant Vicenç de Cardona to the imagination of rationalist historians of medieval architecture. The answer must be, in part, subjective. Of first import, it is the case that the logic of the ground plan *is* fulfilled in all those parts of the building extending from the crossing to the north, south and east, for 'each element of the crossing piers corresponds to the order of an arch, a wall surface or the set-back at the start of the curve of a niche, in a thoroughly logical way.'[35] It is to the west of the crossing, in the body of the church, that ambiguities arise. But here, with the changes introduced in the second phase of construction, the salient feature—the giant order that rhythmically divides and unifies the nave—was maintained, albeit with a simplified profile. What is more, it was given even greater monumentality with the decision to raise the height of the vault. With its imposing, lofty proportions, Sant Vicenç anticipates the great barrel-vaulted buildings of the Romanesque, like those along the pilgrimage routes to Santiago de Compostela. So commanding is the effect of the giant order on our appreciation of the structure that adjacent inconsistencies are easily overlooked.

It could well be argued, however, that what we are reading into the organization of the building, actual as well as conjectural, is not a rational expression of structure at all; that although what we see may have an intrinsic visual logic,

34. Panofsky, *Gothic Architecture*, p. 50-51.
35. E. C. Fernie, 'St Vincent at Cardona and the Mediterranean Dimension ...', p. 25.

this has little or nothing to do with the real transfer of thrusts and loads within the fabric of the building. Modern analyses tell us that the transverse arches of barrel vaults 'do not concentrate the vaulting forces to any great extent' and that originally they were 'really constructional in nature'.[36] They may have 'stiffened the vault at intervals' thus making it 'possible to build vault shells that were much thinner',[37] but only to a very limited extent did they and, it follows, the pilasters that support them have a role in transmitting the weight of the masonry vault to the foundation. But we cannot know how the medieval architect conceived his structures and, even though we may be better informed about their physical nature, it is yet difficult, standing in the impressive volumes of Sant Vicenç, not to *see* those arches borne on their giant pilasters as the primary load-carrying elements in the structure. And it is also tempting, reading the plan, to interpret the lateral alignment of the nave piers with both the transverse arches of the aisles and the buttresses of the outer shell (fig. 9*a*) as an attempt by the designer of the first phase here to provide resistance to the outward thrust of the vault and to spread its load over a wider area. Perhaps that is how he understood the statics of his building. It was the architect responsible for the second phase who evidently recognized that the thrust of the heightened vault could be contained within the thickness of the nave walls and piers. It could even be that this was a reason for his restricting the bulk of the giant pilaster by not carrying further upward its outer order.

Acknowledgements

I wish to acknowledge the help of Professor Txatxo Sabater in providing references to Catalan sources and of Elisabet Urgell with translations from the Catalan. The computer models were constructed by Stuart MacDonald, with funds provided by the University of Strathclyde. All photographs are by the author. Sources for diagrams are acknowledged in the captions.

36. Jacques Heyman, *The Stone Skeleton, Structural Engineering of Masonry Architecture* (Cambridge, 1995), p. 51.

37. John Fitchen, *The Construction of Gothic Cathedrals*, (Chicago, 1981), p. 46-47.