CHAPTER 3

METHODOLOGY AND TECHNIQUES

The methods and techniques used in this study of the sacrum and the vertebral column of Southern African Bantu-speaking Negroes, San and American Negroes are considered under the following headings:-

A. Non-metrical Methods
B. Metrical Techniques:
   (i) Definition of Sacral Measurements
   (ii) Definition of Sacral Indices
   (iii) The Ischium-pubis Index and Sciatic Notch Width
C. Statistical Methods.

A. NON-METRICAL METHODS

The non-metrical observations made on the sacra and vertebral columns are as follows:

1. The Number of Vertebrae Comprising the Sacrum

During the preliminary sorting of the sacra, some could not be included in any of the three well-defined categories, namely, 4-piece, 5-piece or 6-piece sacra. Accordingly, special intermediate categories were introduced to accommodate what are here called 4/5-piece and 5/6-piece sacra. The following classification is used in this study (Fig. 3):

5-piece sacra. The human sacrum is formed generally by the fusion of five sacral vertebrae, thus presenting four anterior and four posterior sacral foramina on each side. With these 5-piece sacra I have included 5-piece sacra to which the first coccygeal element is synostosed. This synostosis[1] comprises a bony union of the sacrum and first coccygeal

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[1]Synostosis (or bony ankylosis or bony fusion) may be defined as the process by which there is osseous union between the bones forming a joint (Dorland 1947, Stedman 1966). The term synostosis is the one most frequently employed in relation to the bony union of the sacrococcygeal joint (Cunningham 1964, Köhler & Zimmer 1968). However, the term ankylosis (used clinically to describe, usually, the abnormal union of the bones of a joint) has been used synonymously with synostosis in relation to the sacrococcygeal joint by Trotter and Lanier(1945). In this study, the term synostosis is employed.

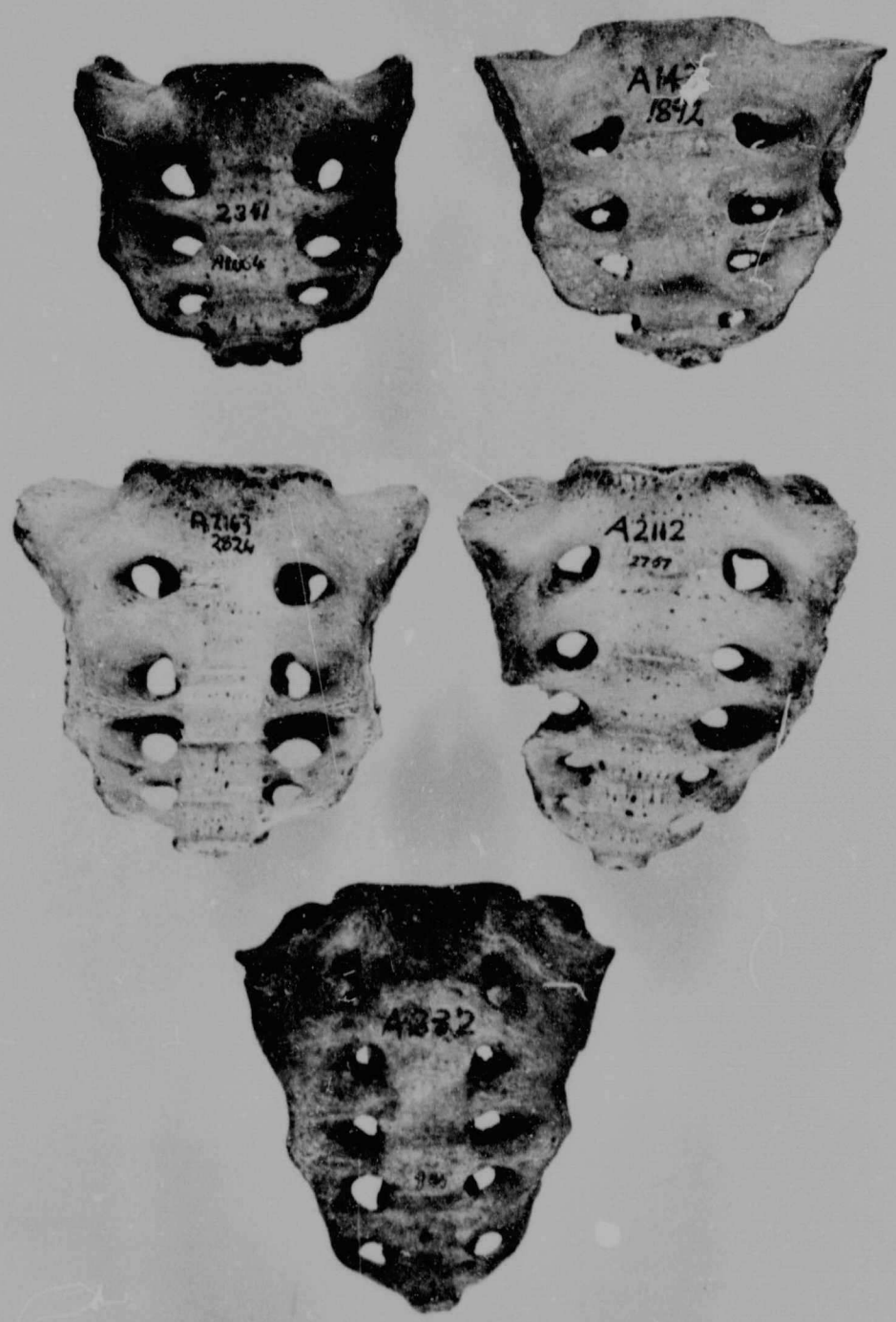

Figure 3 Number of Sacral Vertebrae

Four-piece (A 1664), 4/5-piece (A 1431), 5-piece (A 2163), 5/6-piece (A 2112) and 6-piece (A 832). The lateral wall of the third right sacral foramen in A 2112 is damaged.

piece across the sacrococcygeal symphysis. It is to be distinguished clearly from a fused first coccygeal piece showing sacralisation. In the latter the first coccygeal piece closely resembles and indeed is indistinguishable from the last sacral piece of a 5-piece sacrum, by virtue of the development of its neural arch elements; such a sacrum is then classified as a 6-piece sacrum (see below).

6-piece sacra. The 6-piece sacrum has been defined by Heyns& Kerrich('47) as one with five complete anterior sacral foramina and this usage has been followed here. Heyns and Kerrich submitted that in spines where the thirtieth vertebra is joined to the sacrum, the sacrum should show sufficient development of the transverse processes and caudal elements of sacral vertebrae 5 and 6 to complete the fifth anterior sacral foramen in order for the last element of the complex to qualify for sacral status.

5/6-piece sacra. In this group, the thirtieth vertebra (or the twenty-ninth or the thirty-first depending on the spinal formula) completes a fifth anterior sacral foramen on one side but leaves it incomplete on the other; in the recent state the foramen is completed by the lateral sacro-coccygeal ligament. In addition, there is usually fusion between the bodies of S5 and S6. These sacra closely resemble the 6-piece sacra due to the partial sacralisation of the sixth sacral element. For this reason and to facilitate comparison with the categories of other workers, I shall generally include this group of sacra in the category of 6-piece sacra. However, the incidence and significance of the 5/6-piece sacrum are discussed separately in Chapter 8. The 5/6-piece and 6-piece sacra include sacra with a fused unsacralised coccygeal element.

4-piece sacra. A 4-piece sacrum is formed by the fusion of four sacral vertebrae and presents only three complete anterior and three posterior sacral foramina on each side. A four-piece sacrum bearing a synostosed (but unsacralised) first coccygeal element is included in this category.

4/5-piece sacra. Here there are four complete anterior sacral foramina on one side, while the fourth foramen is incomplete on the other. These sacra closely resemble the 5-piece sacra, lacking only the lateral bony wall of the fifth sacral foramen on one side. This variety (represented by only two sacra) is included in the 5-piece category.

The observations on the number of sacral vertebrae are presented

in Chapter 4.

For purposes of the metrical analysis of the S.A. Negro and San sacra (Chapter 5), the three categories of sacra, namely, 4-piece, 5-piece and 6-piece are lumped together to form a composite 4-5-6-piece group and referred to as the total sample. This grouping follows the practice of all previous workers save for Trotter (1926) and Davivongs (1963). Comparisons are thus possible between the mean measurements of the present study and those of other populations. In addition to the analysis of the lumped data, measurements of the 5/6-piece and 6-piece sacra are analysed as a separate entity and compared with those of the 5-piece sacra (Chapter 6).

2. Variation in the First Sacral Piece

The presence of variation has been noted in the first sacral piece and it may be present at the L5/S1 junction or at the S1/S2 junction. Variation involving the junctional area between the first and second sacral pieces is as follows:

(a) incomplete fusion or complete separation between the bodies[1] of the first and second sacral pieces (Figures 13, 14);
(b) the occurrence of a second sacral promontory (Figure 14);
(c) varying degrees of incomplete fusion between the vertebral arches[1] of the first and second sacral pieces (Figure 15); and
(d) varying degrees of incomplete fusion of the lateral parts of S1 and S2 (Figure 16).

Variation involving the junctional area between L5 and S1 may be observed on the superior surface of the sacrum in the form of alar facets (Figure 17).

The presence or absence of a costo-transverse foramen on the superior surface of S1 was recorded.

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[1] The term 'body' is used in preference to 'centrum'. According to Frazer's Anatomy of the Human Skeleton (1965), the body and centrum are not completely synonymous. 'Centrum' is the part lying between the neurocentral synchondroses, whereas the term 'body' includes the whole portion of the vertebra that lies in front of the free pedicles. The body is thus larger than the centrum. Since the neurocentral synchondroses fuse in early childhood (Gardner, Gray and O'Rahilly, 1969) and all the sacra examined were mature, the term body is used in this study. Similarly, the term 'vertebral arch' is used instead of 'neural arch' since the body includes the centrum and part of the neural arch.

3. Basality:

Three types of basality are described, hypo-, homo- and hyperbasality (Radlauer 1908). When the plane of the superior surface of the lateral mass or ala lies below the plane of the superior surface of the body of the first sacral piece, the sacrum is referred to as a hypobasal sacrum. When the former plane is on the same level, the sacrum is homobasal and if the former plane lies above the latter plane, the sacrum is hyperbasal. The hypobasal sacra were further subdivided into those with moderate and those with marked hypobasality (See Figure 19).

4. Transitional Features in the Last Sacral Piece:

These features are present in the group of 5/6-sacra (and 4/5-piece sacra) and are described earlier in Section A.1 of this Chapter.

5. Sacra with a Synostosed First Coccygeal Piece:

These sacra are considered with reference to sex, age group, number of sacral pieces and the occurrence of transitional features in the first sacral and last sacral piece.

Variation in the first and last sacral pieces, basality, and sacro-coccygeal synostosis are recorded in the S.A. Negro sacra only (Chapter 8).

6. The Number of Precoccygeal Vertebrae:

The presacral (PSV) and sacral vertebrae of each spinal column were articulated serially and the number of vertebrae in each region (i.e. cervical, thoracic, lumbar and sacral) recorded to give the total precoccygeal vertebral number (PCV). The count of PCV is made in S.A. Negroes, American Negroes and San and, in addition, both the regional spinal formula (C.T.L.S) and the presacral/sacral formula (PSV/S) are presented for the S.A. Negro sample (Chapter 9).

A count of coccygeal vertebrae was not made because very few complete coccyges were available. Even if present, inaccuracies are likely in the counting of such small bones, in particular the last three coccygeal vertebrae. Besides, the coccyx is not as important, from an anatomical and functional viewpoint, as the rest of the column. A synostosed coccyx or first coccygeal vertebra was not included in the sacral count.

Care was taken to exclude from the survey any spines with missing vertebrae. This was achieved by strict scrutiny of the articulations

and general conformation of the vertebrae preceding and succeeding each vertebra examined. In addition, if there was any doubt as to the number of thoracic vertebrae, the ribs were examined. A special search was made for lumbar and cervical ribs, as possible corroborative, diagnostic evidence.

Particular attention was paid to the junctional areas between spinal regions and to the status of vertebrae showing variation at these areas. The following criteria were observed:

a) Occipito-cervical junction: One vertebral column presented with unilateral assimilation of the atlas. Since it was only partly assimilated to the occipital, and since it had the typical features of a first cervical vertebra, the atlas in this spine was counted as a presacral vertebra. An atlas, whether unilaterally or bilaterally assimilated, is thus counted as a PSV in this survey.

b) Cervico-thoracic junction: The rare occurrence of a cervical rib on C7 was not on its own considered sufficient evidence upon which to re-classify the vertebra as thoracic, for the cervical rib does not seem to be functionally integrated into, nor to affect, the thoracic cage. Moreover, apart from the rib, the vertebra in question has the typical morphology of a last cervical vertebra and in the spinal columns examined in this study, the succeeding vertebra was always typical of a first thoracic vertebra.

c) Thoraco-lumbar junction: A first lumbar vertebra bearing a lumbar rib or ribs was judged to retain its lumbar status. Lumbar ribs are very small and do not contribute to the thoracic cage. In other respects, the vertebra in question has the typical morphology of a first lumbar vertebra, and the succeeding vertebra that of a second lumbar vertebra.

d) Lumbo-sacral junction: A vertebra showing variation at this junctional area was counted as sacral, if its transverse process was enlarged and developed so as to form part of the sacro-iliac joint and thus to bound a sacral foramen, even if only unilaterally. Fusion of vertebral bodies was not counted as sacralisation, if this was due to osteophytic overgrowth. These criteria correspond with those defined by Lanier (1939) and Bornstein and Peterson (1966).

B. METRICAL TECHNIQUES

The measurements and indices described by Radlauer (1908) and adopted as standard by Martin-Saller (1957) have been followed here, unless

otherwise stated. In general, the measurements and indices correspond with those described by Wilder (1920) who derived most of the measurements from Radlauer (1908). In parentheses are the symbols for each measurement, first the abbreviated symbols of the author's devising and, secondly, the equivalent Martin-Saller (M) numerical designation. The title of the measurement as well as the abbreviated symbols are used in the text and tables.

i) DEFINITION OF SACRAL MEASUREMENTS

All measurements are recorded in millimetres and expressed to the nearest whole millimetre. For measurements 1-5 the sacrum is based in a tray of sand.

1. The Anterior Curved Length (cL - M1):

This is measured from the midpoint of the sacral promontory, along the ventral surface of the sacrum, to the midpoint of the lower border of the last sacral piece (Figure 4, the curved line adb). A pliable, narrow, steel tape-measure is carefully smoothed along the anterior surface of the sacrum between these two points. This measurement excludes the coccyx if synostosed to the sacrum.

2. The Anterior Straight Length (L - M2):

This is the chord between the midpoint of the sacral promontory and the midpoint of the lower border of the last sacral piece (Figure 4, line ab). This measurement excludes the coccyx if synostosed to the sacrum.

For measurements 2, 3 and 4 a co-ordinate caliper is used. The three measurements are recorded on the instrument in one operation.

3. The Height of Maximum Curvature (hmc - M6):

This is the maximum perpendicular which can be dropped from a point on the mid-ventral curved surface of the sacrum to the chord ab (Figure 4, line cd).

4. The Position of the Maximum Curvature (pmc - M7):

This is the distance along the chord ab from the sacral promontory to the foot of the perpendicular which marks the position of the maximum curvature (Figure 4, line ac). This measure is used to derive curvature index C, in which pmc is compared with the anterior straight length. It is sometimes referred to as position of maximum height line.

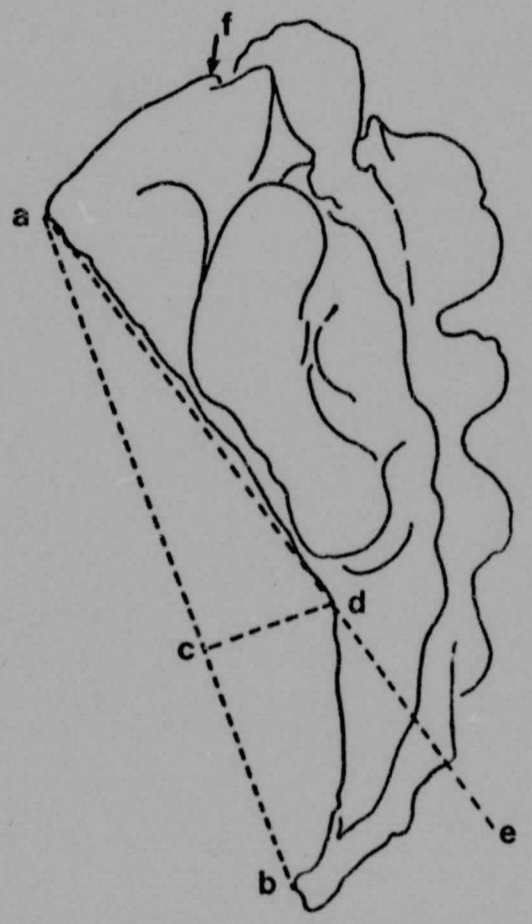

Figure 4 Left Lateral Aspect of Sacrum

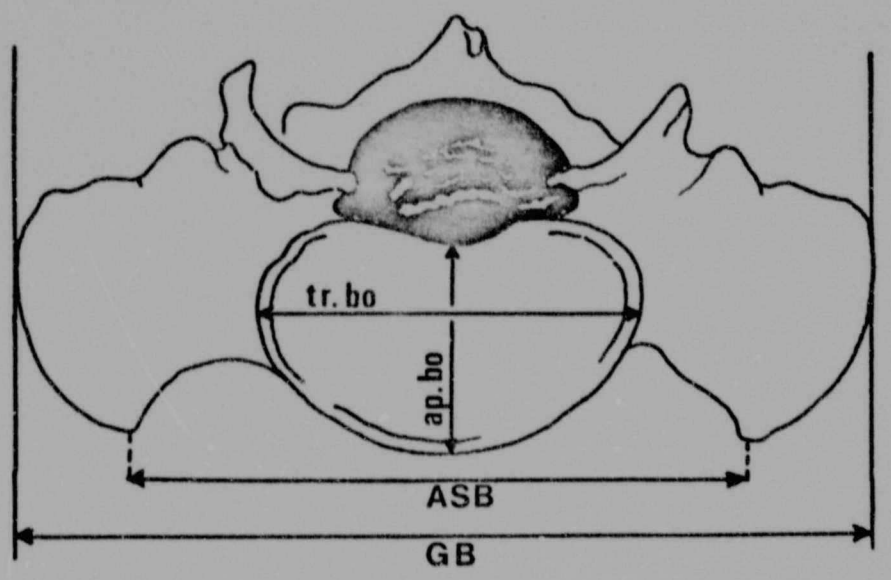

Figure 5 Superior Aspect of Sacrum

5. The Greatest Breadth (GB - M5):

This a measure of the greatest transverse breadth of the sacrum in the horizontal plane wherever it may be (Figure 5, GB) A sliding caliper is used.

5a. The Greatest Breadth of the Base (GBB):

A further measurement of sacral breadth was carried out namely, the greatest breadth or width of the base. This measurement is taken at right angles to the superior surface of the body of the first sacral piece within the limits of its anterior and posterior margins. A sliding caliper is used. This measurement is not described by Radlauer (1908), Wilder (1920) or Martin-Saller (1957). The first reference to it in the literature available to me is by Fawcett (1938) who employed it when he devised the corporo-basal index for sex determination of a sacrum. In practice, in this survey, this measurement was found to be virtually the same as the greatest breadth (see Figure 5). Therefore, though this measurement has been recorded and analysed for all sacra, the results will not be presented.

6. The Anterior Straight Breadth (ASB - M5a):

This is a chord measured horizontally between the most anteriorly or ventrally projecting parts of the left and right auricular surfaces (Figure 5, ASB) A spreading caliper is used.

Wilder (1920) describes the measurement of ASB only and not the measurement of GB.

7. The Anteroposterior Diameter of the Body of the First Sacral Piece (ap.bo.- M18):

The anteroposterior diameter of the superior (or articular) surface of the body of the first sacral piece is measured (Figure 5, ap.bo). A sliding caliper is used for this and measurement 8. In some sacra, the margins of the body of the first sacral piece were rendered irregular by the presence of osteophytes. It was possible, however, in most of the bones, to determine the position of the original margin of the body; this was usually just internal to the osteophytes. If there was any doubt about this measurement or measurement 8, the bone was omitted. This did not seriously decrease the numbers of sacra for this and the succeeding two measurements.

5. The Greatest Breadth (GB - M5):

This a measure of the greatest transverse breadth of the sacrum in the horizontal plane wherever it may be (Figure 5, GB) A sliding caliper is used.

5a. The Greatest Breadth of the Base (GBB):

A further measurement of sacral breadth was carried out namely, the greatest breadth or width of the base. This measurement is taken at right angles to the superior surface of the body of the first sacral piece within the limits of its anterior and posterior margins. A sliding caliper is used. This measurement is not described by Radlauer (1908), Wilder (1920) or Martin-Saller (1957). The first reference to it in the literature available to me is by Fawcett (1938) who employed it when he devised the corporo-basal index for sex determination of a sacrum. In practice, in this survey, this measurement was found to be virtually the same as the greatest breadth (see Figure 5). Therefore, though this measurement has been recorded and analysed for all sacra, the results will not be presented.

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8. The Transverse Diameter (width) of the Body of the First Sacral Piece (tr.bo. - M19):

This is measured at right angles to the anteroposterior diameter (Figure 5, tr.bo.).

9. The Promontory Angle (∠ P - M22):

This is the angle formed between the superior and anterior surfaces of the body of the first sacral piece (Figure 4, angle fae). Martin-Saller (1957) measures this by means of two steel needles. The following more practicable method has been used here (Figure 6). A perspex protractor is mounted with its base along the edge of a thin sheet of firm material (e.g. hardboard or glass) which is provided with a white surface so as to render the protractor markings readily visible. The superior and anterior surfaces of the body of the first sacral piece are marked in the mid-sagittal plane. The line marked on the superior surface of the sacrum is then held against the base of the protractor, to the right (or left) of the null point of the protractor. A narrow ruler is placed firmly against the anterior marked surface of the sacrum. The sacrum and ruler (as a unit) are manoeuvred along the protractor base until the line of the ruler passes through the null point on the protractor. The angle thus indicated is read (Figure 6, angle ghk). If osteophytes were present in the midline and thus interfered with this measurement, or if there was marked osteophytosis as a whole, the bone was omitted.

(ii) DEFINITION OF SACRAL INDICES

The following indices have been calculated from the foregoing measurements:

1. Curvature Index A (100 L/cL - 'chord-arc' curvature index of Martin-Saller): 100 anterior straight length/anterior curved length.

This index gives an indication of the longitudinal curvature of the sacrum. The nearer this index is to 100, the flatter is the sacrum. Categories are not described for this index by Martin-Saller, nor for curvature indices B or C.

Four categories of longitudinal curvature were devised for this index, following a suggestion (Tobias, personal communication 1973). They are: strong sacral curvature where the index is less than 85,0%,

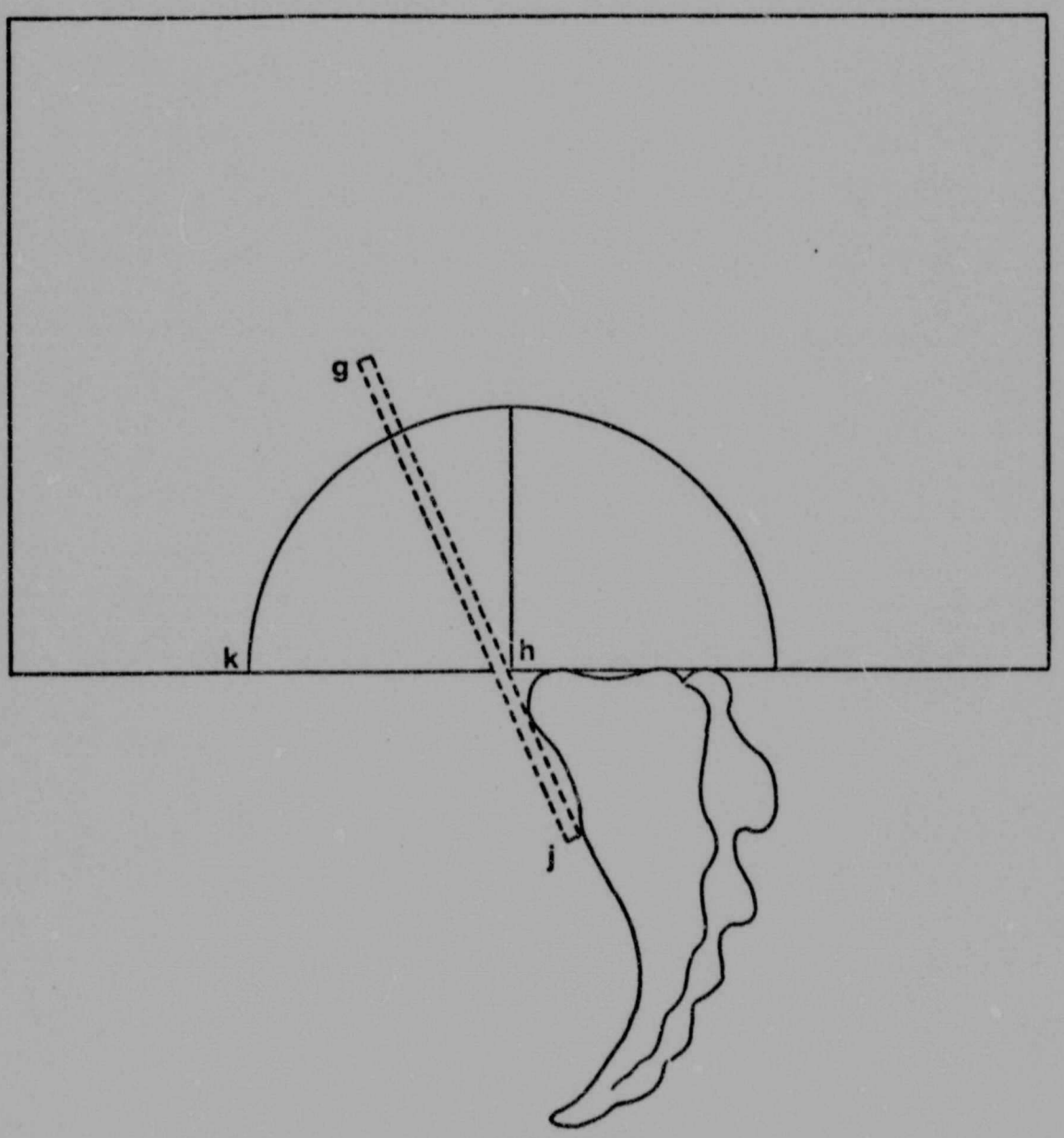

Figure 6 Method of Measurement of Promontory Angle
The dotted line ghj represents the ruler which is held firmly against the anterior surface of S1 and projected through the null point of the protractor. The angle ghk is the promontory angle.

marked sacral curvature when the index lies between 85,0% and 89,9%, moderate sacral curvature when the index is between 90,0% and 94,9% and slight curvature when the index is equal to or greater than 95.0%.

2. Curvature Index B (100 hmc/L - 'chord height' curvature index of Martin-Saller): 100 height of maximum curvature/anterior straight length.

The higher this index, the more curved is the sacrum.

3. Curvature Index C (100 pmc/L - 'height-length' curvature index of Martin-Saller): 100 position of maximum curvature/anterior straight length.

This index is alternatively referred to as relative position of maximum curvature and gives an accurate indication of the position of the point of greatest depth relative to the straight length. The higher the index, the more caudal is the point of deepest curvature.

The designation and description of curvature indices A, B and C correspond with those of Wilder (1920).

4. Sacral Index A (100 ASB/L - not described by Martin-Saller): 100 anterior straight breadth/anterior straight length.

The first mention of this index found in the literature available to me was by Wilder (1920). He does not describe sacral index B and uses sacral index A in its place; in fact, he employs the same categories for sacral index A as others have used for sacral index B. It is possible that Wilder believed this index to be the sacral index (sacral index B) first described by Turner (1885/6b) which employs the measure of greatest breadth, since the difference between anterior straight breadth and greatest breadth, though definite, is small (see Figure 5).

5. Sacral Index B (100 GB/L - length-breadth index (a) of Martin-Saller[1], commonly known as 'the sacral index'): 100 greatest breadth/ anterior straight length.

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[1] Martin-Saller's length-breadth indices (b) and (c) relate the anterior straight breadth and the anterior curved breadth to the anterior curved length. These indices are rarely employed and were not calculated in the present series.

This index corresponds with the sacral index first described by Turner (1885/6b) and is the proportion of greatest breadth to length. He devised two categories of this index, platyhiery when the sacral index is above 100, and dolichohiery when the index is below 100. Paterson (1892) modified this classification to include a subplatyhieric category of 100 to 105.9% The categories are thus dolichohiery (less than 100%), subplatyhiery (100 - 105.9%) and platyhiery (106% and greater). This classification, used by Martin-Saller, is followed in this study.

This method of computing the sacral index, besides being employed by Paterson (1892), Radlauer (1908) and Martin-Saller (1957), is followed by Le Double (1912), Drennan (1937), Frazer's Anatomy of the Human Skeleton (1965) and Trotter and Peterson in the Osteology section of Morris's Human Anatomy (1966). All these workers designate this index simply as 'the sacral index'. The two methods of estimating the sacral index, sacral index A and sacral index B, are discussed further in Chapter 5, Section E.

6. Sacral Base Index (100 ap.bo/tr.bo - sacral base index of Martin-Saller): 100 anteroposterior diameter of body of S1/transverse diameter of body of S1.

The antero-posterior diameter of the body of the first sacral piece is expressed as a percentage of the breadth of the body of the first sacral piece.

7. Corporo-basal Index (100 tr.bo./GB - not described by Martin-Saller, the corporo-basal index of Fawcett (1938)): 100 transverse diameter of body of S1/greatest breadth.

This index expresses the ratio of the width of the body of the first sacral piece to the greatest breadth (or to the greatest breadth of the base). It is not described by Radlauer (1908), Wilder (1920) or Martin-Saller (1957). This index was devised and tested by Fawcett in 1931 and later published (1938). He described it as the ratio of the transverse diameter of the body of S1 to the transverse diameter of the base of the sacrum. This latter measurement (GBB), as stated, virtually coincides with sacral breadth and the index employed here uses the sacral breadth for convenience. Fawcett (1938) found this index to be a reliable indicator of sex.

(iii) THE ISCHIUM-PUBIS INDEX AND SCIATIC NOTCH WIDTH: THE SEXING OF THE SAN SPECIMENS

The sex was known for certain in the S.A. Negro sacra, all of which had been derived from cadavers. In the San series, however, only seven individuals out of 63 were of known sex. As sex differences were being sought amongst the sacra, it was essential to sex the skeletons (rather than the sacra) as reliably as possible. Accordingly, the pelves have been sexed using the ischium-pubis index and the measurement of sciatic notch width. Washburn (1948,1949) and Hanna and Washburn (1953) advocate the combination of the two methods. They find that the ischium-pubis index alone will sex the majority of skeletons, provided they belong to one major racial group; the measurement of the sciatic notch width will determine sex in part of the remaining pelves and the combination of the two will sex the vast majority of skeletons. The use of the ischium-pubis index and sciatic notch width for sex determination has been used successfully by Davivongs (1963) on the collection of Australian aboriginal skeletons at the South Australian Museum, and, more recently, by Glanville (1967) on a series of 89 Tellem skeletons (the Tellem are a medieval Negro population from the Mali Republic). Olivier (1969) advocates the use of the ischium-pubis index and states that it is probably one of the best criteria for sexual differentiation of the pelvis. This finding is echoed by Basmajian (1971).

1. The Ischium-pubis Index (abbreviation not used, sometimes called the ischium-pubis index of Schultz): 100 pubis length/ischium length.

The technique of measurement followed is that described by Schultz (1930) and adopted by Washburn (1948,1949). Both the pubis and ischium are measured from a point within the acetabulum at which they meet (Figure 7). This point 'a' can usually be identified by an indentation at the inner edge of the acetabular articular surface or by a ridge in the region of junction of the two bones in the acetabulum. The pubis is measured from point 'a' to the medial aspect of the superior portion of the pubic symphysis. Washburn (1949) advises that care should be taken to hold the caliper parallel to the long axis of the pubis for this measurement. The ischium is measured from point 'a' to a point 'c'. Point 'c' is the lowest point on the ischial tuberosity.

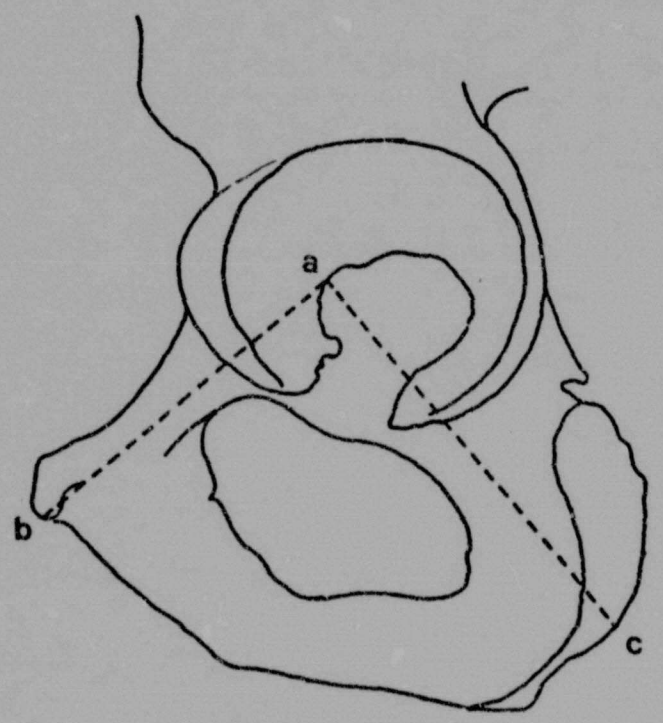

Figure 7 Measurement of Length of Pubis and Length of Ischium (after Schultz, 1930)

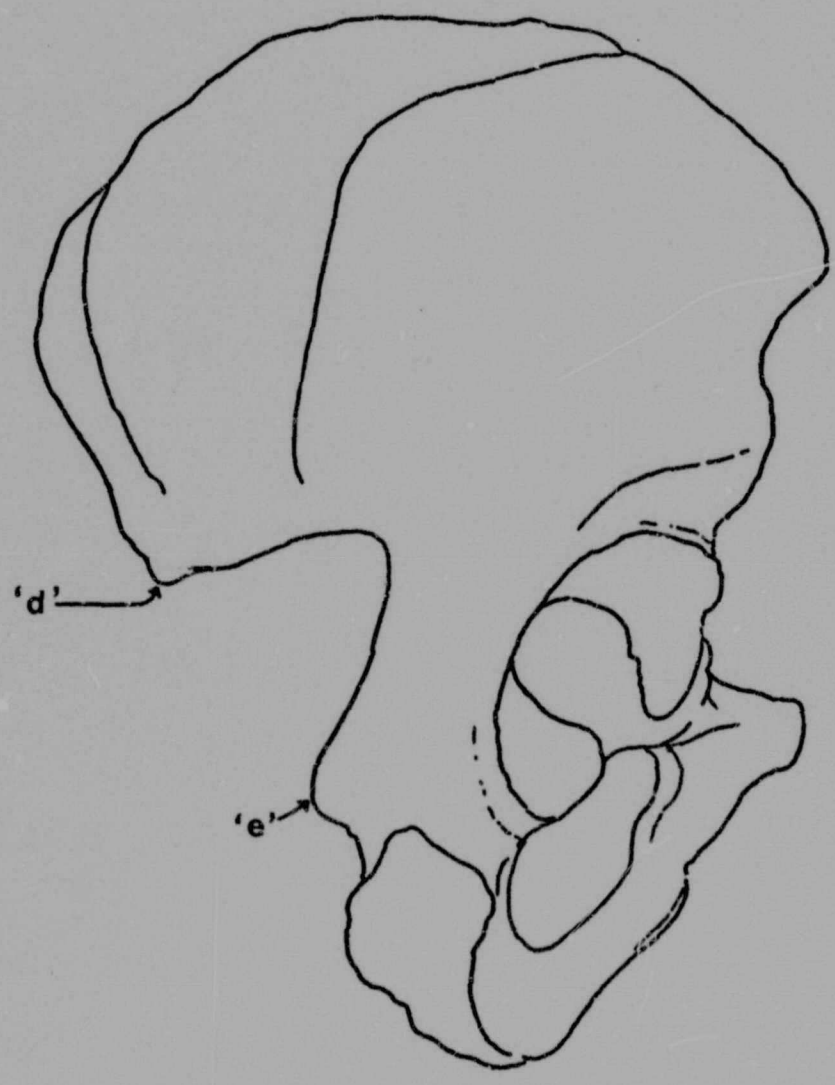

Figure 8 Measurement of Sciatic Notch Width

The notch is measured from point 'd' to point 'e'.

2. The Sciatic Notch Width:

The sciatic notch width is the measure of the maximum width of the sciatic notch. It is measured by means of a sliding caliper from point 'd' which is located at the inferior border of the posterior inferior iliac spine at its junction with the sciatic notch to a point 'e' situated at the tip of the ischial spine (Figure 8).

Washburn (1949) did not define precisely his method of measurement of sciatic notch width, stating merely that the maximum width of the sciatic notch was measured. Martin-Saller (1957) measures it from the ischial spine to the posterior inferior spine. Davivongs (1963) describes point 'd' as the pyramidal projection located at the termination of the posterior border of the greater sciatic notch and point 'e' as the terminal point on the ischial spine. Glanville (1967) follows this definition. The technique used by the author for the measurement of sciatic notch width corresponds with that described by Martin-Saller (1957) and Davivongs (1963) and presumably with Washburn's maximum width of the sciatic notch.

Washburn first tested the method of sex determination by means of the ischium-pubis index in man, on 300 adult skeletons of known sex and race (200 American Caucasoids and 100 American Negroes). He found that the sex of over 90% of skeletons could be determined using the index. If the index was used in conjunction with the sciatic notch width, it was possible to sex all skeletons correctly. Later (1949) working on 152 S.A. Negro skeletons in the R.A. Dart Collection in the Department of Anatomy, he had similar results; only three female pelves fell in the range of male variation and their ischium-pubis indices were at the top of the male range of variation. One of these was correctly designated female using the sciatic notch width. In the same survey, he examined 55 San (Bushman) skeletons of unknown sex (only three were of known sex) and he was able to sex all except one skeleton by means of the index. Norms were thus established for the index in the San (Table 4) and are utilised for sex determination in the present San series. My series of 63 San pelves includes 35 which were in Washburn's series of 55 pelves.

Washburn (1948,1949) found that the size of the sciatic notch was useful in assessing the sex of some of the doubtful cases not definitely sexed by the index. It is so used here. He found the notch to be approximately 1cm wider in females than in males but the variability was so great that it was a less reliable indicator of sex than the index.

An additional check on skeletal sex was available for the San material from the McGregor museum. Orford (1934) had assigned sex to these pelves on the basis of many metrical and other criteria and her results were identical with mine (using the ischium-pubis index and sciatic notch width). The Dart Collection of San crania, including the material from the Port Elizabeth museum, has been sexed variously by Professor R.A. Dart, Professor P.V. Tobias and Professor H. de Villiers and unpublished records of this are available for many of the crania. The S.A. Museum supplied a catalogue record of sex. The sex of the skeletons according to the ischium-pubis index coincided with the catalogue record of sex in all but six pelves. The ischium-pubis index was accepted as the final arbiter of sex in these six pelves, as, in all but one, the value lay well within the prescribed range for either sex.

RESULTS

1. The Ischium-pubis Index

The values for the ischium-pubis index were calculated in 52 of the 63 San pelves of the present series. The remaining 11 pelves were too damaged to measure accurately. The means and measures of spread given by Washburn (1949) for the ischium-pubis index in the San are given in Table 4. The present San series were sexed according to Washburn's criteria. Of the 52 pelves, 31 are placed in the male category and 21 in the female category (see Table 4).

TABLE 4

The Ischium-pubis Index in Washburn's (1949) San Series and the present San Series

Source		No.	Mean	Range	SD	CV
Washburn,1949	Male	26	83,7	76-91	3,3	4,0
	Female	29	100,0	93-108	3,9	3,9
Present Study	Male	31	83,7	75,6- 91,0	4,3	5,1
	Female	21	99,2	91,3-112,9	6,4	3,5

The mean ischium-pubis index in males is identical in Washburn's series and the present series (83,7 cm), and the range is similar (lower limit of range extends by 0,4 cm in present study). The mean ischium-pubis index in females