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Cervicodorsal, Dorsal and Sacral Vertebrae of Titanosauria (Sauropod Dinosaurs) Discovered from the Latest Cretaceous Dinosaur Beds/VitakriMember of Pab Formation, Sulaiman Foldbelt, Central Pakistan

M. Sadiq Malkani

Paleontology and Stratigraphy Branch, Geological Survey of Pakistan, Sariab Road, Quetta, Pakistan.

The vertebral count in most titanosaurids is not known. However in most Argentinian *Saltasaurus loricatus,* there are about 23 presacral and about 35 caudal vertebrae. In Indian titanosaurus colberti, the exact vertebral count also remains unknown. Present paper is based on fragmentary 2 cervicodorsals, 13 dorsals and 6 sacrals (three coosified pair) vertebrae, which are newly collected by me from central Sulaiman fold and thrust belt. The dorsal centra are divided in to three morphological categories. The first morphology represents short and broad opisthotic centra with smooth ventral surface as characterised by the first cervicodorsal vertebrae. The second morphology represents short and circular centra. It may be in the transition between the anterior and posterior dorsals from hemisperical to cylinderical shape of centra. The third type is tall, relatively long and has sagital ventral ridge/keel, and slit like pleurocoels. Deep slit like pleurocoels occur on the lateral surfaces just below the neural arches on the tall centra. Posterior concavity seems to be larger than anterior convexity. All these three morphologies may belong to three different taxa or may be variable due to positions; it will clear after finding articulated skeleton. The centrum length increases from the first cervicodorsal vertebrae but throughout series remain unknown due to fragmentary nature however with possible close findings I can say that the length increase in the anterior dorsals and then decrease up to sacral. From morphology I can guess that the transeversely hemisphericity decreases up to mid dorsal. In posterior dorsal the transeversely hemisperity shifted to the ventrodorsally hemisperity. In dorsals, the broadness is going to be low ie transeverse ellipticity is going to be low as going backward. The neural canal is subrounded. There is no hyposphene-hypantrum in any of the collected dorsals. The neural spine is undivided. Anteriormost sacral cone is covex ie opisthotic.It lacks pleurocoels. The sacral centra are short and slightly broad having ventral keel/ridge (no ventral smooth surface), and less tall than wide. It have posterior amphiplatan surface. The bones are pneumatic/somphospyndalous. Sacral vertebrae have ribs forming cavity between ribs in the proximal portion and seem to be fused forming sacricoastal yoke. The anterior most rib belonging to anteriormost sacral vertebra is separate and may combine with preacetabular process of ilia. Fragmentary partial ribs pieces are collected. The tuberculum and capitulum are of subequal size, subrounded capitulum and oval to suboval toberculum and are marked with a notch in between. There is a marked ridge running along the length of the rib shaft bifurcating just before the proximal notch and terminating toward the end of the capitulum and tuberculum. Medially there is a marked depression running anteriorly. The proximal part of the rib is spongy and concavo-convex in cross section and distally massive and plano-convex.

Key words; Cervicodorsal, dorsal and sacral vertebrae, Titanosauria, Late Cretaceous, Sulaiman foldbelt, Pakistan.

Corresponding Author:
E. Mail: Malkanims@yahoo.com

Introduction

The Sauropoda is diagnosed on the basis of very large body size, relatively small skulls, long necks, long tails, skull with large dorsally placed nares, greatly reduced jugal usually excluded from the ventral border of the skull, large quadratojugal, relatively small endocranial capacity, highly vaulted palate with large pterygoids, presacral centra lightened by deep pleurocoels and/or cancellous bone, neural arches and spines largely reduced to a complex of thin laminae, 12 to 19 cervicals, 8 to 14 dorsals, scapula oreiented more nearly horizzontal than vertical, illium with broadly expanded preacetabular process and with pubic peduncle much longer than ischial, limb bones robust and solid, no notch between head and greater trochanter in femur, carpus and tarsus reduced to one or two elements each in all but perhaps the earliest forms, metacarpals longer than metatarsals, number of phalanges greatly reduced in manus, digit 1 alone retaining a claw, number of phalanges reduced in digitsIV aand V of pes(Mclntosh,1990).

To increase strength while minimizing increase in weight in animals the size of the sauropods, the centra are greatly lightened by the development of paired pleurocoels, which in extreme cases (e.g., the dorsals of the *Camarasaurus* and *Brachiosaurus*), occupy most of the interior of centrum. Pleurocoels are not found in the caudals except in *Diplodocus*. The more common method of lightening the arches in the cervical, but more particularly in the dorsals, is to reduce them to little more than a complex of thin laminae extending from one structure to another (Mclntosh, 1990). The laminae are well decribed and named by Janensch (1929) and Wilson (1999).

So far India was the only source of dinosaur assemblage (Hislop,1864; Falconer, 1868; Lydekkar, 1877, 1879; Huene and Matley, 1933; Jain &Bandyopadhay, 1997; Wilson & sereno, 1998; Powel, 2003). Gingerich et al. (2001) reported Tertiay mammals from Pakistan. But now Pakistan has produced well preserved dinosaur fossils scoring useful anatomical features for taxonomy and paleobiogeography. First dinosaurs from Pakistan were discovered by me from the Late Cretaceous Pab Formation of Vitakri area, Barkhan District, Balochistan during 2000. Until now total about three thousand fragmentary bones/pieces of bones/fossils have been collected by author from the terrestrial strata of latest Cretaceous (Maestrichtian) Dinosaur beds/Vitakri member of upper part of Pab Formation from Central Sulaiman foldbelt. The caudal vertebrae of Pakistani titanosaurs tell five tales like three genus and species (*Pakisaurus balochistani, Sulaimanisaurus gingerichi and Khetranisaurus barkhani)* of herbivorous pakisaurid=titanosaurid, and two genus and species (*Marisaurus jeffi and Balochisaurus malkani)* of herbivorous Balochisaurids/Saltasaurids (Malkani, 2004a, 2005, 2006a). One genus and species (*Vitakridrinda sulaimani)* of carnivorous abelisaur theropods have already established (Malkani, 2004a, 2005, 2006a). One genus and species (*Pabwehshi pakistanensis)* of Mesoeucrocodylia are diagnosed (Wilson, et al. 2001, Malkani, 2004b). A genus and species (*Brohisaurus kirthari*) of Late Jurassic/Early Cretaceous Titanosauria (Malkani, 2003c) have been discovered from Kirthar foldbelt, Pakistan. In addition to this four armor bones (Malkani, 2003b), one braincase (Wilson, Malkani and Gingerich, 2005, Malkani, in process), of titanosaurian dinosaurs have been discovered by me. New discoveries like new *Marisaurus*, a rostrum of *Vitakridrinda* Theropod, a rostrum of *Balochisaurus*, appendicular elements, and an atlas-axis complex of titanosaurian sauropod dinosaurs have been reported (Malkani, 2005, Malkani, in press). Presently the collections of cervicodorsal, dorsal and sacral vertebrae of titanosaurian sauropod dinosaurs from Pakistan are being described here.

Geological and Stratigraphic setting

The study area of Sulaiman fold belt is located in the Central part of Pakistan (Figure-1). Latest Cretaceous (Maestrichtian) dinosaurs are hosted by the Pab Formation of Sulaiman fold belt. The Latest Cretaceous sediments in the study area underwent considerable tectonic deformation during the collision of Asian and Indo-Pakistan continental plates that commenced in the Late Cenozoic. As a result dinosaur beds along with other formations have been folded. The lateral extension of dinosaur beds of the Pab formation have been observed in the major four anticlinoriums named as Vitakri-Mari Bohri, Dhaola-Andari, Phulali-Pikal-Siah Koh, and Fort Munro anticlinoriumns, generally trending NNE to SSW, however the western part of Dhaola and Mari Bohri anticlines trend E-W forming lobate belts.

The Sulaiman foldbelt consists of sedimentary rocks ranging in age from Jurassic to Pleistocene (Table-1). The rocks comprising of shale, limestone, sandstone, siltstone, marl and conglomerate in different lithological units in ascending order as; Jurassic Sulaiman group representing Spingwar, Loralai and Chiltan formations, Cretaceous Parh group representing Sember, Goru and Parh formations, newly proposed Fort Munro group (type and reference sections are Rakhi Gaj section in toposheet 39 K/1 and Shadani section in toposheet 39 J/4) representing Mughal Kot, Fort Munro and Pab formations; Paleocene Ranikot Group representing Khadro, Rakhi Gaj and Dungan formations; Eocene Ghazij Group represents Shaheed Ghat, Toi, Drug and Baska formations; Kirthar group represents Habib Rahi, Domanda, Pir Koh and Drazinda formations, Oligocene-Pliocene newly proposed Vahova group (type section the Vahova Rud in toposheet 39 I/4,8) group represents Chitarwata, Vahova, Litra and Chaudhwan formations, Pleistocene Dada Formation, Subrecent and recent fluvial, eolian and colluvial deposits conceal the bed rock at places (Malkani, 2004c, 2006b)(Table -1)

Table 1. STRATIGRAPHIC SEQUENCE OF SULAIMAN FOLDBELT

Age		**Formation**	**Lithology**
Q	Recent	Modern channel deposits	Gravel, sand, silt and clay
U		Sand, silt and clay deposits	Sand, silt and clay with minor gravel
A		(cultivated lands)	
T			
E	and	Sand, silt and clay deposits	Sand, silt and clay with minor gravel
R		(non-cultivated lands)	
N		Colluvium deposits	Boulder, pebbles,cobbles,with sand
A			silt and clay.
R		Fan gravel deposits	Poorly consolidated gravel, sand,
Y			silt and clay.
	Sub-Recent	Terrace gravel deposits	Poorly consolidated gravel, sand,
			Silt and clay.
		------------------------------------**Angular Unconformity** ---	
	Pleistocene	Dada Formation	Conglomerate, sandstone and clays.
		--------------------------------**Angular Unconformity** ---	
T	Pliocene	Chaudhwan Formation	Clays, conglomerate and sandstone
		Litra Formation	Sandstone, clays and conglomerate
E	Miocene	Vihova Formation	Clays, sandstone and conglomerate
	Oligocene	Chittarwata Formation	Clays, conglomerate and sandstone
R		-------------Disconformity ---	
		Drazinda Formation	Shale with minor coquina.
T		Pir Koh Formation	Limestone, marl and shale.
		Domanda Formation	Shale with minor coquina and gypsum.
I		Habib Rahi Formation	Limestone, marl and shale.
	Eocene	Baska Formation	Gypsum, shale with minor silty dolomite.
A		Drug Formation	Rubbly limestone and mudstone / shale.
		Toi Formation	Sandstone,shale, rubbly limestone and coal.
R		Shaheed Ghat Formation	Mainly shale with minor marl /
			limestone and siltstone.
Y	Paleocene	Dungan Formation	Limestone, marl and shale
		Rakhi Gaj Formation	Shale, mudstone, siltstone, sandstone & lime
		Khadro Formation	Limestone with minor shale and sandstone
C		-----------------------Disconformity --	
R			
E		Pab Formation	Sandstone with subordinate shale
T	Late	Fort Munro Formation	Limestone, shale and coquina beds
A		Mughal Kot Formation	Shale with minor marl/limestone and
C			coquina beds
O	Early	Parh Formation	Limestone with minor marl and shale
U		Goru Formation	Shale and marl with minor limestone
S		Sembar Formation	Mainly shale with minor marl and mudstone
	Late	----------------------Disconformity ---	
		Chiltan Formation	Mainly Limestone.
JURASSIC	Middle	Loralai Formation	Limestone with insignificant shale
	Early	Spingwar Formation	Shale, marl and limestone.

Materials and Methods

Present paper provide the description of newly discovered materials including cervicodorsal, anterior dorsals, posterior dorsals and sacral vertebrae of Pakistani titanosaurs collected from the central Sulaiman foldbelt (Figure1), Pakistan. There are 2 cervicodorsal vertebre, sample nos MSM-120-2 and MSM-133-4 collected from Bor Kali Kakor and Kinwa Kali Kakor localities respectively belong to the Vitakri region (Figure-1). There are 13 dorsal vertebre, sample nos MSM-121-2 to MSM-125-2 found from Bor Kali Kakor locality of Vitakri area, MSM-131-16 to MSM-132-16 found from Top Kinwa locality of vitakri area, MSM-134-8 found from Nala locality of Gumbrak area belongs to Dhaola range, and MSM-126-15 to MSM-130-15 found from Mari Bohri locality belongs to eastern plunge of Mari Bohri-Mawand anticlinorium. There are six (three pair) sacral vertebre, sample nos MSM-135-2, MSM-136-4, and MSM-137-16 found from Bor Kali Kakor, Kinwa Kali Kakor and Top Kinwa Kali Kakor localities of Vitakri area. The important fact of these collections is the four associations belonging to four localities.

All of these vertebrate assemblages of terrestrial ecosystems of Sulaiman Latest Cretaceous Park are found in the red muds/clays rich horizon of Vitakri member/Dinosaur beds (upper member) of Late Cretaceous Pab Formation in the central Sulaiman foldbelt of central Pakistan. Late Cretaceous Pab Formation of Vitakri region has been divided in to three members like Lower Dhaola member, middle Kali member and upper Vitakri member/Dinosaur beds. The environment and vertebrate assemblages of Sulaiman fold belt Cretaceous Park show a model of medium to large bodied Pakisaurids/titanosaurids and Balochisaurids/saltasaurids, and theropods habitat along with the possible earlier mammals on the over bank fluvio-lacustrine environments, crocodile habitat in the rivers and lakes, and walking and flying birds on the land and air. The discovery of saltasaurids, abelisaurid and baurusuchid from Pakistan broadens the distribution of saltasaurids, abelisaurid and baurusuchid, and indicating close affinity with South America and Madagascar of Gondwanaland.

The method applied here is the paleontological methods representing description, interpretation, discussion and conclusions.

Description of cervicodorsal, dorsal and sacral vertebrae of titanosaurian sauropod dinosaurs from the Latest Cretaceous Pab Formation of Suliman foldbelt.

The following description is based on 2 cervicodorsals, 13 dorsals and 6 sacrals (three coosified pair) vertebrae.

Cervicodorsal vertebrae; There are 2 cervicodorsal vertebre in this collection. Sample no, MSM-120-2 and sample no MSM-133-4 collected from Bor Kali Kakor and Kinwa Kali Kakor localities respectively. Parapophyses are located on the anterior of pleurocoel. Centra are broad and short i.e., height is less than width. The length is more than width. The centra are strongly opisthotic and have single pleurocoel and ventral flat surface. The broken vertebrae represent the spongy/ pneumatic texture.

The measurements of cervicodorsal centra are shown in Table 2.

Table 2. Measurement of Cervicodorsal centra in centimeters

Samlple no	Length	Width	Height
MSM-120-2	14	11	6.5
MSM-133-4	16	15	10

Dorsal vertebrae

There are 13 dorsal vertebre (Table 3) in this collection. Sample no, MSM-121-2 to MSM-125-2 from Bor Kali Kakor locality, MSM-126-15 to MSM-130-15 from Mari Bohri locality, MSM-131-16 to MSM-132-16 from Top Kinwa locality and MSM-134-8 from Nala locality are collected. The centra are opisthocoelous. The dorsal centra are divided in to three morphological categories (Figure 2-5). The first morphology represents short and broad opisthotic centra with smooth ventral surface as characterised by the first cervicodorsal vertebrae. The second morphology represents short and circular centra. It may be in the transition between the anterior and posterior dorsals are hemisperical to cylinderical centra are found. The third type are tall, relatively long and have sagital ventral ridge/keel, and slit like pleurocoels. Deep slit like pleurocoels occur on the lateral surfaces just below the neural arches on the tall centra. Posterior concavity seems to be larger than anterior convexity. All these three morphologies may belong to three different taxa or may be variable due to positions; it will clear after finding articulated skeleton.

The ventrolateral smooth surfaces form the V-shape ridge on meeting on ventral axial plane represented on some dorsals may belong saltasurids synopomorphies. In addition the ventrolateral surface below the pleurocoel is small.The posterior concavity seems to be larger than anterior convexity. The centrum length increases from the first sacrodorsal vertebra but throughout series remain unknown due to fragmentary nature however with possible close findings I can say that the length increase fisrt and then decrease up to sacral. From morphology I can guess that the transeversely hemisphericity decreases up to mid dorsal. In posterior dorsal the transeversely hemisperity shifted to the ventrodorsally hemisperity.

The anterior dorsals are broad, short and have smooth ventral surface and open wide pleurocoels while the posterior dorsals are tall, relatively long and have sagital ventral ridge and slit like pleurocoels. Deep slit like pleurocoels occur on the lateral surfaces just below the neural arches. The neural canal is subrounded.The transeverse process are robust and directed laterally and little upward.The width across the transverse processes is larger in the anterior dorsals but reduce in the mid dorsal region. The articular facets are are quite prominent in all the dorsals. There is a gradual change in the position of the parapophyseal facets from the anterior to mid dorsals. Parapophyses come close to diapophyses in mid dorsals. The two articular facets,which are quite widely spaced in the anterior dorsals, move closer in the mid dorsals. These are more or less the same size. There are three laminae on the transeverse processes. The centro diapophyseal laminae, post zygapophyses and spine laminae. The centro diapophyses lamina extends from the diapophyses downward and joins with the infrapostzygapophyseal lamina, which again extends from the postzygapophyses downward to the floor of the neural canal. The postzygapophseal lamina is directed backward to the postzygapophysis and the supradiapophseal lamina is directed upward to the spine. the prezygapophyseal almina is not prominent in any of the dorsals. The centrodiapophyseal, postzygapophyseal and infrapostzygapophyseal laminae together form the strong, deep lateral infradiapophyseal cavity. The supradiapophyseal lamina together also constitute the deep supradiapophyseal cavity.The prezygapophyses and postzygapophyses are placed quite wide in anterior dorsals while placed close in posterior dorsals. There is no hyposphene-hypantrum in any of the collected dorsals. The neural spine is undivided. The spine is directed perpendicular to the neural canal and slightly inclined backward. The anterior and posterior nature is mostly judged from the study of Spanish titanosaurs (Sanz, et al. 1999) ie the parapophyses are located on the anterior of pleurocoel. Anterior dorsals are short, broad, flat ventral surface, opisthotic and have pleurocoels while the posterior dorsals broadness is going to be low ie transeverse ellipticity is going to be low as going backward. Posterior centra are tall and relatively long and having ventral saggital ridge. Keel/ridge may be transition from dorsal to sacral. The broken dorsal vertebrae represent the spongy/ pneumatic texture. The measurements of dorsal centra are shown in Table 3.

Thoracic Ribs

Fragmentary partial ribs pieces are collected. The tuberculum and capitulum are of subequal size, subrounded capitulum and oval to suboval toberculum and are marked with a notch in between. There is a marked ridge running along the length of the rib shaft bifurcating just before the proximal notch and terminating toward the end of the capitulum and tuberculum. Medially there is a marked depression running anteriorly. The proximal part of the rib is spongy and concavo-convex in cross section and distally massive and plano-convex.

Table 3. Measurement of Dorsal centra in centimeters

Samlple no	Length	Width	Height
MSM-121-2	15	11	7
MSM-122-2	17	13	8
MSM-123-2	12	11	10.5
MSM-124-2	20	12	10
MSM-126-15	17	14	9
MSM-127-15	20	15	10
MSM-128-15	-	17	12
MSM-129-15	18	13	-
MSM-130-15	14	9	8
MSM-131-16	15	14	10
MSM-132-16	-	12	10
MSM-134-8	12	12	10

Sacral Vertebrae

Total 6 sacral (Partial, three coosified pairs) vertebrae are collected. Anteriormost sacral cone is covex ie opisthotic.It lacks pleurocoels. The sacral centra are short and slightly broad having ventral keel/ridge (no ventral smooth surface), and less tall than wide (Table 4). It have posterior amphiplatan surface (Figure 2-5). The bones are pneumatic/ somphospyndalous. Sacral vertebrae have ribs forming cavity between ribs in the proximal portion and seem to be fused forming sacricoastal yoke. The anterior most rib belonging to anteriormost sacral vertebra is separate and may combine with preacetabular process of ilia. Posterior articular surface of last sacral shows axial keel surrounded by rectangular/subrounded groove. The broken part of sacral vertebrae represent the indication of some spongy/ pneumatic texture.

The measurements of sacral centra are shown in Table 4.

Table 4. Measurement of Sacral centra in centimeters

Samlple no	Length	Width	Height
MSM-135-2	10+(4=cone)	16	11
MSM-136-4	9	13.5	9
MSM-137-16	10	13.5	10

Discussion

The anatomy of Pakistani Titanosauria represents the subdivision of caudal vertebrae in to five, dorsal vertebrae in to three, limb bones in to two and cranial elements possibly in to three morphologies.

The vertebral count in most titanosaurids is not known. However in most Argentinian *Saltasaurus loricatus,* there are about 23 presacral and about 35 caudal vertebrae (Powell, 2003). In Indian titanosaurus colberti, the exact vertebral count also remains unknown (Jain and Bandyopadhyay, 1997). The following description is based on 2 cervicodorsals, 13 dorsals and 6 sacrals (three coosified pair) vertebrae.

Vertebral laminae are structural elements for resisting stress generated by the elongate neck and enormous thorax in sauropods. Their fuction for large sauropod seems to be structural supports. Ball and socket joint of vertebrae are significant for support. Presacral vertebrae with sponge/ large open cell and many laminae in neural arches represent weight lightening.

The dorsal centra are divided in to three morphological categories. The first morphology represents short and broad opisthotic centra with smooth ventral surface as characterised by the first cervicodorsal vertebrae. The second morphology represents short and circular centra. It may be in the transition between the anterior and posterior dorsals from hemisperical to cylinderical shape of centra. The third type is tall, relatively long and has sagital ventral ridge/keel, and slit like pleurocoels. Deep slit like pleurocoels occur on the lateral surfaces just below the neural arches on the tall centra. Posterior concavity seems to be larger than anterior convexity. All these three morphologies may belong to three different taxa or may be variable due to positions; it will clear after finding articulated skeleton. The centrum length increases from the first cervicodorsal vertebrae but throughout series remain unknown due to fragmentary nature however with possible close findings I can say that the length increase in the anterior dorsals and then decrease up to sacral. From morphology I can guess that the transeversely hemisphericity decreases up to mid dorsal. In posterior dorsal the transeversely hemisperity shifted to the ventrodorsally hemisperity. In dorsals, the broadness is going to be low ie transeverse ellipticity is going to be low as going backward. The neural canal is subrounded. There is no hyposphene-hypantrum in any of the collected dorsals. The neural spine is undivided. Anteriormost sacral cone is covex ie opisthotic.It lacks pleurocoels. The sacral centra are short and slightly broad having ventral keel/ridge (no ventral smooth surface), and less tall than wide. It have posterior amphiplatan surface. The bones are pneumatic/somphospyndalous. Sacral vertebrae have ribs forming cavity between ribs in the proximal portion and seem to be fused forming sacricoastal yoke. The anterior most rib belonging to anteriormost sacral vertebra is separate and may combine with preacetabular process of ilia.

Fragmentary partial ribs pieces are collected. The tuberculum and capitulum are of subequal size, subrounded capitulum and oval to suboval toberculum and are marked with a notch in between. There is a marked ridge running along the length of the rib shaft bifurcating just before the proximal notch and terminating toward the end of the capitulum and tuberculum. Medially there is a marked depression running anteriorly. The proximal part of the rib is spongy and concavo-convex in cross section and distally massive and plano-convex.

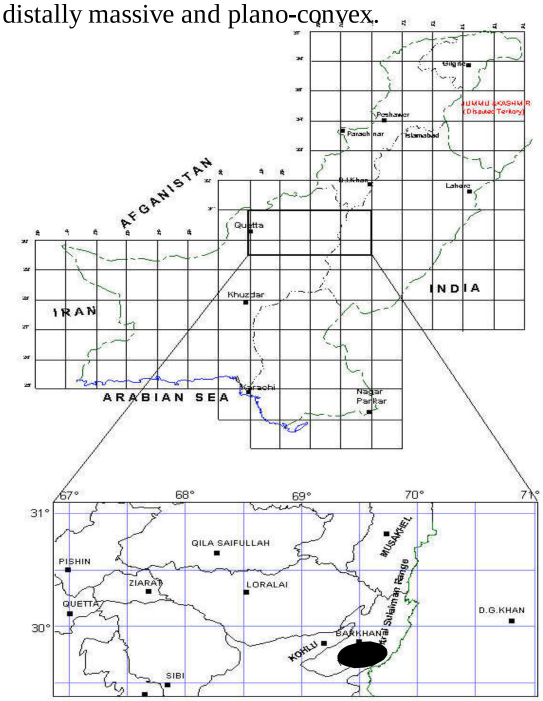

Figure 1. Index map of Pakistan showing the Vitakri and vicinity area, which is the host of newly discovered cervicodorsals, dorsals and sacral vertebrae of Titanosaurian Sauropod dinosaurs. Black oval represents the study area.

Figure 2. Vertebrae of Pakistani Titanosaurian Sauropod Dinosaurs uncovered from Vitakri and Mari Bohri areas of Barkhan District, Balochistan, Pakistan.
First (upper or top row); 6 dorsal vertebrae; left laterodorsal view
MSM-120-2 (cervicodorsal), MSM-121-2, MSM-122-2, MSM-123-2, MSM-124-2, MSM-125-2
Second row; 5 dorsal vertebrae; left laterodorsal view
MSM-126-15, MSM-127-15, MSM-128-15, MSM-129-15, MSM-130-15,
Third row; 4 dorsal vertebrae; left laterodorsal view
MSM-131-16, MSM-132-16, MSM-133-4(cervicodorsal), MSM-134-8
Fourth (lower) row 3 pair / 6 sacral vertebrae; left laterodorsal view
MSM-135-2, MSM-136-4, MSM-137-16.
Scale is in centimeter (cm). Every black digit is 1 cm.

Figure 3. Vertebrae of Pakistani Titanosaurian Sauropod dinosaurs uncovered from Vitakri and Mari Bohri areas of Barkhan District, Balochistan, Pakistan.
First (upper or top row); 6 dorsal vertebrae; anterodorsal view
MSM-120-2 (cervicodorsal), MSM-121-2, MSM-122-2, MSM-123-2, MSM-124-2, MSM-125-2
Second row; 5 dorsal vertebrae; anterodorsal view
MSM-126-15, MSM-127-15, MSM-128-15, MSM-129-15, MSM-130-15,
Third row; 4 dorsal vertebrae; anterodorsal view
MSM-131-16, MSM-132-16, MSM-133-4(cervicodorsal), MSM-134-8
Fourth (lower) row 3 pair / 6 sacral vertebrae; anterodorsal view
MSM-135-2, MSM-136-4, MSM-137-16,
Scale is in centimeter (cm). Every black digit is 1 cm.

Figure 4. Vertebrae of Pakistani Titanosaurian Sauropod dinosaurs uncovered from Vitakri and Mari Bohri areas of Barkhan District, Balochistan, Pakistan.
First (upper or top row); 6 dorsal vertebrae; posterodorsal view
MSM-120-2 (cervicodorsal), MSM-121-2, MSM-122-2, MSM-123-2, MSM-124-2, MSM-125-2
Second row; 5 dorsal vertebrae; posterodorsal view
MSM-126-15, MSM-127-15, MSM-128-15, MSM-129-15, MSM-130-15,
Third row; 4 dorsal vertebrae; posterodorsal view
MSM-131-16, MSM-132-16, MSM-133-4(cervicodorsal), MSM-134-8
Fourth (lower) row 3 pair / 6 sacral vertebrae; posterodorsal view
MSM-135-2, MSM-136-4, MSM-137-16,
Scale is in centimeter (cm). Every black digit is 1 cm.

Figure 5. Vertebrae of Pakistani Titanosaurian Sauropod dinosaursuncovered from Vitakri and Mari Bohri areas of Barkhan District, Balochistan, Pakistan.
First (upper or top row); 6 dorsal vertebrae; anteroventral view
MSM-120-2 (cervicodorsal), MSM-121-2, MSM-122-2, MSM-123-2, MSM-124-2, MSM-125-2
Second row; 5 dorsal vertebrae; anteroventral view
MSM-126-15, MSM-127-15, MSM-128-15, MSM-129-15, MSM-130-15,
Third row; 4 dorsal vertebrae; anteroventral view
MSM-131-16, MSM-132-16, MSM-133-4(cervicodorsal), MSM-134-8
Fourth (lower) row 3 pair / 6 sacral vertebrae; anteroventral view
MSM-135-2, MSM-136-4, MSM-137-16,
Scale is in centimeter (cm). Every black digit is 1 cm.

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