future steroid studies. The left ovary (1.3 gms) was completely degenerated and did not contain any corpora lutea whereas the right ovary (23 gms) was fully developed and contained 32 fresh corpora lutea, an amount equal to the number of oviducal eggs. Both reproductive tracts were fully developed and highly vascular; each weighed 29 gms. The oviducal eggs were equally distributed (16 in each oviduct) indicating that half of the eggs migrated from the right ovary to the left oviduct. In contrast to the present study where there is only one functional ovary, the trans-coelomic transfer of ova known in other turtles (Legler, 1958; *Terrapene, Emydoidea, Chrysemys, Pseudemys*), (Moll and Legler, 1971; *Pseudemys*) and (Tinkle, 1959; *Sternotherus*) involved two functional ovaries. Previously extra-uterine migration has not been observed in *Chelydra*, and more important, has not been reported in chelonians producing large numbers of eggs. Legler (1958) has suggested that equalizing the distribution of eggs in the oviducts might be advantageous in maintaining body balance, especially in aquatic turtles bearing large numbers of eggs. He also suggested that overcrowding of eggs in one oviduct might cause damage to both eggs and oviduct. The total weight of 247 gms for the 32 oviducal eggs of *Chelydra* might have interfered with the body balance had it not been for the equal distribution of the eggs.

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NOTES ON THE DEVELOPMENT OF EMBRYOS OF THE AFRICAN ROCK PYTHON, *PYTHON SEBAE* (SERPENTES: BOIDAE)

Despite its wide distribution and popularity in captivity there have been few records concerning reproduction in the African rock python, *Python sebae*. Recently one of us (Patterson, 1974) published details describing the hatching in captivity of python eggs. A review of the literature has revealed differences in the incubation period of this species in different parts of its range. In addition Vinegar (1973) has reported differences in the growth rate and development of embryos in the Indian python (*Python molurus*) from eggs incubated at different temperatures, describing abnormalities in the pigmentation and vertebral column in embryos incubated at low temperatures.

We describe here additional data concerning the hatching in captivity of African python eggs, including details of a particularly lengthy incubation resulting in abnormal, stunted hatchlings.

Clutch 1.—A gravid female approximately 4m in length, captured near Lydenburg in the Eastern Transvaal, South Africa, laid 27 eggs on 9 October 1973, 3 days after capture. Initially the eggs were left with the female, but were removed for incubation after 3 days due to their deteriorating condition. The eggs adhered together forming a large mass within which 5 eggs had collapsed and were covered with mould. Adjacent eggs were also affected, and it was decided to separate all eggs and incubate them individually.

Twenty-two eggs were incubated on damp towels in sealed plastic bags in a Gallenkamp drying oven maintained at a constant temperature of 29-30 C. The remaining 5 eggs were opened on the third day after laying and, with the exception of one which was infertile, all contained well-developed embryos weighing 0.55, 0.68, 0.82, and 0.84 g and measuring 71, 78, 81, and 82 mm respectively. On 29 October, 20 days after laying, another egg was opened and found to contain a living embryo weighing 3.26g and measuring 149mm in length. Two other eggs, in which no embryos could be detected, were also discarded.

By 16 November only 4 eggs remained viable. All of the 15 eggs discarded contained embryos although no data for these eggs were collected. The remaining eggs weighed: A, 164g; B, 154g; C, 139g; and D, 142g. On 8 December these eggs weighed 134, 122, 128, and 129g respectively, weight losses of between 11 (8 per cent) and 34 (22 per cent)g.

Egg A hatched on 28 December, 80 days after laying. The hatchling weighed 105g and the eggshell 17.5g. Egg B hatched 3 days later, the hatchling and egg-shell weighing 95.8 and 16.0g respectively. Eggs C and D had not hatched by the 10 January (93 days after laying) and were opened for inspection. Both contained well-formed, full-grown embryos weighing 94.2 and 102.1g, and measuring 542 and 551 mm respectively. Both were dead without apparent cause. The hatchlings refused all food until after their first slough; A sloughed on 24 January and B on 26 January.

Clutch 2.—These eggs were laid by a female measuring 3.2m and weighing 11.5kg, which had been in captivity at the Transvaal Snake Park for over 11 years, and had laid eggs on 3 previous occasions (discussed in Patterson, 1974).

Laying commenced at 3:15 pm on 5 November 1973, and by 6:05 pm 32 eggs had been laid. A thermometer placed between the coils of the female next to the emerging eggs gave a reading of 33 C. Air temperature in the enclosure at the time was 26.5 C. Three more eggs were laid overnight. The eggs were removed, cleaned with freshwater, and incubated on damp towels either in sealed plastic bags or polystyrene boxes.

On 6 November 20 eggs chosen at random were weighed and had a combined total weight of 2799 g, a mean individual weight of 139.9g, and a range of 130.8 to 152.2g. One of these eggs was opened on the 14 November and contained an 85mm embryo weighting 0.88g. None of these eggs hatched and no further data concerning their incubation or development was collected.

The remaining 15 eggs were incubated initially in a heated cupboard, the temperature of which fluctuated between 24-30 C. On 20 December, due to a prolonged power failure, the temperature dropped to 21 C for 12 hours. Subsequently the eggs were transfered to a Vosmar incubator on the 10 January and maintained at a temperature of 30-32 C.

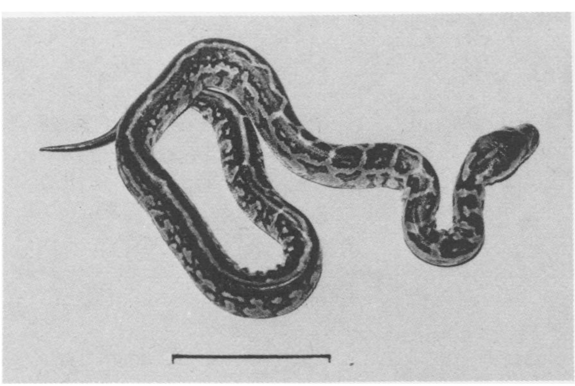

FIGURE 1. Hatchling 2B showing the distinctive vertebral stripe on the posterior part of the body of hatchlings incubated at low temperatures. Scale 10 cm.

On 24 January one egg was opened and contained a live male embryo with everted hemipenal anlage. Pigmentation was well-developed and the 289mm embryo weighed 34g. Another egg was opened on 7 February and contained a dead male embryo of approximately 300mm. The weight was not recorded.

On 17 February, 104 days after laying, the remaining 11 eggs were inspected by cutting a flap in the egg shell. Four embryos were dead. Their weights and lengths were as follows: 50.5g and 458mm; 60.7g and 535mm; 52.0g and 470mm; 66.5g and 472mm. The remaining 7 embryos were all moving within their membranes.

The first hatchling (2A) crawled from the cut egg on 19 February, the umbilicus breaking and a ball of yolk of approximately 15.0g being left behind. On the same day 3 other hatchlings emerged. One died soon after emerging; it weighed 66.1g and measured 510mm. In another hatchling (2B) the umbilicus again broke and the yolk was not withdrawn into the body cavity. This hatchling, like 2A, had pale pigmentation, weak motor control, and a distinct vertebral stripe on the posterior part of the body (Fig. 1). Hatchlings 2A and 2B weighed 64 and 52g respectively on emergence. Hatchling 2C successfully absorbed the yolk into the body cavity, weighed more than its siblings (71g), and appeared more normal, having much darker pigmentation, better motor control, and a less distinct vertebral stripe.

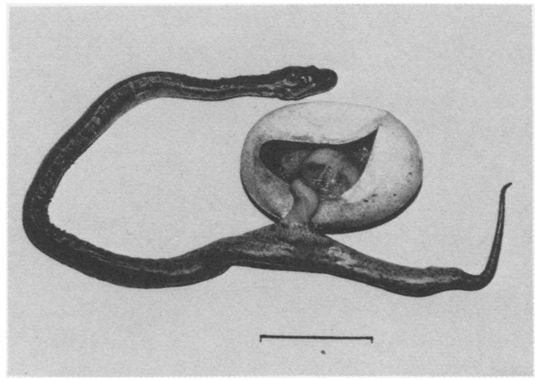

FIGURE 2. Python hatchling which died shortly after emerging following 110 days incubation. Scale 10cm.

On 22 February, 2 of the remaining embryos were found dead within their shells. No data were collected for these embryos. The final embryo emerged from the shell on the next day, 110 days after laying. The yolk was not withdrawn into the body cavity and the hatchling died shortly afterwards (Fig. 2).

Hatchling 2C sloughed on the 3 March. On this day the weights and lengths of the hatchlings were as follows: 2A, 63g and 500mm; 2B, 54g and 470mm; 2C, 70g and 550mm. Differences in their pigmentation were still apparent (Fig. 3).

The female python which laid clutch 2 although captive for over 11 years had grown from only 2.5 to 3.2m during this period. She has laid eggs for the last 3 successive years in the late spring (November). Pythons housed in captivity in South Africa usually fast during the winter, and this particular female in addition fasts during the period of egg development prior to laying. The last clutch of 35 eggs, weighing approximately 4.9kg, represents almost 42 per cent of the female's weight after laying, and it is believed that the energy expenditure of this female during reproduction is responsible for her slow rate of growth. Feeding during the summer and autumn is sufficient to replace the weight of eggs, but does not allow for significant growth prior to the winter fast.

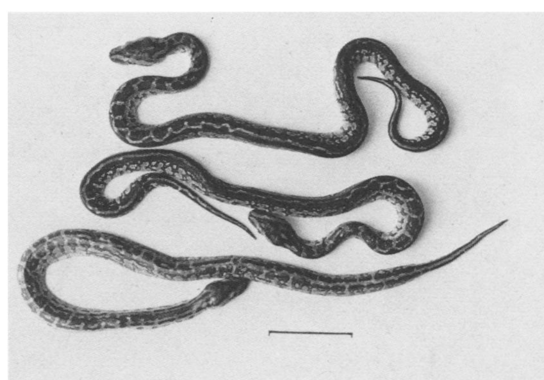

FIGURE 3. Immature pythons which hatched after 106 days incubation. Note the difference in pigmentation and the vertebral stripe on the posterior part of the body. Scale 10cm.

Data for incubation times in the genus *Python* has been collated from various sources (Table 1). No records detailing incubation of eggs in either *P. anchietae* or *P. timorensis* are known to the authors.

It appears that in both *P. sebae* and *P. molurus* the time for the development of the embryos is increased when they are incubated at low temperatures. The brooding female *P. molurus* maintains a temperature of 32-33 C (Hutchison, Dowling and Vinegar, 1966; Valenciennes, 1841) and at this temperature incubation takes from 57-61 days. At lower temperatures the development time is increased to 61-68 days at 30.5 C and 93 days at 27.5 C (Vinegar, 1973). This same author found no development in *P. molurus* eggs incubated at 23 C.

TABLE 1. Incubation times of eggs for the genus *Python.*

Species	Incubation Time (Days)	Incubation Temperature (C)	Authority
Python sebae			
	49	30-32	Joshi, 1967
	52	22-29	Joshi, 1967
	62-70	?	Schütte, 1970
	80-83	29-30	Branch and Patterson, 1974
	81-88	26-31	Patterson, 1974
	88-93	25-27	Munning Schmidt, 1973
	<100	25-34	Lederer, 1944
	106-110	21-32	Branch and Patterson, 1974
Python molurus			
	57-66	?	Pope, 1965
	57-61	32-38 Brooded by female	Valenciennes, 1841
	60-62	? Brooded by female	Yadav, 1967
	61-68	30.5	Vinegar, 1973
	93	27.5	Vinegar, 1973
Python reticulatus			
	55-60	?	Pope, 1965
	78	?	Taylor, 1965
	80	?	Pope, 1965
	94	30-32	La Panouse and Pellier, 1973
	92,98,105	26-28	Honegger, 1970
Python curtus			
	<63	?	Vinegar, et al, 1970
	80-90	?	Guibe, 1970
Python regius			
	90-95	27	Logan, 1973
	97	27	Logan, 1973
	102	27	Logan, 1973.

Few accounts of egg incubation by *P. reticulatus* include temperature recordings. The records of Honegger (1970) and La Panouse and Pellier (1973), however, suggest that embryonic development is faster at higher temperatures. Whether the brooding *P. reticulatus* shows facultative endothermy is still debatable. Vinegar, Hutchison and Dowling (1970) after reviewing the available data concluded that the reticulated python lacked any physiological thermoregulatory ability. However, Honegger (1970) and La Panouse and Pellier (1973) recorded temperatures above that of the air or substrate within the coils of incubating females.

Brooding female *P. sebae* do not show facultative endothermy (Vinegar, Hutchison and Dowling, 1970) and the eggs are subjected to temperature fluctuations, although these may be reduced by such factors as site selection or brooding behaviour. Few records exist detailing egg incubation by *P. sebae* in the wild. Pitman (1938) records two nests in long grass, one of which was attended by the female for 6 weeks. Broadley (1959) discovered recent hatchlings and the mother in a hole in the bank of a small dam. In neither of these accounts was the full incubation period observed. Recently Schütte (1970) reported an incubation period of 62-70 days for eggs incubated by a female in a cavity in an old antheap. No temperature recordings were taken, however.

It is possible that genuine differences in the development time of *P. sebae* eggs occur in different parts of its range. Eggs from South African *P. sebae* (Patterson, 1974) appear to take longer to develop than eggs from Nigerian females (Joshi, 1967), even when incubated at similar temperatures. In both this study and that of Joshi (1967) embryos from newly-laid eggs were well-developed and differences in the degree of development of the embryos at laying would not appear to account for the difference in the development times. Similarly, there seems to be no basis for considering such factors as different humidity of the incubating eggs as being responsible as during this study the eggs were heavily watered, although no humidity recordings were taken. It is of interest that the development of *P. sebae* eggs can still occur at temperatures below that of the minimum requirements for the development of *P. molurus* eggs.

Developmental abnormalities in *P. sebae* embryos incubated at low temperatures are similar to those described by Vinegar (1973) for *P. molurus* embryos incubated at 27.5 C. Such hatchlings appear 'premature', have pale pigmentation and weak motor control. A characteristic feature of these hatchlings is a distinct vertebral stripe on the posterior part of the body (Fig. 1). It is not known whether this is lost during subsequent growth. In addition these hatchlings, although taking between 106-110 days for development, weighed substantially less ($\bar{x}$ = 63.6g) at emergence than normal hatchlings ($\bar{x}$ = 100.4g) taking only 80-83 days to develop. Vinegar (1973) found a similar difference in hatchling weight of *P. molurus* embryos incubated at different temperatures.

Logan (1973) has described unusually long development times for *P. regius* eggs incubated at 27 C. However, none of the young exhibited any abnormalities attributable to the relatively low incubation temperatures. *P. regius* is a savannah species (Menzies, 1966) and selects cooler spots when offered a temperature range of 25-29 C (Logan, 1973). Brooding, but not facultative endothermy, has been described in this species, and it is possible that these eggs are able to withstand lower incubation temperatures, although consequently taking longer to develop than *P. molurus* eggs.

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COLONIC TORSION IN A WESTERN DIAMONDBACK RATTLESNAKE, *CROTALUS ATROX*

A captive-born 3 year old male *Crotalus atrox*, the progeny of an albino female and wild type male, began to develop a pliable, firm enlargement in the posterior portion of the abdominal cavity in March 1973. The mass slowly increased in size and prevented defecation although small amounts of nitrogenous waste were passed. Attempts to palpitate the blockage were unsuccessful. The snake had fed exclusively on laboratory mice but discontinued feeding 15 May 1973. Since the snake was declining rapidly, it was killed with ether on 14 June 1973 at which time it measured ca. 127 cm and weighed 950 g.

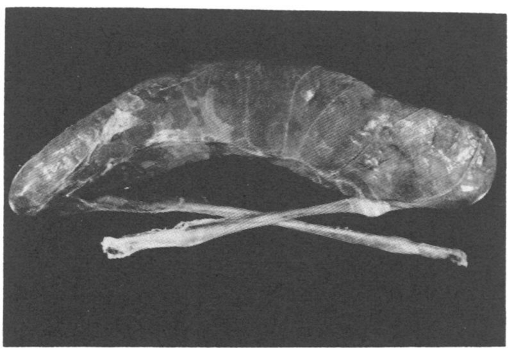

FIGURE 1. Segment of lower bowel of *Crotalus atrox* distended due to colonic torsion.

Dissection revealed a 25 cm × 5 cm segment of lower bowel, markedly distended with feces, about 15 cm anterior to the cloaca. There was a 180° anterior-posterior rotation of this segment which resulted in the anterior large intestine entering the distended portion at its posterior end and the posterior segment of colon leaving the distended portion at its anterior end.

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OVULATION INDUCED BY VOCALIZATION IN MEMBERS OF THE *RANA PIPIENS* COMPLEX

On 11 occasions in Texas I have captured ovulated females of 3 members of the *R. pipiens* complex—*R. sphenocephala* (6), *R. berlandieri* (3) and *R. blairi* (2) (nomenclature sensu