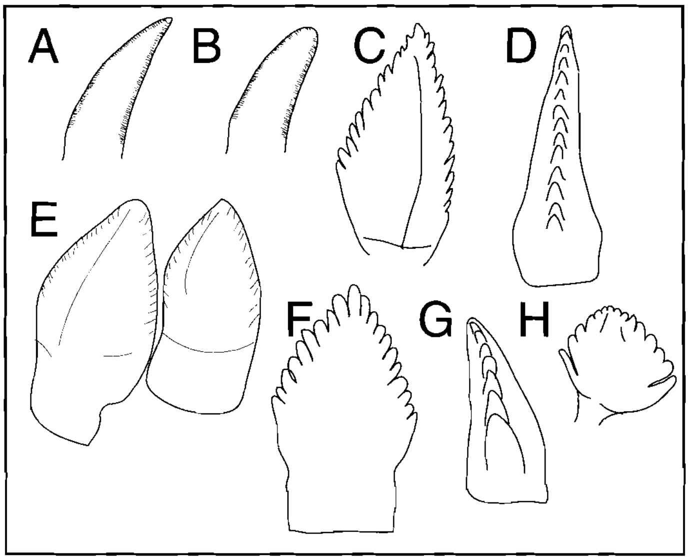

FIGURE 13: Representative primitive dinosaur teeth. A, generalized theropod, B, the theropod *Herrerasaurus*, C-D, generalized prosauropod, E, two teeth of the prosauropod *Thecodontosaurus*, F-G, generalized ornithischian, H, the ornithischian *Lesothosaurus*. Not drawn to scale. B from Sereno and Novas (1993), C-D and F-G modified from Hunt and Lucas (1994), E drawn from Benton et al. (2000), H modified from Sereno (1991b).

the upper Elliot Formation of southern Africa, *contra* Sereno (1991b) and, more recently, Knoll (2002a,b).

Early cladistic attempts to describe ornithischian dinosaur evolution were restricted to Early Jurassic and younger taxa, and essentially ignored teeth (Norman, 1984; Maryanska and Osmólska, 1985). More recently, several authors have described ornithischian tooth synapomorphies to the extent that that they are now recognized in the semi-popular literature as well as the professional literature (Sander, 1997b, p. 720).

> Plesiomorphic ornithischian teeth, as exemplified by *Lesothosaurus* [=*Fabrosaurus*], are differentiated into simple conical teeth in the premaxilla and laterally compressed teeth in the maxilla and dentary. The triangular tooth crown of the latter is much expanded over the root and lined by distinct denticles. On the buccal side of the upper teeth and the lingual side of the lower teeth the denticles continue as ridges to the base of the crown.

Sereno (1986; 1991b, p. 172-173) indicated that low, subtriangular crowns separated from the roots by a basal constriction and the absence of recurvature in dentary/maxillary teeth were synapomorphies of the Ornithischia. Hunt and Lucas (1994) would further expand and codify these synapomorphies and identify others, although they did not conduct a phylogenetic analysis. Ornithischian synapomorphies *sensu* Hunt and Lucas (1994, p. 227-228) are:

> (1) low, triangular tooth crown in lateral view (Sereno, 1986); (2) recurvature absent from maxillary and dentary teeth (Sereno, 1986); (3) well-developed neck separating crown from root (Sereno, 1986); (4) prominent large denticles arranged at 45° or greater to the mesial and distal edges; (5) premaxillary teeth distinct from dentary/maxillary teeth; (6) maxillary and dentary teeth asymmetrical in mesial and distal views.

Sereno (1997, 1998, 1999) also expressed these to varying degrees in discussions on dinosaur evolution in other papers. In the explicit phylogeny published by Sereno (1999) the characters were described as follows [my comments in brackets]:

> S20 maxillary/dentary teeth crowns recurved (0), subtriangular (1) or lanceolate (2) [I would recode as two separate characters]
>
> S21 maxillary/dentary teeth marginal ornamentation: serrations (0) or denticles (1)
>
> Also:
>
> S19 Premaxillary tooth number: 4 (0); 2 (1) 5 (2); 6 (3); 7 (4)
>
> S22 maxillary/dentary teeth, position of largest [tallest] tooth: anterior end (0) or center (1) of tooth row.

From a functional standpoint, the term "constriction" applied to the narrower root relative to the crown in ornithischian teeth is a misnomer. Certainly the crowns are mesio-distally longer than the roots. However, the tooth pattern of Early Jurassic ornithischians demonstrates that this is not so much a constriction of the root but an expansion of the crown. This requires the teeth to be canted so that the maximum length of the tooth is oblique to the antero-posterior length of the tooth row (e.g., Sereno, 1991b, fig. 5c-d; Thulborn, 1992, fig. 1). Consequently, I use the term "expanded" to describe the base of the tooth crown, rather than referring to "constricted" roots in ornithischians and similar taxa.

Other workers, most notably Hunt and Lucas (1994) but also including Godefroit and Cuny (1997), Cuny et al. (2000) and Godefroit and Knoll (2003) have utilized these characteristics to identify isolated ornithischian teeth. Indeed, Hunt and Lucas (1994) named several taxa, including *Tecovasaurus murryi*, *Lucianosaurus wildi*, *Galtonia gibbidens*, and *Pekinosaurus olseni*, from the Chinle Group in the western U.S.A. (*Tecovasaurus* and *Lucianosaurus*) and the Newark Supergroup in the eastern U.S.A. (*Galtonia* and *Pekinosaurus*). Similarly, Godefroit and Cuny (1997) identified isolated ornithischian teeth from Saint-Nicolas-de-Port and Cuny et al. (2000) did the same for Lons-le-Saunier, both French microvertebrate localities. Godefroit and Knoll (2003) identified the first Triassic dinosaurs from Belgium, from the microvertebrate site at Habay la-Vieille.

This approach is not without its problems. Recently Parker et al. (pers. comm.) have discovered skeletal remains at the Petrified Forest National Park that appear to demonstrate that a non-dinosaurian archosaur possessed the teeth assigned to the ornithischian *Revueltosaurus callenderi*. Knoll (2002a,b) and, before him, Sereno (1991b) have both been outspoken critics of taxa based on teeth. The dinosauriform *Silesaurus opolensis* Dzik (2003) also bears at least some teeth that appear superficially ornithischian, although the denticles on *Silesaurus* teeth are finer and much less well-developed than most of those ascribed to ornithischians here. Some of these concerns are addressed in the following paragraphs.

TEETH AND TAXONOMY

Later in this monograph I establish several new generic and specific names for microvertebrate taxa. The holotypes of these new taxa are all isolated teeth or tooth-bearing bone fragments. Although there are pitfalls in this approach, it is inescapable in a study of microvertebrates. Consequently there are several points worth noting here in pre-emptive fashion to defend my taxonomic approach. The following discussion focuses primarily on dinosaurs, but is applicable to all taxa named here, and is provided in part to reduce redundancy of arguments where each taxon is named.