

THE TRIASSIC-JURASSIC BOUNDARY IN THE JUNGGAR BASIN (NW-CHINA) — PRELIMINARY PALYNOSTRATIGRAPHIC RESULTS

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ABSTRACT. A complete Triassic-Jurassic transition is well documented in the Haojiagou valley section 40 km to the west of Urumqi Xinjiang, China. The results of the preliminary palynological study from the first field work with 13 samples reveal a well preserved microflora which confirm that the Hojiagou Formation belongs to the *Concavisporites-Duplexisporites problematicus-Riecisporites tuberculatus* Zone (Upper Triassic) and that the Badaowan Formation belongs to the *Concavisporites-Duplexisporites problematicus* Zone (Lower Jurassic). These two palynostratigraphic zones have been used previously in Afghanistan, Iran and Germany for correlation and identification of the Triassic-Jurassic boundary by Schweitzer *et al.* (1987).

KEY WORDS: Triassic, Jurassic, palynostratigraphy, China, Xinjiang

INTRODUCTION

The Junggar basin, located in the Autonomous Uygur Region Xinjiang (Fig. 1) is of great scientific interest because it plays a central part in the tectonic evolution of Central Asia and because it is very rich in Mesozoic fossil plants and vertebrates. In addition, the Junggar basin

has a huge economic significance because of its large coal-, oil- and natural gas resources.

In a cooperative research project, the Nanjing Institute of Geology and Palaeontology, Academia Sinica, and the Institute and Museum of Geology and Palaeon-

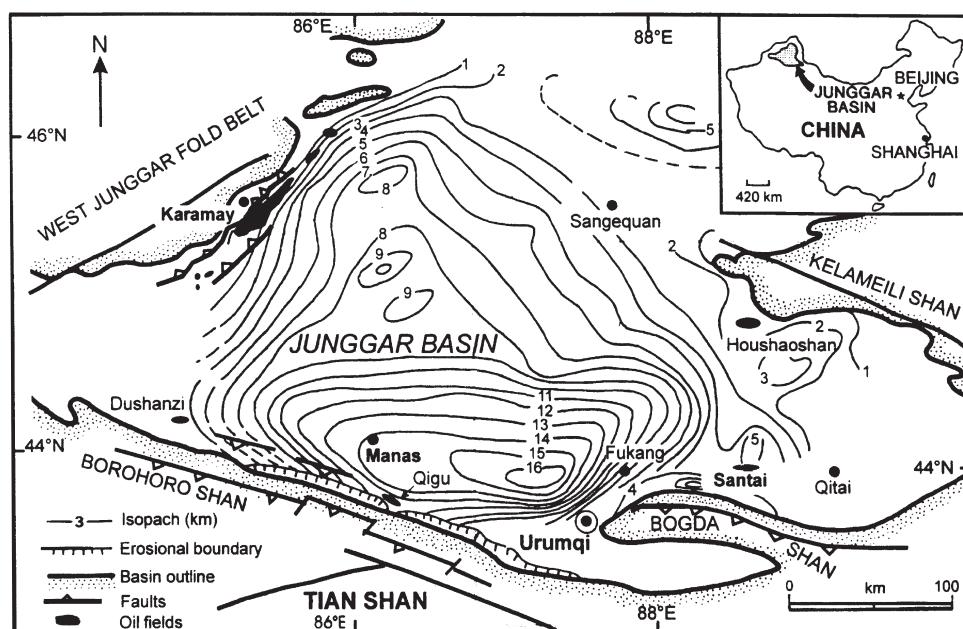


Fig. 1. Geographic position of the Junggar Basin with isopachs of the Permian-Tertiary sediments. The major oil fields are also indicated. (After Tang *et al.* 1997)

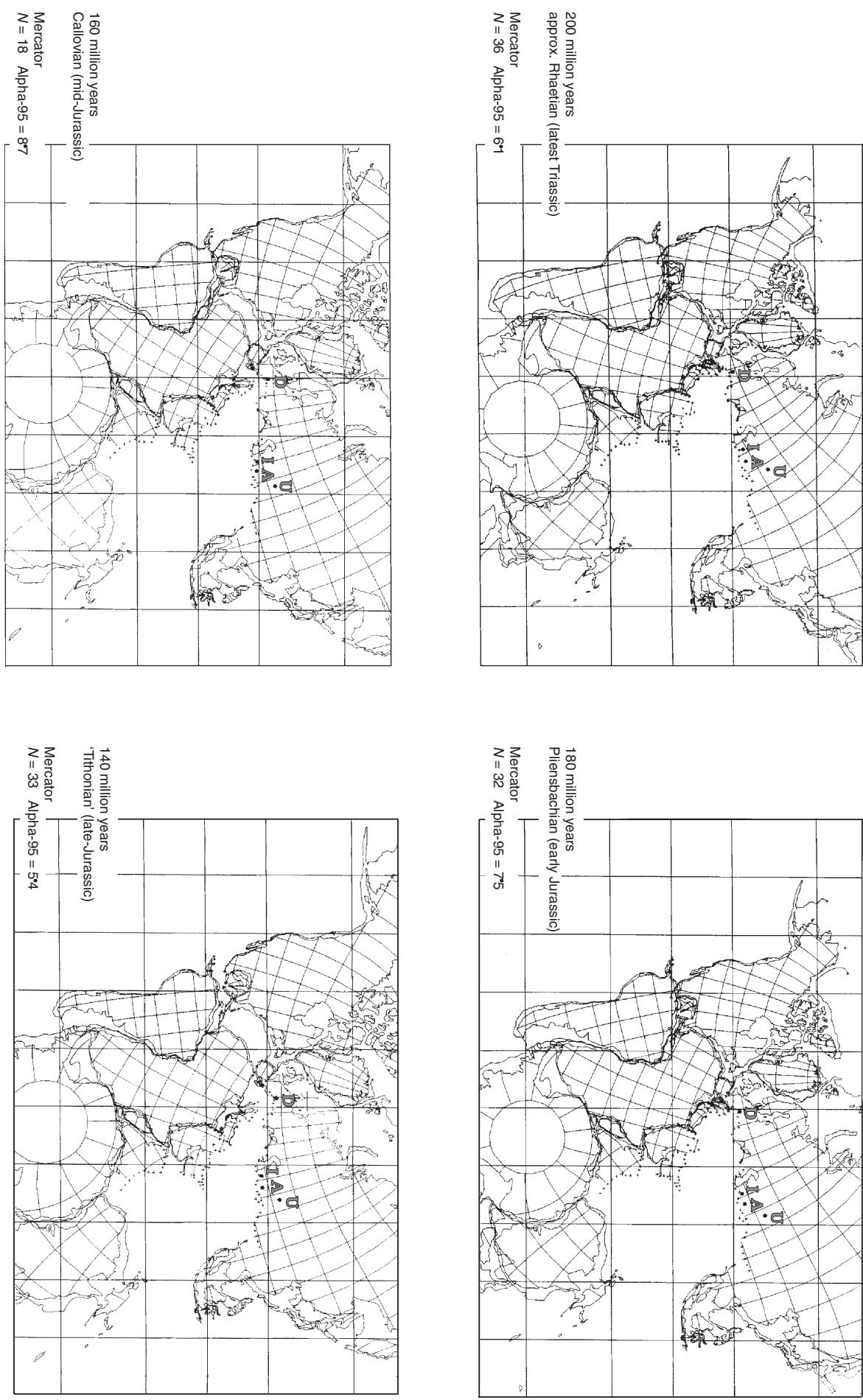


Fig. 2. Palaeogeographic positions of the Junggar basin from the Upper Triassic (Rhaetian) to Upper Jurassic in comparison with other contemporary sequences. A=Afghanistan, I=Iran, D=Germany, U=Urumqi (Junggar basin). (Palaeocontinental maps from Smith & Briden 1977)

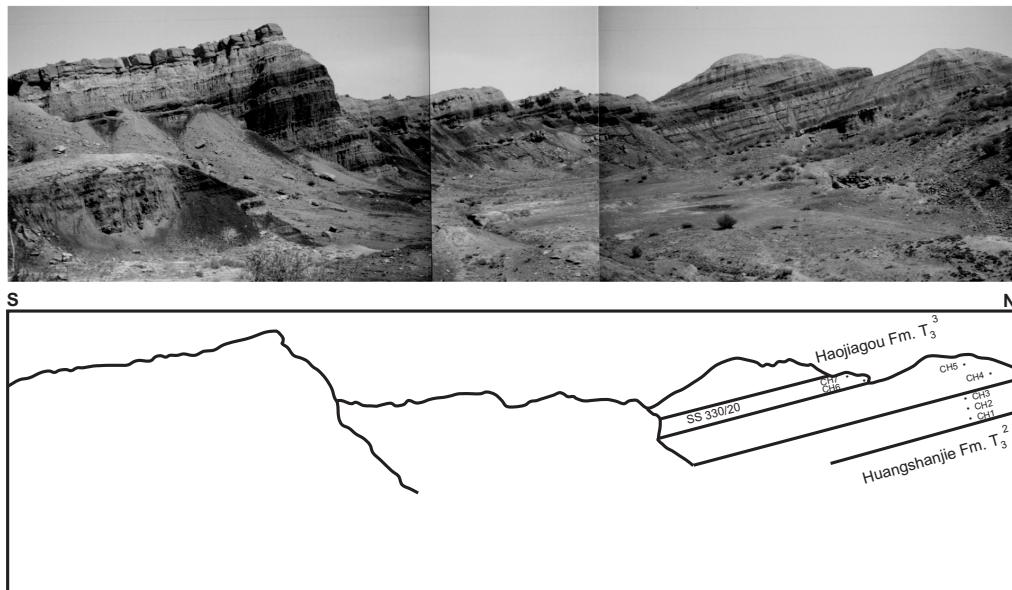


Fig. 3. View of the Upper Triassic sediments (Haojiagou Formation) in the Haojiagou valley near Urumqi

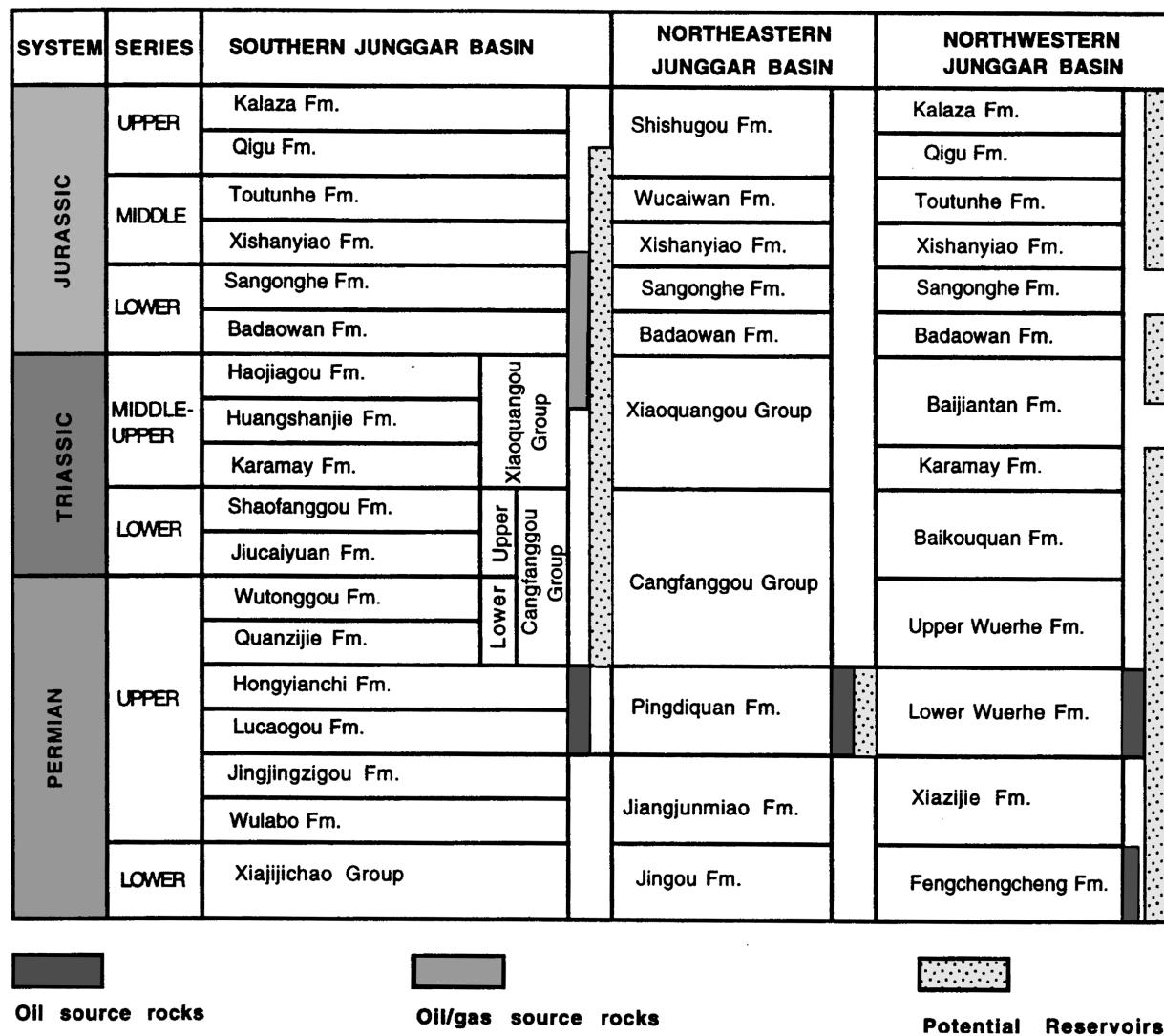


Fig. 4. Lithostratigraphic subdivisions of the Permian to Jurassic sediments of the Junggar Basin (after Tang *et al.* 1997)

tology, University of Tübingen, started investigations concerning the stratigraphy and the development of forest-ecosystems and palaeoclimate across the Triassic-Jurassic boundary in the Junggar basin (NW-China).

The first goal of this cooperative research project is to establish a high-resolution palynostratigraphy. This stratigraphy shall be used as a base for the reconstruction of the vegetation and climate change across the Triassic-Jurassic boundary. The observed vegetation and climate evolution in the Junggar Basin will then be compared with other time-equivalent sequences (e.g. Afghanistan, Iran, Germany) for which the palynostratigraphy is well known (e.g. Arjang 1975, Arjang *et al.* 1977, Ashraf 1977, 1979, Achilles 1981, Achilles *et al.* 1984, Schweitzer *et al.* 1987, Weiss 1989).

In this short article we want to give some preliminary palynostratigraphical results, which are the base for the entire project, which started in 1998 and will be continued for the next years.

MATERIAL AND METHODS

The samples for palynological investigations have been collected from several coal seams, marls and clay beds along a profile in the Haojigou Valley (NW-China, Uygur Autonomous Region Xinjiang) (Ashraf, in prep.). Subsequently the samples have been prepared with standard techniques according to Kaiser & Ashraf (1974), Ashraf & Mosbrugger (1994) and Ashraf & Hartkopf-Fröder (1996). For identification of palynomorphs additionally to LM and REM we have used Confocal Laser Scanning Microscopy (CLSM). With this technique optical cross-sections as well as 3D-images of palynomorphs can be obtained.

PALAEOGEOGRAPHY AND GEOLOGY OF THE JUNGGAR BASIN

Beside the Tarim and Turpan basins, the Junggar basin is one of the three great sedimentary basins located in the Xinjiang Uygur Autonomous Region of northwest China. The basin is bounded on the northwest by the West Junggar Mountains, on the northeast by the Altay Shan, and on the south by the Tian Shan (Fig. 1). The Junggar basin was cut off from marine sedimentation during the Carboniferous to Early Permian due to the collision of the Tarim craton with the southern margin of central Asia and the uplift of a "Palaeo-" Tian Shan (there are different opinions regarding the formation of this basin; c.f. Allen *et al.* 1995, Tang *et al.* 1997). The Permian-Tertiary sediments may attain a thickness of approximately 16 km in the centre of the basin; the Mesozoic sediments are up to 6 km thick and are lacustrine to fluvial in origin.

As is evident from the palaeogeographic maps of Fig. 2, the (palaeo-)latitudinal position of the Junggar Basin re-

mained more or less constant from the Upper Triassic to the Late Jurassic and is comparable to the present-day position (Fig. 1). Therefore, the climate signal preserved in the Mesozoic sediments of the Junggar Basin is largely undisturbed by plate movements across latitudes.

The Upper Triassic to Jurassic sediments, which are of particular interest in our research project, are well exposed in the South of the Junggar basin around Urumqi (Fig. 3). The strata are folded with a WSW-ENE trending axis. They are considered to represent alternations of fluvial and lacustrine sedimentation with frequent intercalations of coal beds. The fluvial sediments, consisting of siltstones, sandstones and conglomerates, are derived from the 'palaeo-Tian Shan' in the South and interfinger with the fine-grained sediments of a huge intramontane lake extending from E to W for more than 500 km.

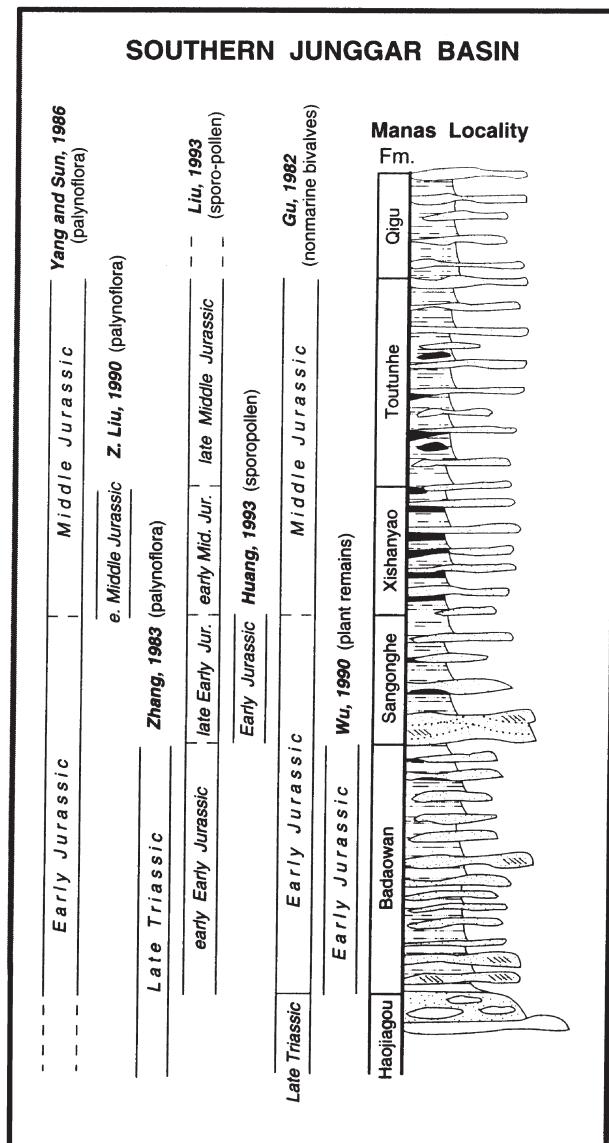


Fig. 5. Different age interpretations for the lithostratigraphic units (Haojiagou to Qigu Formation) of the Southern Junggar Basin (after Hendrix *et al.* 1995)

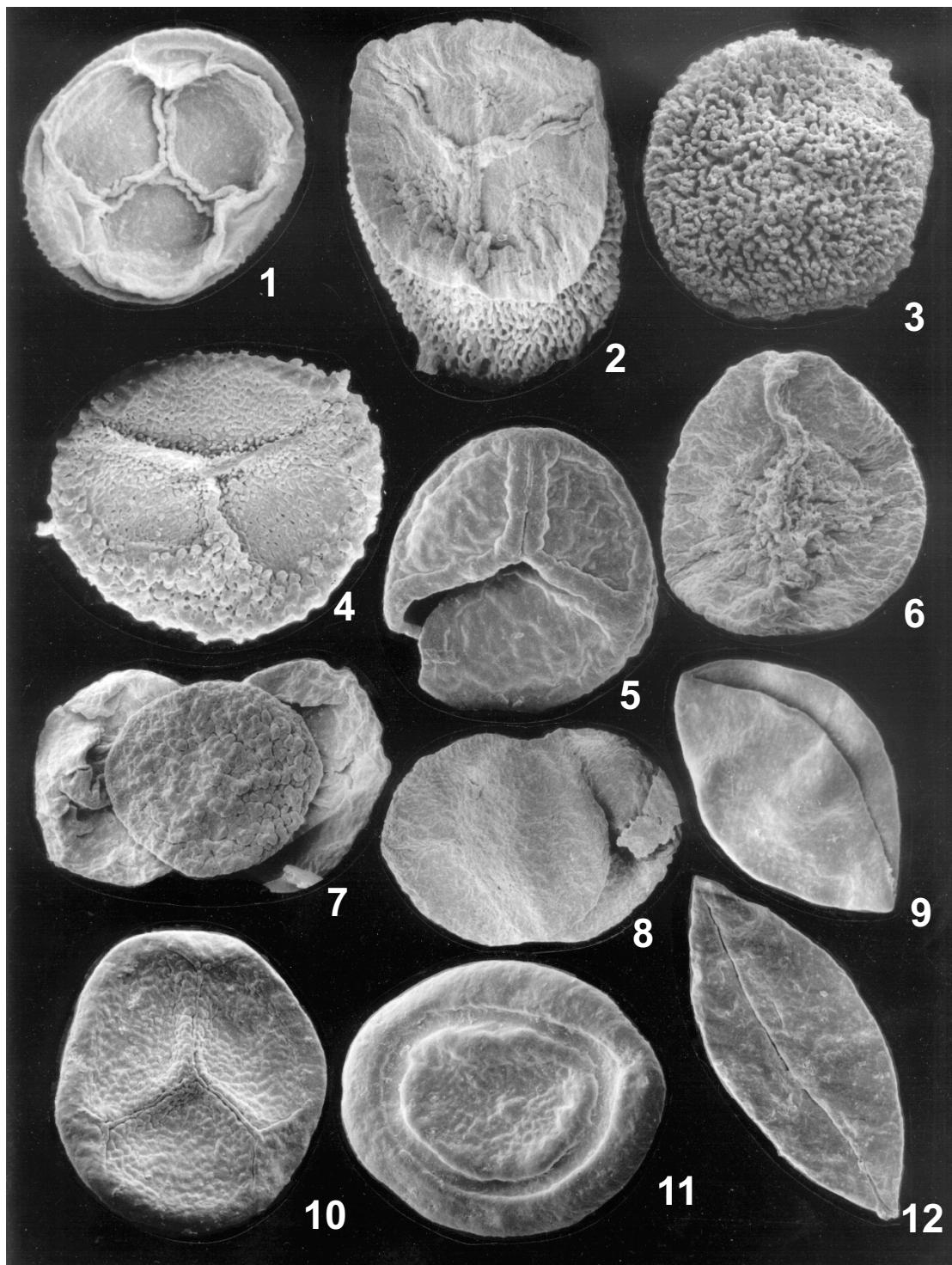


Fig. 6. SEM photographs of some palynomorphs from the Haojiagou- and Badaowan Formation. 1–3 – *Cadargasporites baculatus* De Jersey et Paten 1964; 4 – *Carnisporites granulatus* Schulz 1967; 5 – *Camarozonosporites (Camarozonosporites) rufus* (Lesch 1955) Klaus 1960; 6 – *Ara-trisporites fisheri* (Klaus) Plyford et Dettmann 1965; 7 – *Alisporites bisaccus* Rouse 1959; 8 – *Pseudopinus textilis* Bolkh 1956; 9 – *Cycadopites* sp.; 10 – *Retusotriletes simplex* Naumova 1953; 11 – *Discisporites psilatus* De Jersey 1964; 12 – *Cycadopites* sp.

STRATIGRAPHY

The stratigraphy of the Mesozoic sediments in the Junggar Basin is still largely based on lithostratigraphic subdivisions. Correspondingly, there exist regional differences in the formation names (Fig. 4). For the stra-

tigraphic dating of the various formations palynofloras, non-marine bivalves and vertebrates have been used so far. The results, however, are controversial (Fig. 5). For instance, the position of the boundaries between the Upper Triassic and Lower Jurassic and between the Lower and Middle Jurassic are still a matter of debate.

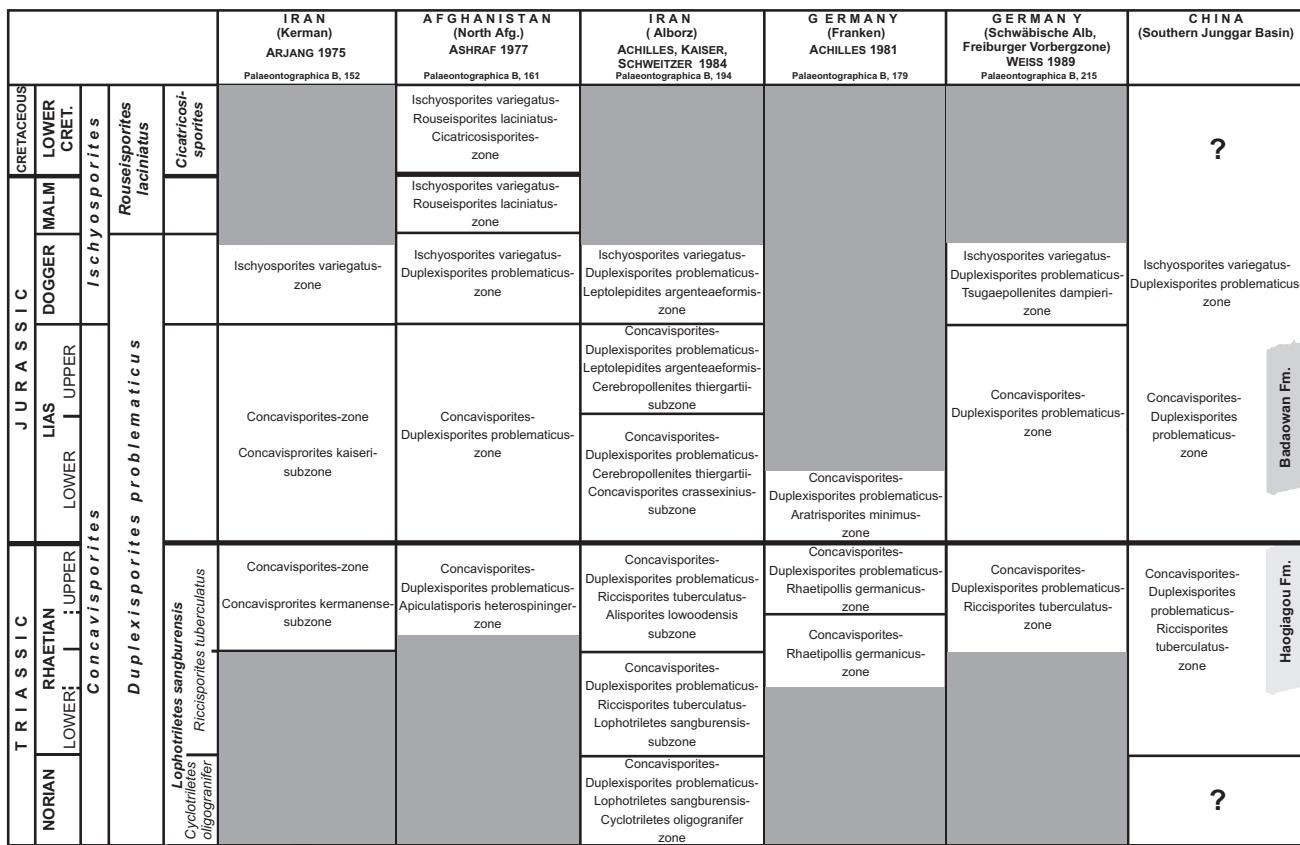


Fig. 7. Palynostratigraphic subdivision and correlation of the Upper Triassic and Jurassic of South Germany, Iran, Afghanistan and Southern Junggar Basin (modified after Schweitzer *et al.* 1987)

PALYNOSTRATIGRAPHIC ANALYSIS AND RESULTS

The following preliminary palynostratigraphical results can be stated:

(1) Palynomorphs are abundant and well preserved in both the Haojiagou and Badaowan Formation (see Fig. 6). Many of the taxa are known from other regions, like Afghanistan, Iran and Germany and can be used for palynostratigraphical purposes. Detailed descriptions of the palynomorphs will be published elsewhere, in the final reports about this project.

(2) From our analysis of the samples we could identify the

– *Concavisporites-Duplexisporites problematicus* zone and the

– *Concavisporites-Duplexisporites problematicus-Riccisporites tuberculatus* zone (Fig. 7), which are useful for correlation and identification of the Upper Triassic-Jurassic boundary, what has been shown repeatedly in Iran, Afghanistan and Germany (e.g. Schweitzer *et al.* 1987). This result indicates that all these basins belong to the same phytogeographic province. In addition, there is good evidence in the published literature that addition-

ally the *Ischyosporites variegatus-Duplexisporites problematicus* zone, well known from the Middle Jurassic of Europe and Middle Asia, is also present in the Junggar Basin (data not shown).

(3) Our samples from the Haojiagou Formation clearly belong to the *Concavisporites-Duplexisporites problematicus-Riccisporites tuberculatus* zone and thus to the Upper Triassic. In contrast, the Badaowan samples contained a palynoflora typical of the *Concavisporites-Duplexisporites problematicus* zone and hence belong to the Lower Jurassic. An Upper Triassic age of the Badaowan Formation, as suggested by some authors (see Fig. 5), is ruled out by our results.

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