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DAMARAN BASEMENT-CORED FOLD NAPPES INCORPORATING PRE-COLLISIONAL BASINS, KAOKO BELT, NAMIBIA, AND CONTROLS ON MESOZOIC SUPERCONTINENTAL BREAKUP

I.G.STANISTREET and E.G. CHARLESWORTH

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by

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ABSTRACT

Deformation styles are reassessed in the Kaoko fold-thrust belt, NE Damaran orogen, that were due to the collisional convention of Gondwana ending ~500Ma ago. Downward-facing sequences on the overturned limb of a major recumbent fold nappe are exposed in the Hoanib valley beneath pre-Damara basement, initially identified in a D2/D3 antiformal refold core, constituting the Obias River Window. Basement paragneisses, psammitic and pelitic protoliths, were infolded into the core of a major (40 x 150 km) recumbent anticlinal D1 fold nappe structure, comparable with other major fold nappes (e.g. the Loch Tay nappe of the Scottish Highlands). D2/D3 refolding causes large polyphase fold traces. The nappes detached along flat-lying sole thrusts (Eastern Zone), soled by the Sesfontein master thrust, and are backed by a structurally steep root zone (Central Zone) and farther west by ramped up synorogenic granitoids intruded into the Damara sediments (Western Zone). Some thrust zones mark major facies changes and imply a pre-compressional identity, with most complete stratigraphic sequences immediately to their west. The latter Damaran (750-600Ma) sequences on-lap progressively westwards onto basement, successively to exclude lowest units. Reconstructed half-graben sub-basin fills were accommodated by extensional fault systems. Subsequent Damaran compression reversed extensional fault polarity, to reuse them as thrust zones. Intra-Pangean extension and break-up, ~300 Ma later, inverted Damaran thrusts, accommodating Karoo to post-Karoo sediments and volcanics in resulting half-grabens. Indeed, the Damaran continental suture probably inverted to form the southern South Atlantic breakaway zone between Africa and South America. Atlantic shelf sediments now cover the suture apart from in southernmost Namibia, where it is the thrust-floored Oranjemund Complex, Damaran Gariep Belt, incorporating an exotic Adamastor Oceanic volcanic prominence thrust onto the African foreland.

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INTRODUCTION

The Kaoko Belt of northwest Namibia comprises late Proterozoic metasediments, meta-volcanics (Fig. 1) and granitoid intrusives, deformed during Damaran orogenesis, that culminated at about 500 Ma, following closure of the Adamastor ocean (Kröner, 1974; Hartnady et al., 1985; Stanistreet et al., 1991). Initial geological mapping (Guj, 1970) revealed a predominantly easterly verging fold-thrust belt. Of major importance is the Sesfontein fault zone (Fig. 1), which, as well as bounding areas of differing structural style, also divides platform/shelf facies to the east from

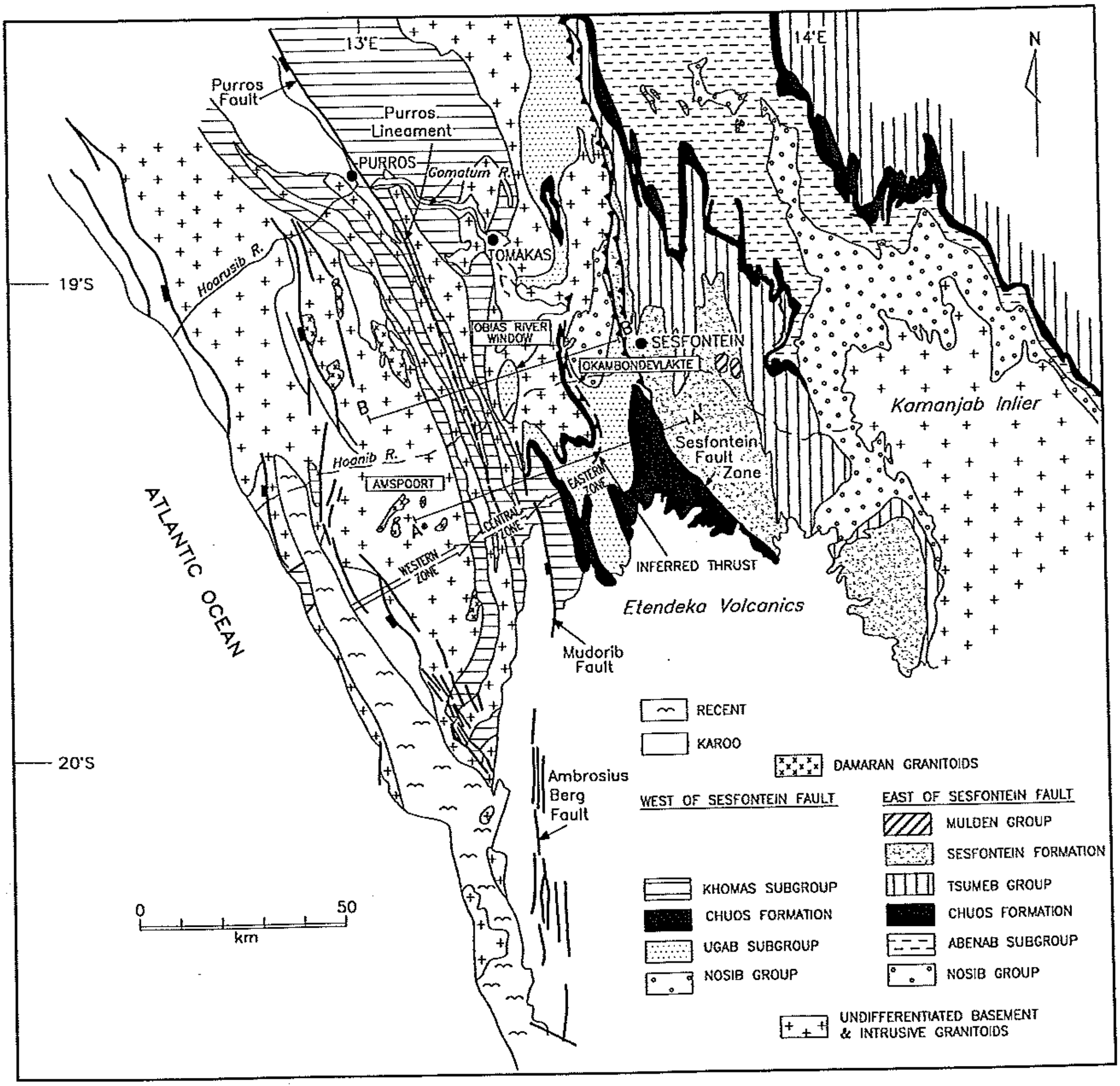

Figure. 1. Geological map of the southern Kaoko Belt with crucial locations and structural profiles marked that are mentioned in the text.

shelf and deep water facies to the west. The reader is directed elsewhere (Porada, 1979; Miller, 1983) for an assessment of the Kaoko Belt in the regional context of the Damaran orogen as a whole.

Earlier structural analysis in the Kaoko Belt (Coward, 1983) has identified south-eastward vergent thrusting from the evidence of lineations and directional indicators. Three identified zones (Western, Central and Eastern, see Fig. 1) exhibit differing structural styles (Dingeldey et al., 1994) and a tectonic window, termed here the Obias River Window, reveals Damara Supergroup stratigraphy beneath a substantial volume of basement. A reinterpretation of the geology of the Kaoko Belt involved predominantly transpressional and strike-slip tectonism (Dürr and Dingeldey, 1995, 1996).

Kaoko Belt stratigraphy, since its first delineation (Guj, 1970), has been reinterpreted several times subsequently. The sequence broadly correlates with representative Damaran sequences elsewhere in Namibia (Miller, 1983). Extensional rift basins that accommodated early Damara Supergroup sedimentation were initially filled in Kaokoland by dominantly continental and shoreline Nosib Group sediments (Henry et al., 1992/93), while later sedimentation responded to thermal subsidence with the deposition of open shelf carbonates, orthoquartzites and mudstones of the Ugab Subgroup (legend of Fig. 1). Renewed extension and oceanic opening coincided with glaciation followed by shelf pelagics in the form of iron formations and glacial dropstone facies, so characteristic of the Chuos Formation elsewhere in Namibia (Henry et al., 1986; Bühn and Stanistreet, 1993, 1997). Remaining accommodation space produced was filled by shelf carbonates which gave way to thick turbidite sequences (Guj, 1970; Miller, 1983) in the Khomas Subgroup (legend of Fig. 1).

Recognition of pre-Damaran basement (Miller and Grote, 1988) was extended from earlier assessments (Guj, 1970) and this was furthered by a reassessment of the metamorphic grade of both Damara and basement lithologies (Dingeldey et al., 1994; Dingeldey and Okrusch, 1995). Subsequent U-Pb zircon dating has revealed considerable volumes of large granitoid bodies intruded into the western area (Seth et al., 1997), where large syn- and smaller late orogenic variants can be distinguished. Further mapping is required to distinguish the relative extents of basement and either sort of intrusive body in the Western Zone.

Reconsideration of the structural significance of the Obias River Window, the east-west variation in structural styles and constraints from fabrics and shear sense indicators, has led the authors to a reinterpretation of the structural style represented in the Kaoko Belt and the impact upon it of early Damaran extensional structures. This reinterpretation has further provided recognition of the reactivation of Damaran structural features by Mesozoic extensional tectonics to bound much younger Karoo-filled half-grabens during Pangean supercontinental break-up and the opening of the Atlantic Ocean.

DOWNWARD FACING STRUCTURES AT OBIAS RIVER WINDOW AND OKAMBONDEVLAKTE POORT

Significance of the Obias River Window

Earlier investigations (Guj, 1970; Dingeldey et al., 1994) identified an antiformal fold core (Obias River antiform, Fig. 1) at the confluence of the Obias and Hoanib Rivers, through which meta-orthoquartzites of the Nosib Group appear beneath pre-Damara mixed paragneissic and orthogneissic basement. The basement/Damara contact was initially delineated (Dingeldey et al.,

1994) as a thrust, but lack of localised high-strain at this contact has led us to agree with an earlier assessment (Guj, 1970) that it represents a sedimentary contact (Fig. 1). However, the reclassification of basement lithologies and obvious discordance, visible both in outcrop and aerial photograph, now implies that the contact is an angular sedimentary unconformity. Because the downward facing antiform reveals Damara beneath basement, its core is named here the Obias River Window. As the axial trace of the doubly plunging antiform is followed southward, Damara sediments are encountered at a higher structural level on top of the same basement, tracing around the antiform and thus demonstrate an upward facing relationship at that structural level. This implies that the Obias River Window represents part of the lower limb of an extensive recumbent fold (dimensions about 40km x 150 km), a possibility barely considered previously (Guj, 1970), that has been locally elevated because of refolding by the Obias River antiform.

Structural profiles (Guj, 1970) to the north and south of the Hoanib River (Fig. 1) therefore expose differing structural levels of, respectively, the refolded lower and upper limbs of this major recumbent fold. Thus, from the mapped geology, the two profiles can be considered together (Fig. 2) to reveal the full fold nappe geometry. This is not the first time that downward-facing structures have revealed early recumbent major folds in the Damara orogen; they have also been established in the inland orogenic branch (Kukla et al., 1989), where they were only developed close to widely separated major thrust surfaces.

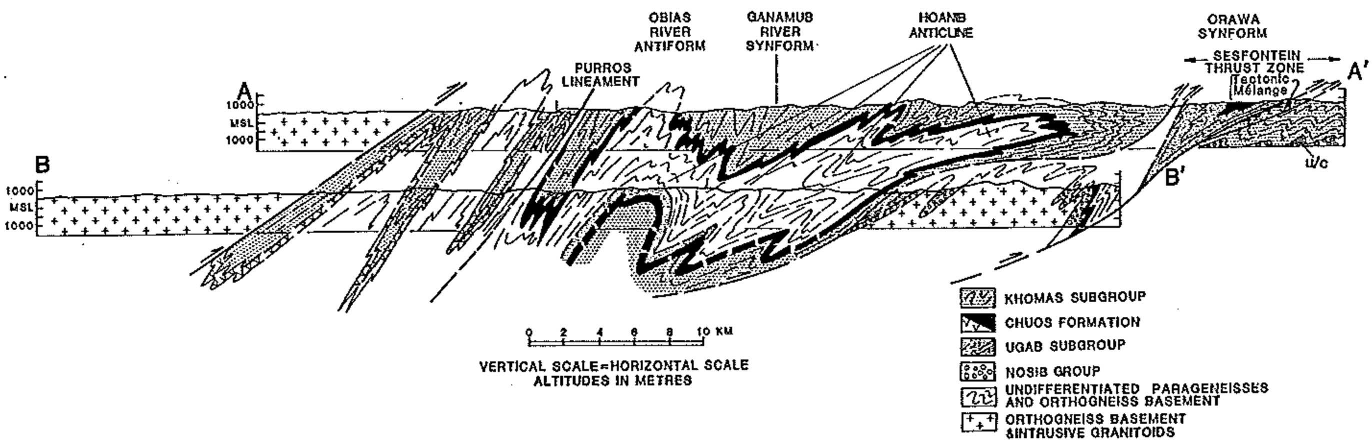

Figure. 2. Structural profile through the Hoanib Fold Nappe, generated by juxtaposing structural cross-sections A-A' and B-B' at their respective structural levels

Significance of Okambondevlakte Poort

At the Hoanib gorge or poort, on the west side of Okambondevlakte (Fig. 1), Damara sequences are also exposed beneath basement. Here diamictite is in contact with the basement and is structurally underlain successively by iron formation and marbles (Fig. 3). The strain observed is variable, with strain exhibited by Damara lithologies increasing downwards away from the basement/Damara contact towards the area of the Okambondevlakte, presently obscured by Quaternary sediments (Fig. 3). The relatively lesser deformed basement/Damara contact shows no evidence of having acted as a major shear zone and the authors identify it as a sedimentary unconformity. This implies that folds north of the Hoanib River and west of Okambondevlakte Poort are also downward facing (Figs. 1 and 2) on the lower limb of the same major recumbent fold structure identified near the Obias River confluence with the Hoanib River.

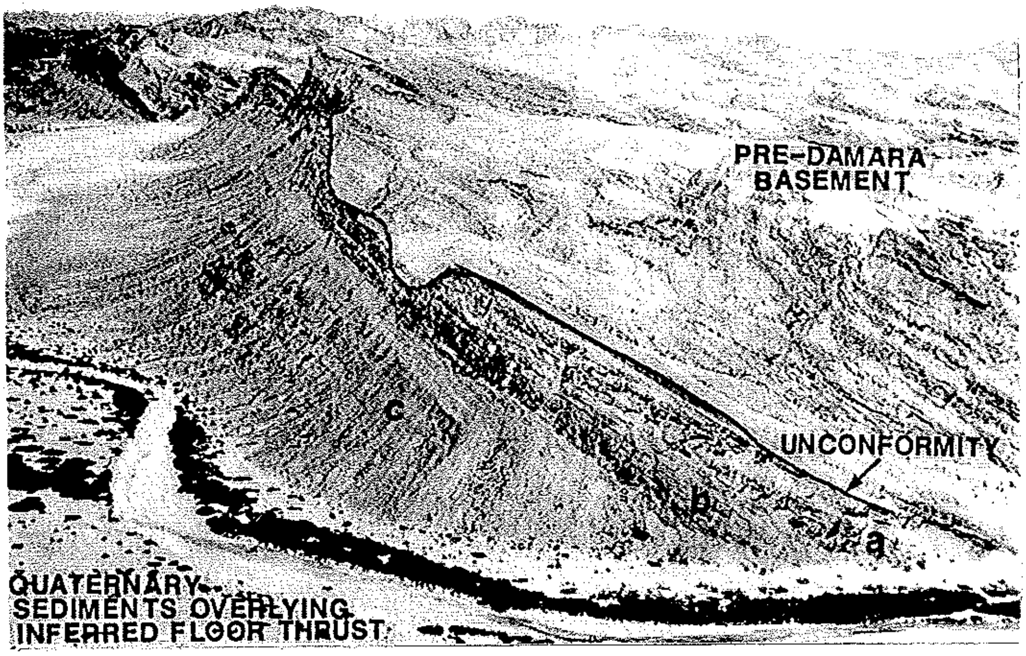

Figure. 3. Oblique aerial photograph of the downward-facing and lower limb of the Hoanib Fold Nappe at Okambondevlakte Poort showing the Pre-Damara basement gneisses structurally overlying a sequence of Chuos diamictites (a), Chuos iron formation (b) and marbles (c).

The recognition of an unconformity between basement and diamictite with iron formation has considerable implication. In the Damara Supergroup, the association of iron formations and diamictite is typical of the Chuos Formation (Henry et al., 1986; 1992/93; Bühn and Stanistreet, 1993) and contrary to an earlier proposal (Guj, 1970) the authors make this correlation. Because of the presence of older Ugab and Nosib Group sediments farther west (Henry et al., 1992/93), it is concluded that the Damara Supergroup on-laps westwards onto basement so that earlier depositional phases of the Damara sequence are progressively excluded. Regionally, the Chuos Formation lies on the most pronounced disconformity throughout the Damara Supergroup (Martin, 1983; Henry et al., 1990; Jasper, 1994), and this relationship is evident in the mapped geology to the east of Sesfontein (Fig. 1). It is therefore not surprising that such an erosive surface can have placed Chuos directly on basement over a significant part of the study area west of the Sesfontein thrust.

MAJOR RECUMBENT FOLDS IN A KAOKO BELT CONTEXT

Hoanib Anticlinal Fold Nappe

The major recumbent anticlinal structure is named here the Hoanib Fold Nappe and dominates the geology of the Eastern Zone delineated by Dingeldey et al. (1994) of the Kaoko Belt (Fig. 1). The structural style of the Eastern Zone, with open and upright D2 and D3 fold structures, contrasts sharply with the steeply inclined structures of the Central Zone and the upfaulted massive synorogenic granitoids which dominate the Western Zone. Nevertheless, fold patterns of the Eastern Zone are characterised by many obvious complex refold patterns, particularly farther north around Tsongoari and in the Gomatum Valley. Refolding of an early recumbent structural style can therefore be identified on all scales, within individual field localities, individual subsidiary structures and on the larger scale of the Hoanib Nappe itself.

The Hoanib Nappe Anticline is classified as a D1 structure refolded by upright D2/D3 structures. The recumbent form of the Hoanib anticline is entirely consistent with the generally bedding subparallel nature of the S1 penetrative closely spaced foliation identified by Dingeldey et al. (1994). Figure 2 reveals the nature of the Hoanib Anticline as a fold nappe riding on an underlying thrust surface. This is similar to structures that have been described from many fold-thrust belts throughout the world (e.g. the Himalayas, Treloar et al., 1992 and the Alps, Ramsay et al., 1983) and in belts more contemporary with the Damaran Kaoko Belt, such as in the Caledonides, and the Tay Nappe (Harris et al., 1976; Roberts and Treagus, 1977).

When the major recumbent fold geometry is reconciled with lineation and shear sense indicator information (Coward, 1983; Dürr and Dingeldey, 1996), D1 is revealed as a major thrust episode that tectonically transported the Kaoko Belt south-eastwards as a fold nappe-thrust pile riding on the Sesfontein floor thrust surface. The pile was subsequently shortened by the progressive phases D2/D3. Shear sense indicators of left-lateral displacement (Coward, 1983), concentrated along specific zones such as the Central Zone (Dürr and Dingeldey, 1996), are interpreted here as a late structural overprint concomitant with late orogenic strike-slip displacement in the coastal branch as a whole (Stanistreet et al., 1991). Equivalent late orogenic strike-slip motion was identified in the Damaran inland branch (Kukla, 1990), in that case with a right-lateral sense, and is a feature typical of many other Phanerozoic collisional fold-thrust belts (Laubscher, 1992; Treloar et al., 1992; Stone et al., 1997). In the Kaoko Belt cross-folding by ESE-trending D4 folds is further represented by crenulation on earlier foliations. These structures further explain the doubly plunging periclinal nature of earlier open folds, for example evident in the cases of the Tsongoari Syncline (Henry et al., 1992/93) and the Obias River Window considered here.

Reconciliation of Recumbent Structure with the Kaoko Belt Farther to the West

The tectonic style of the Central Zone (Fig. 1) is characterised by extremely tight upright folds that are registered at both structural levels depicted in Figure 2. The steep nature of the structural style contrasts markedly with the recumbent nature of the Hoanib Anticline and associated thrusts in the Eastern Zone (Fig. 2) and these need to be reconciled. In addition there is a pronounced increase in both bulk strain and metamorphic grade (Dingeldey et al., 1994; Dürr and Dingeldey, 1996) in crossing from the Western to the Central Zone. This change in structural style led to the definition (Miller and Schalk, 1980; Miller, 1983) of the Purros Lineament (Figs. 2 and 3), which had been mapped in part previously (Guj, 1970), when a fault element (the Mudorib Fault) was named by him.

The Purros Lineament represents a fundamental tectonic boundary, effectively that between the Eastern and Central Zones. The steep structural style of the Central Zone the authors interpret as relating to a root- zone geology, ramping up to emplace the fold nappe. The geometry of the root zone is also consistent with the overthrusting emplacement of major massive synorogenic granitoid bodies dated at between 552-567Ma (Seth et al., 1997) that had been intruded into the

Damaran sequences within the Western Zone. The overall geology of Kaokoland reveals that the rocks of the Western and Central Zones ramped up over more easterly geology (Fig. 2), producing a large scale bow-shaped thrust front (Fig. 1) with lateral dimensions of 40km across and 160km along the tectonic grain of the Kaoko Belt.

PRE-COLLISIONAL DAMARAN BASIN GEOMETRIES

In addition to revealing the structural architecture of the Kaoko Belt, reconstructively unfolding the Hoanib nappe also reconciles what initially appeared to be stratigraphic and sedimentological inconsistencies. At the Obias River Window, the overturned Nosib Quartzites stratigraphically lie unconformably on basement (Fig. 2), presently to the *west* of the Okambondevlakte Poort, where younger Chuos sits on basement. At first sight this runs against the regional trend, whereby younger sedimentary units lap progressively westwards onto basement. However, when the recumbent form of the Hoanib Anticline is reconstructively unfolded, the Obias River Window geology lies to the *east* of the Okambondevlakte Poort geology as portrayed in Figure 4. Units lying unconformably on basement at various localities in the Hoanib and neighbouring Gomatum

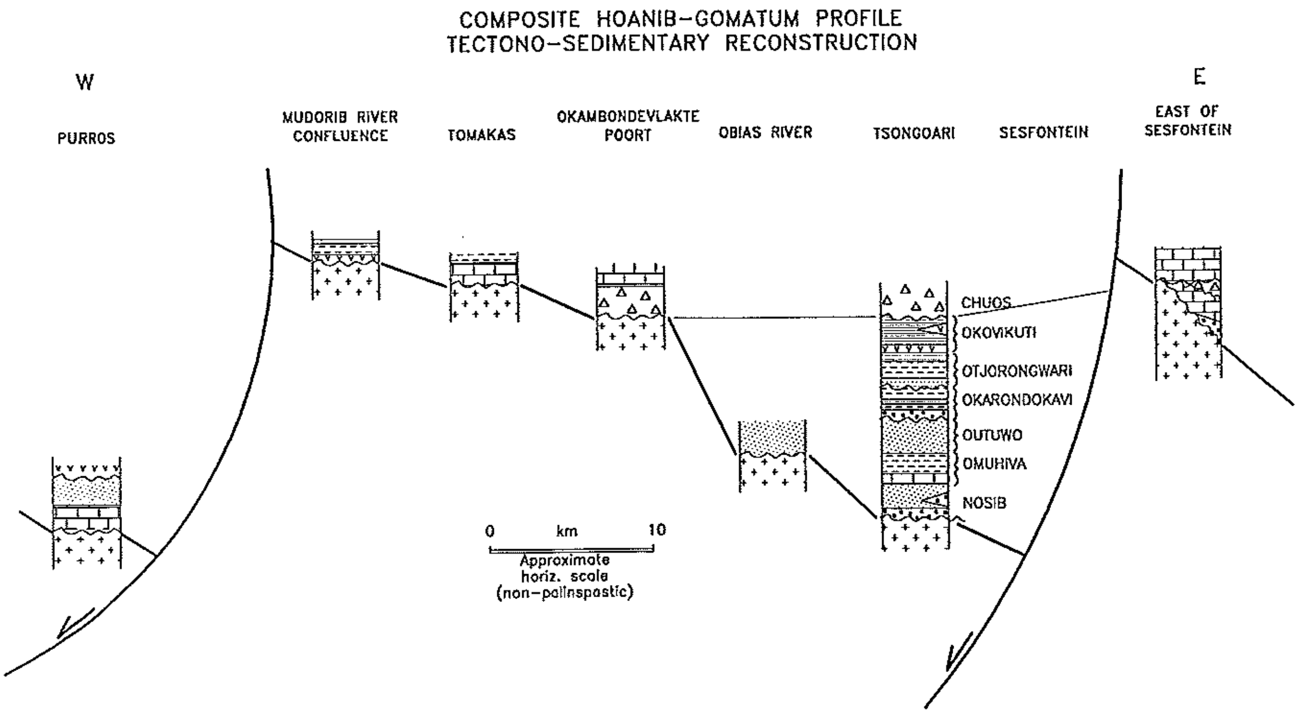

Figure. 4. Stratigraphic elements observed with respect to the Damara/basement unconformity at various localities in the Hoanib and Gomatum valleys. Localities are positioned as if the Hoanib Fold Nappe was reconstructively unfolded. Stratigraphic height is determined in accordance with type sections immediately west (Henry et al., 1992/93) and east (Guj, 1970) of the Sesfontein fault system. Positions of inferred extensional faults are indicated.

valleys are placed in their relevant stratigraphic location in Figure 4 with respect to the stratigraphy defined in the Tsongoari Syncline (Henry et al., 1992/93) and in the platform sequences east of Sesfontein defined by Guj (1970). Localities in Figure 4 are placed unfolded in their approximately palinspastic locations at incremental positions away from the Sesfontein

Thrust. Taking positions between Okambondevlakte Poort and the Mudorib River confluence, marbles and interbedded metapsammites/metapelites are exposed along the Gomatum valley, juxtaposed to basement. The onlapping relationships can be reconciled with the major facies changes across the Sesfontein Fault (Guj, 1970) by interpreting the Sesfontein Fault to have had an extensional geometry and history prior to its subsequent inversion as a thrust zone. The resulting half-graben geometry accommodates the thicker, more varied and more complete pre-Chuos sequence recorded at Tsongoari (Henry et al., 1992/93). Extensional rotation of such a fault-block would also explain why Chuos and pre-Chuos sediments on-lap westwards onto basement towards the Mudorib River confluence. The latter locality has an ortho-amphibolite unit at its base. Another ortho-amphibolite is recorded just beneath the Chuos Formations at Tsongoari. Such volcanics may be contemporary with a phase of basic volcanism associated with limited oceanic spreading of the Khomas Gulf, established in central Namibia between the Congo and Kalahari Cratons during the history of the Damara Supergroup close to the time of the deposition of the Chuos Formation (continental basic volcanism recorded by Breitkopf and Maiden, 1987; oceanic spreading recorded by Kukla et al., 1988, 1991; Henry et al., 1990; Bühn et al., 1992].

In Kaokoland, the fundamental importance of the Purros Lineament is reiterated by the fact that Damara shelf carbonates and orthoquartzites are once again preserved adjacent to the lineament on its western side. Additionally, basal ortho-amphibolites lying on basement beneath the Khomas Subgroup are restricted to the west of this tectonic boundary. Figure 5 shows how this occurrence can be interpreted to be reconciled with the half-graben geometry defined farther east. The shelf sediments are accommodated in a second half-graben structure bounded by a fault zone that coincided with the present position of the Purros Lineament, an element of which is the Mudorib Fault. It is concluded that the Sesfontein and Purros zones acted as major and subsidiary elements, respectively, of a down-to-the-west extensional fault system during the deposition of the Damara Supergroup, and were subsequently reactivated in a reverse sense during the collision of proto-South American continental elements with the newly constituted proto-African foreland (Stanistreet et al., 1991). It was the Purros lineament with its Mudorib Fault identity that caused the ramping evident in the Central and adjacent Eastern Zones.

The Figure 4 reconstruction of the localisations of the Nosib Group and Ugab Subgroup as terrestrial and shallow marine initial fills of the two defined half-graben geometries is comparable with the controls of Damaran basin geometries identified in other parts of the Damara Orogen (Henry et al., 1990; Stanistreet et al., 1991; Jasper, 1994). The sub-Chuos unconformity has been proposed elsewhere as an onset unconformity during the opening of the Khomas Sea (Stanistreet et al., 1991). The extensional effects on continental lithosphere of the Congo and Kalahari Cratons at this late stage of Rodinian supercontinental break-up explains the continuing widespread development of extensional rift basins. After oceanic onset extensional rifting waned and remaining accommodation space in the half-graben depositories were filled passively after Chuos deposition by subsequent Khomas Subgroup facies (Fig. 4).

POSSIBLE PRE-DAMARA STRUCTURAL FRAMEWORK INHERITANCE

Basement rock types seem to vary in accordance with their position in the Central and Eastern Zones. Paragneissic lithologies, originating as interbedded psammitic and pelitic protoliths and intruded by the Pruwes granodiorite (Guj, 1970), are exposed in the cores of anticlines in the Central Zone. Basement exposures farther to the east, as far as and including that of the Kamanjab

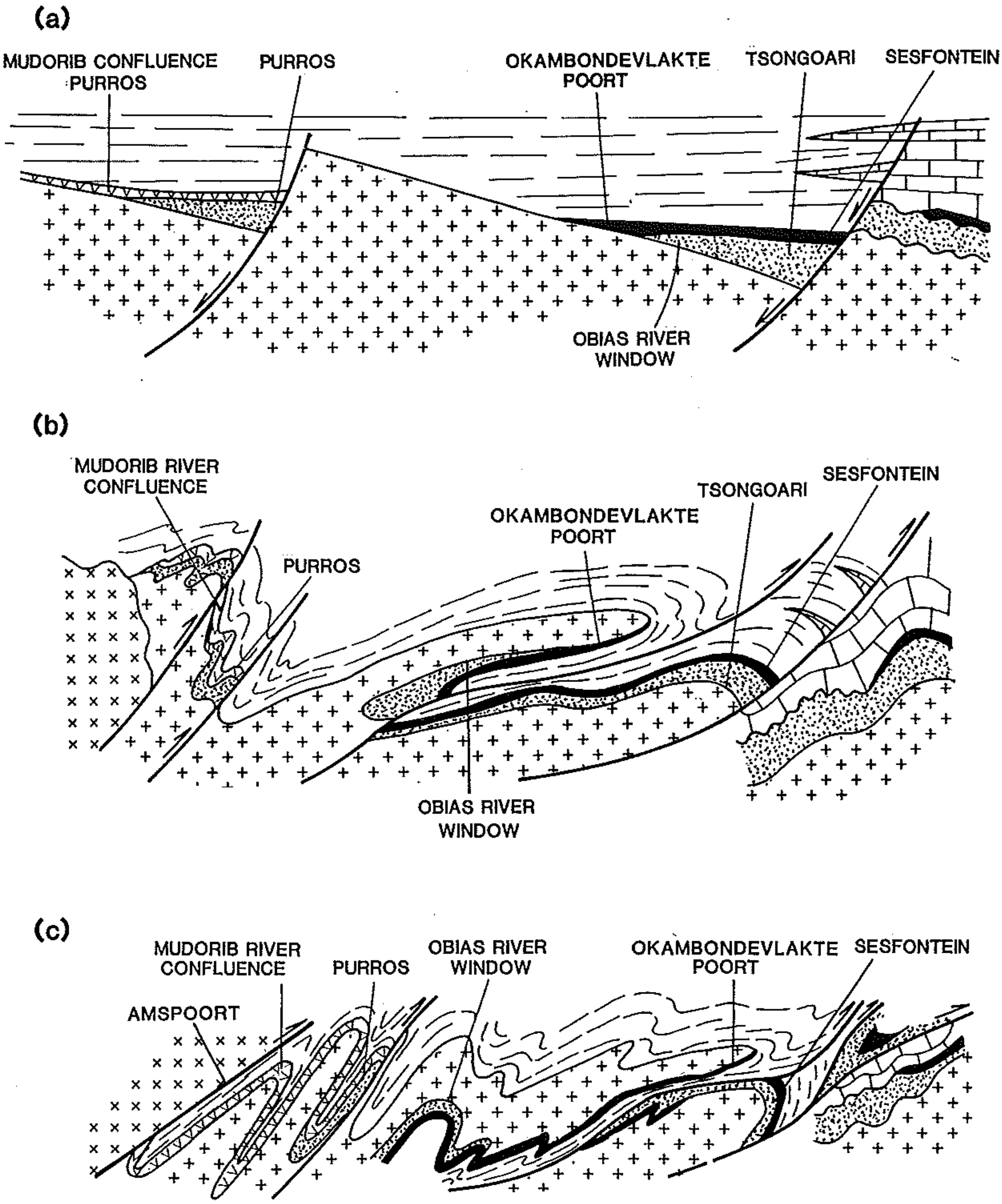

Figure. 5. Schematic sections showing the envisaged evolution of the Hoanib Fold Nappe from extensional half-graben depositional geometries to collisional fold nappe pile.(a) Envisaged relationships between stratigraphic units deposited in half-grabens prior to collision; (b) During collision extensional fault systems are reactivated as thrust zones. Also a new thrust floors the developing Hoanib Fold Nappe; and (c) Progressive refolding and tightening of fold structures led to the present geology.

Inlier beneath the platform sequences, are dominantly orthogneisses (Fig. 2). Thus, the identified thrust root zone may have a history extending prior to Damaran basin development. The basement paragneisses were folded into the Damaran cover sequence from the area of the root zone, as exemplified by the Hoanib Nappe core. In contrast, the basement orthogneisses to the east acted as a massif over which the paragneiss-cored fold nappes were thrust. This structurally differential behaviour of particular basement lithologies during Damaran orogenesis would have been promoted to a great extent by the competency contrast between the paragneissic and orthogneissic lithologies. The pre-Damara structural framework might therefore have played a considerable role in predisposing the zonation of the later Damaran Orogen. The writers imagine a differentiated basement similar to that of southern Namibia, (investigated by Hoal, 1985,1990; Hoal et al., 1989), in which small exotic terrains collided with the Kalahari Craton during the Middle Proterozoic to form a mosaic that influenced the evolution and positioning of the younger cratonic and continental margins. Comparatively, the orthogneissic basement of Kaokoland would represent old gneissic continental crustal material of the Congo Craton interior. This craton might, most appropriately, have sourced zircons to the paragneisses, yielding dates between 2520 and 2620 (Seth et al., 1997). The psammitic and pelitic interbeds were themselves intruded by granodiorites that yielded zircons with ages ~1340 and ~2000 Ma (Seth et al., 1997). Taking the younger of these ages as the most likely igneous age, this is similar to the age (1271 $\pm$ 62 Ma) of the Aunis Tonalite Gneiss (Hoal et al., 1989) of southern Namibia, representing one of a group of granitoids intruded during ongoing middle Proterozoic oceanic subduction, deformed ultimately during collision of exotic terranes with the Kalahari Craton (Hoal, 1990).

RE-ACTIVATION OF DAMARAN STRUCTURES DURING MESOZOIC ATLANTIC OPENING

Damaran structural patterns have, in their turn, had a considerable influence on later tectonism in both the Kaokoland and Damaraland regions during the Phanerozoic. A major down-to-the-west detachment fault system, with fault elements variously identified as the Ambrosius Berg (Milner and Duncan, 1987) and Mudorib (Guj, 1970) faults, that was a syn-sedimentary system and tectonic basinal divide during the deposition of the Karoo Supergroup (Figs. 1 and 3), follows closely the structural grain of the underlying Damara Orogen. In the Hoanib area the fault system coincides with the Purros Lineament discussed earlier, with downthrow increasing away from the centre of the bow-shaped thrust front between the Eastern, the Western and the Central Zones (Fig. 4). It is as if the laterally ramped areas of the Purros thrust front were the more susceptible to reactivation during Mesozoic continental lithospheric extension that led to the opening of the southern South Atlantic Ocean. It is concluded that the identified Damaran root zone represents a long-lived lithospheric weakness that has been used and reactivated at least between 750Ma and 100Ma and was possibly initially programmed into the continental lithosphere as far back as the middle Proterozoic.

A Damaran continental suture was developed within the coastal branch orogen as proto-South American continental elements overrode the proto-African foreland (Hartnady et al., 1985; Stanistreet et al., 1991) prior to about 500 Ma. It is deduced that this even more fundamental structural element lies parallel to the tectonic grain of the Kaoko Belt farther to the west and is largely obscured by present South Atlantic shelf sedimentary cover. The authors join with other writers (Hartnady et al., 1985; Ben-Avraham et al., 1993) and speculate that it was this lithospheric weakness that acted during Gondwana break-up as the locus of continental rupture in Namibia, to specify the position of much of the southern South Atlantic south of the Walvis Ridge. Although the Damaran suture is largely covered at present by Cretaceous to Recent shelf sequences the suture is exposed near the coast of southernmost Namibia (Hartnady et al., 1990;

Jasper et al., 1993). At this locality, the suture is identified as the thrust zone beneath the Oranjemund Complex exposed in the Damaran Gariep belt. The complex incorporates exotic oceanic terranes, including a Late Proterozoic carbonate-capped volcanic sea-mount prominence (Smith and Hartnady, 1984), derived from the Adamastor ocean and obducted onto the African foreland.

SUMMARY AND CONCLUSIONS

In a broader context the writers view the fold nappes and associated thrusts of the Kaoko Belt as the geology underthrust beneath the over-riding proto-South American continental lithosphere that was tectonically transported south-eastward over the African foreland in Namibia. The metamorphic grade exhibited by the Damara lithologies (Dingeldey and Okrusch, 1995) increases rapidly westwards from greenschist facies close to Sesfontein to granulite facies conditions farther west. A straightforward explanation of the metamorphic grade increase is that the foreland was loaded by the developing fold-thrust belt to develop high-grade metamorphic facies conditions and that early orogenic extension and rebound has allowed the generation of the low pressure/high temperature conditions reported by Dingeldey and Okrusch (1995).

In accordance with the late tectonic history of many collisional mountain belts, initial folding and overthrusting was succeeded by lateral motion that uses major thrust discontinuities and shear zones to generate strike-slip motions and, in the case of the Kaoko Belt, to produce the consistent left-lateral shear sense indicators previously reported. The collisional event that caused the Damara coastal orogen completed the convention of Gondwana, a configuration that was only disturbed when the Pangean supercontinent started to disaggregrate. Extension and break-up reused earlier thrusts and shear zones to nucleate extensional fault systems. The Mesozoic fault systems that accommodated Karoo Supergroup fills in the Kaokoveld area provide good examples of such inheritance from precursor Late Proterozoic structural features.

On a more regional scale, it is speculated that the continental suture produced by the closure of the Adamastor ocean, when proto-South America was overthrust onto the African foreland, was re-used as a break-away during Pangean disintegration. The suture is largely obscured at present by shelf sediments, apart from the thrust zone beneath the Oranjemund Complex exposed in the Damaran Gariep fold-thrust belt of southern Namibia.

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