Chapter 3

Internal Stratigraphy of the Keonjhar Siliciclastics

3.1. Introduction

The siliciclastic succession studied here is exposed for a stretch of about 20 km to the north of Keonjhar Town between the Singhbhum Granite and the Iron Ore Group of rocks of the Noamundi-Jamda-Koira Valley (Western IOG). Keonjhar siliciclastics can be traced as discontinuous outcrop belts to the Mahagiri Quartzite of the Daitari-Tamka Range in the South and to the Mankaharchua siliciclastics of the Pallahara area in the West (Fig. 3.1). The Keonjhar siliciclastics unconformably overlie the Singhbhum Granite with a locally preserved Mesoarchean paleosol (Fig. 3.2) (*the Keonjhar Paleosol*, Mukhopadhyay et al. 2013, 2014). Mukhopadhyay et al. (2014) dated these siliciclastics from Keonjhar-Mahagiri-Pallahara areas with U-Pb detrital zircon LA-ICPMS ages.

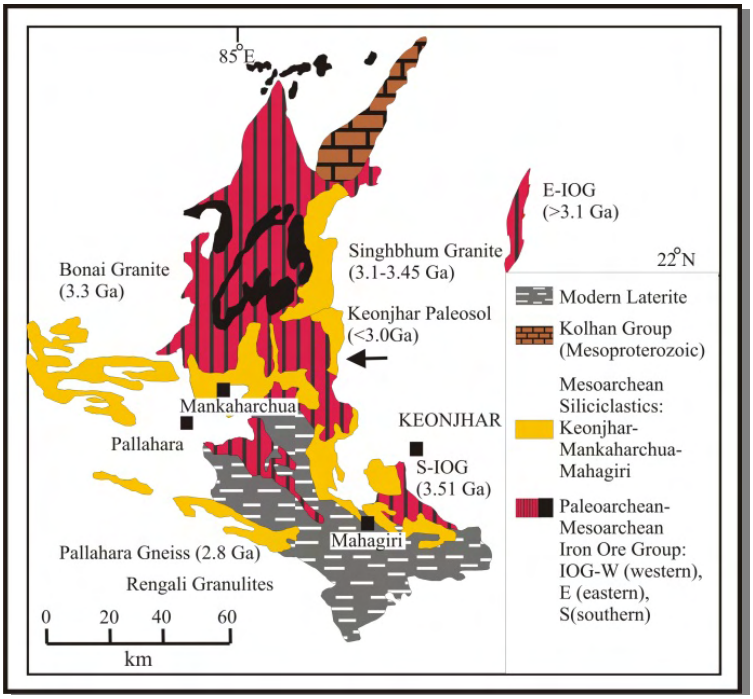

Fig.3.1. Outline map of distribution of Mesoarchean siliciclastics around Keonjhar-Daitari-Tamka-Pallahara areas (after Mukhopadhyay et al. 2014).

They inferred maximum depositional age of ~3 Ga for these siliciclastics. The siliciclastics studied here from the North of Keonjhar Town is mappable in 1:50,000 scale and based on the distinct lithological character and mappability a formation status is proposed here. The unit is named here as Keonjhar Quartzite as per the guidelines of the International Code of Stratigraphic Nomenclature (Murphy and Salvador 1998).

3.2. Internal stratigraphy of the Keonjhar siliciclastic

The detail internal stratigraphy of the hitherto unclassified Keonjhar siliciclastics has been carried out. For this purpose geological map (1:50000 scale) of the study area was prepared and structural control on outcrop pattern was established. Keonjhar Quartzite includes further two distinctive lithologies that are not mappable in practicable scale. The lower part of the succession includes conglomerate and pebbly sandstone (Fig. 3.3A and 3.3B) interbedded with coarse-grained sandstone.

Fig.3.2. Field photograph of Paleosol (*Keonjhar Paleosol*) along the unconformity.

The conglomerate-pebbly sandstone-coarser sandstone association has been assigned here the status of a member. The association is about 25 m thick. It is best preserved in the Asurkhol hill section (Lat. 21°55′54.9″ Long. 85°32′13.0″) and is named here as Asurkhol Member (Fig. 3.4). The other distinctive lithology is a pocket

of iron ore-BIF clast-bearing conglomerate (Fig. 3.5). The iron ore clast-bearing conglomerates occur as amalgamated mass-flow beds in a zone of about 40 m thickness and about 150 m width with mature arenite near the upper part of the Keonjhar Quartzite.

A.

B.

Fig.3.3. Field photograph of A. Conglomerates and B. Pebbly sandstone that characterize the Asurkhol Member from the lower part of the Keonjhar Quartzite.

The most prominent body is exposed in the hills of Chamakpur village (Lat. 21°59′32.8″ Long. 85°28′27.1″). The laterally restricted mode of occurrence of the conglomerate renders them a form of a lentil and a member status is proposed here. The lentil is named here as Chamakpur Member (Fig. 3.4).

The beds in the Keonjhar Quartzite are gently westerly dipping with a general dip amount not exceeding 15 degrees. The Keonjhar Quartzite in the study area unconformably overlies the Singhbhum Granite or IOG metabasic lava. The outcrop pattern (Fig. 3.4) reveals that the basement has been repeated in three major fault slices. The faults are in general N-S oriented and are subparallel to the general strike of the beds. Locally developed asymmetric/symmetric folds, strong fracture cleavage (Fig. 3.6A, B) and repetition of stratigraphy confirm the fault slices. There are mainly three fault slices: a) Asurkhol slice, b) Hatidari slice and c) Kankana slice.

Table 3.1. The proposed lithostratigraphic classification of Keonjhar Quartzite, Singhbhum craton, Odisha.

Formation	Lithology	Members	Characteristics
Keonjhar Quartzite Formation	Trough cross-stratified medium-to-coarse grained mature sandstone, pebbly sandstone, conglomerate	Chamakpur Member	Lentil shaped iron ore clast-bearing conglomerate
		Asurkhol Member	Trough cross stratified coarse grain mature sandstone. Matrix-supported conglomerate and Clast-supported conglomerate
----------*unconformity*----------			
Singhbhum Granite phase I- III-OMTG with IOG-OMG enclaves			

The Asurkhol slice is the eastern most outcrop belt of the Keonjhar Quartzite and constitutes the Asurkhol Member. Internally the package includes fining upward succession of conglomerate pebbly sandstone-cross-stratified sandstones (Fig. 3.7A).

The Hatidari slice repeated the pebbly sandstone and cross-stratified sandstone package against the Asurkhol slice. Basement greenstone metalava and metadolerite have been upthrown on the Asurkhol slice (Fig. 3.7B).

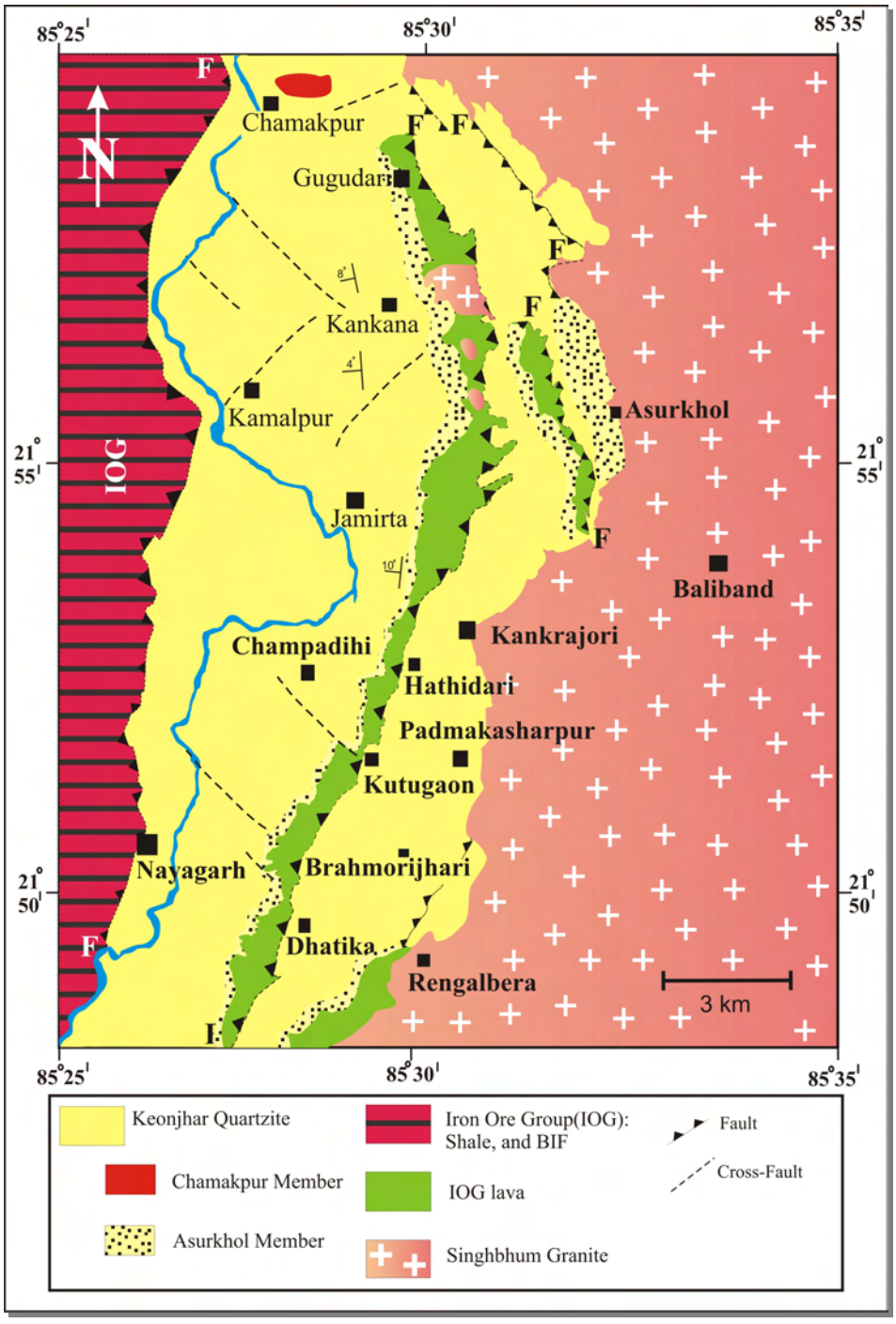

Fig.3.4. Geological map of the Keonjhar Quartzite, north of the Keonjhar Town.

A.

B.

Fig.3.5. A. Field photograph of lensoid iron ore conglomerate bodies mined out from Chamakpur Member. B. Field photograph of iron ore conglomerate with clasts of hard iron ore (dark steel gray) and BIF (reddish) in Chamakpur Member. Note well rounded hard iron ore clast (near the left upper corner coin scale).

The Kankana Slice is the westernmost package and represents the most extensive outcrop belt of the Keonjhar Quartzite. The Kankana slice starts with the basement metalava and locally the basement granitoid. The basement has been upthrown against

the Hatidari slice with low angle reverse fault/thrust. The Kankana succession also records the parts of Asurkhol Member with conglomerates at the lower part and mature cross-stratified arenite in the upper part (Fig. 3.7C).

A.

B.

Fig. 3.6. Field photographs of megascopic deformation structures close to major faults in Keonjhar Quartzite: A. Locally developed asymmetric fold and B. Strong fracture cleavage.

The three thrust packages from east-west in down dip direction (Fig. 3.8) record the stratigraphy. The faults in the outcrop are subparallel to the strike of the beds and also are at low angle with the contour pattern. This suggests that the faults are of low

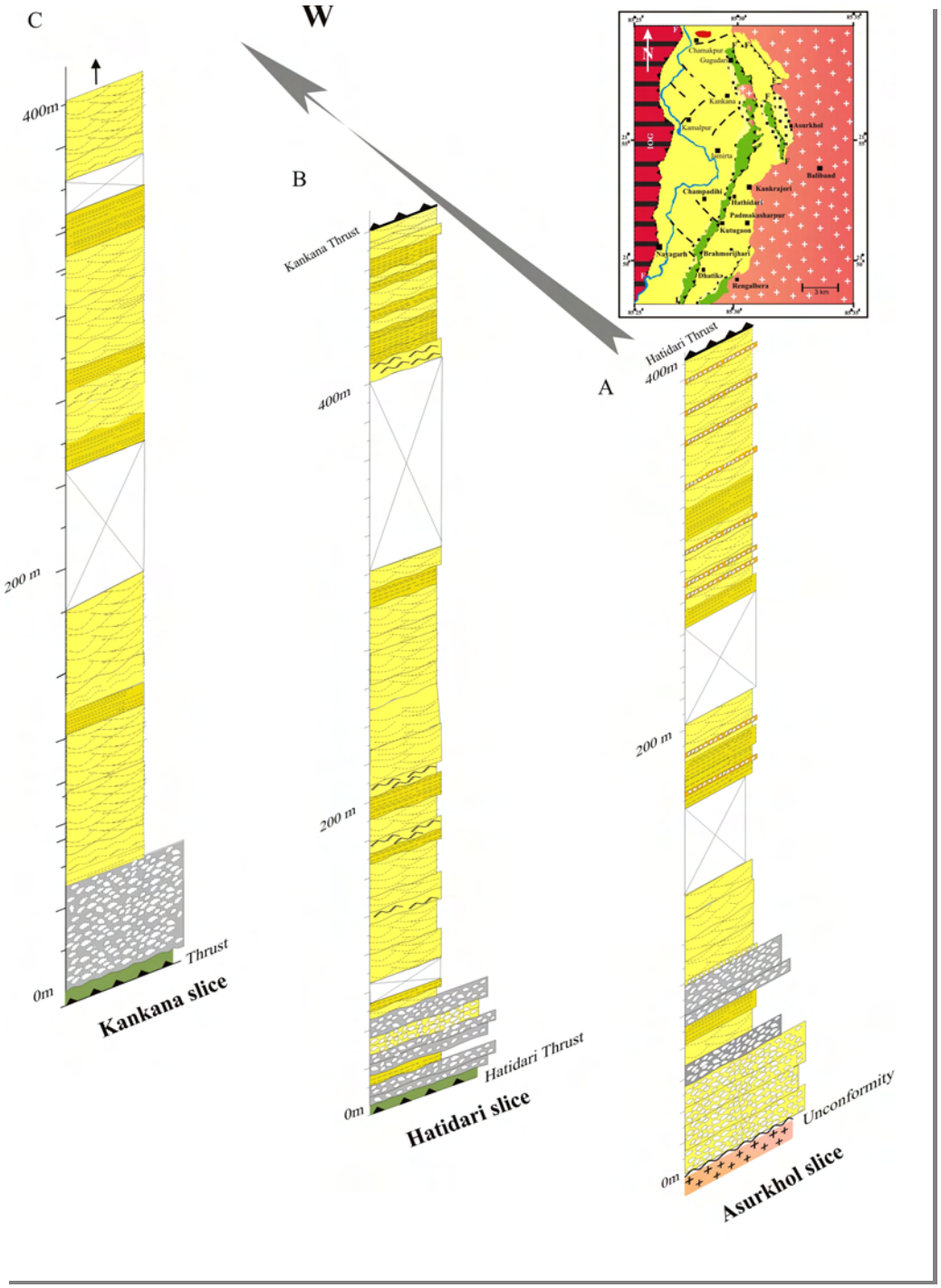

Fig. 3.7. Lithologs of the three major slices in east-west down dip direction: A. Asurkhol slice, B. Hatidari slice C. Kankana slice.

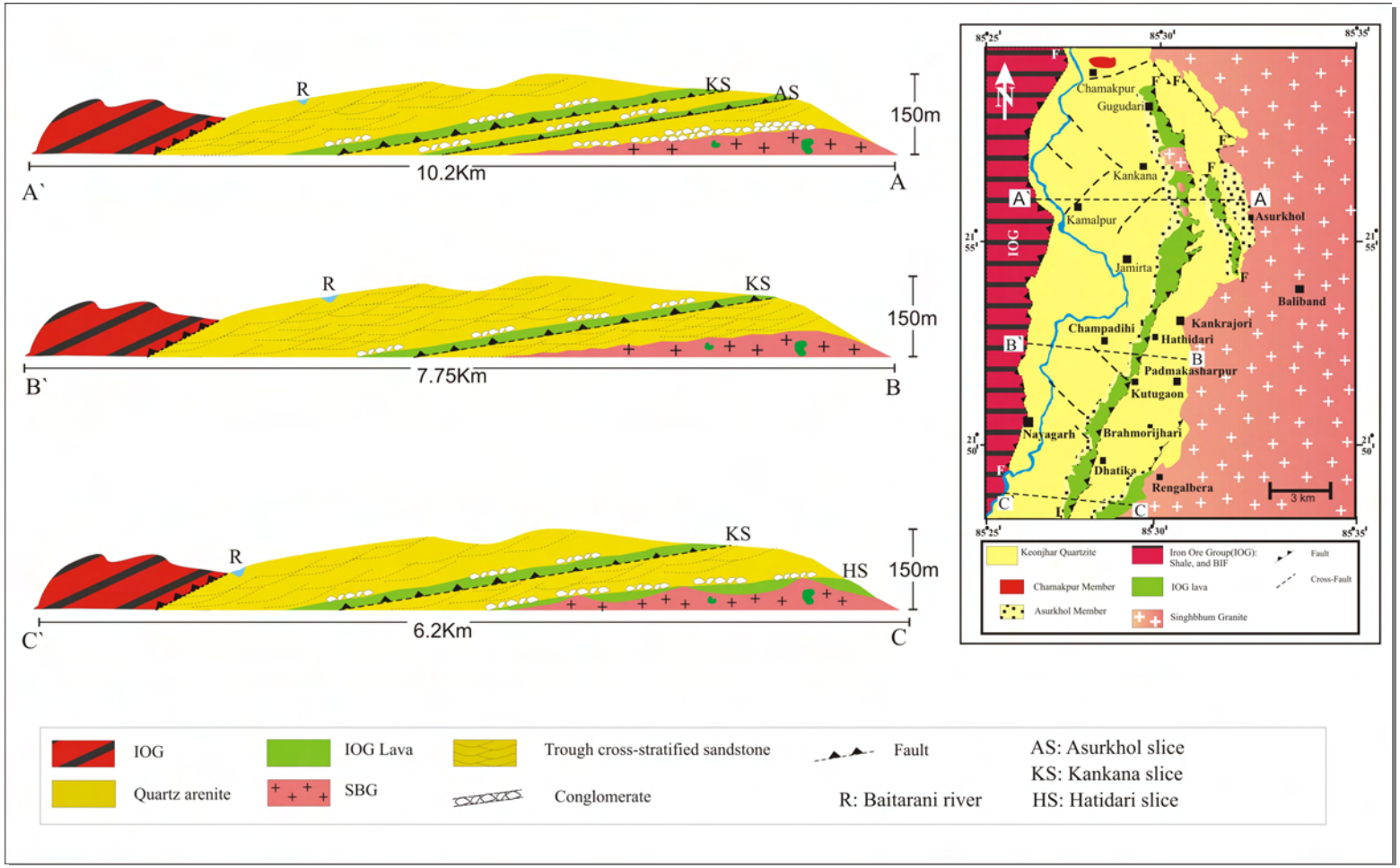

Fig. 3.8. Profile sections along true dip direction.

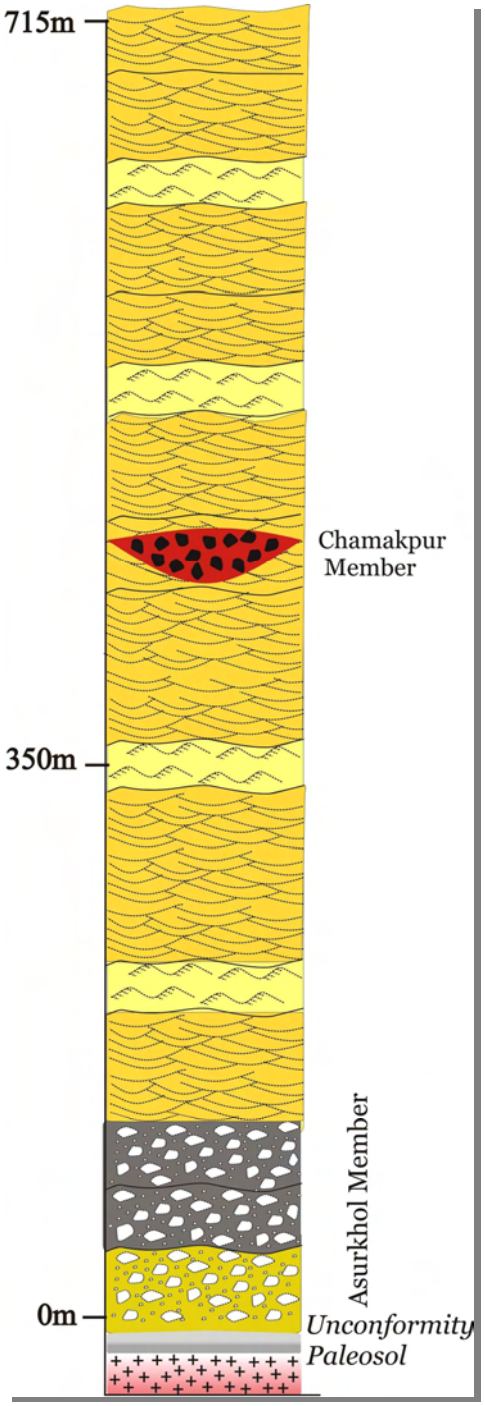

Fig. 3.9. Composite stratigraphic succession of the Keonjhar Quartzite. Note: two members classified within this formation: Asurkhol Member and Chamakpur Member.

angle and since they repeat the stratigraphy down dip the faults represent thrust faults. The Iron Ore Group of rocks that stratigraphically form the basement for these quartzites also are upthrown against the Keonjhar Quartzite on the western boundary of the study area. The thrust slices mapped here that occur in the footwall side of this major thrust fault may represent footwall break backs of the same system of thrusting that had upthrown the entire IOG belt on the down dip of then Keonjhar Quartzite.

A composite litholog (Fig. 3.9) from all the thrust slices and one autochthonous block from Chamakpur hillock (Fig. 3.4) represents the generalized stratigraphy (Table 3.1) of the Keonjhar Quartzite. The conglomerate dominated lower unit, the Asurkhol Member constitutes the lower 25 m and the Chamakpur Member occurs as a lens in the upper part of the formation.