The Nidar Ophiolite and its surrounding units in the Indus Suture Zone (NW Himalaya, India): new field data and interpretations

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Introduction

The Nidar Ophiolite is located in the Indus Suture Zone, between the North Himalayan nappes and the Ladakh Batholith (Eastern Ladakh, NW Himalaya, India) (Fig. 1a). Based mainly on geochemical arguments, this ophiolite is classically interpreted as a relic of an intra-oceanic arc (Mahéo et al. 2000; Mahéo et al. 2004), which developed at around 140 Ma, prior to the collision between the Indian and Eurasian plates (Ahmad et al. 2008).

Recent detailed mapping (Fig. 1a) of the Nidar Ophiolite between Nidar village and the Kyun Tso area show a great diversity of mafic and ultramafic rock types. It demonstrates that the internal structure of the ophiolite is more complex than previously suggested.

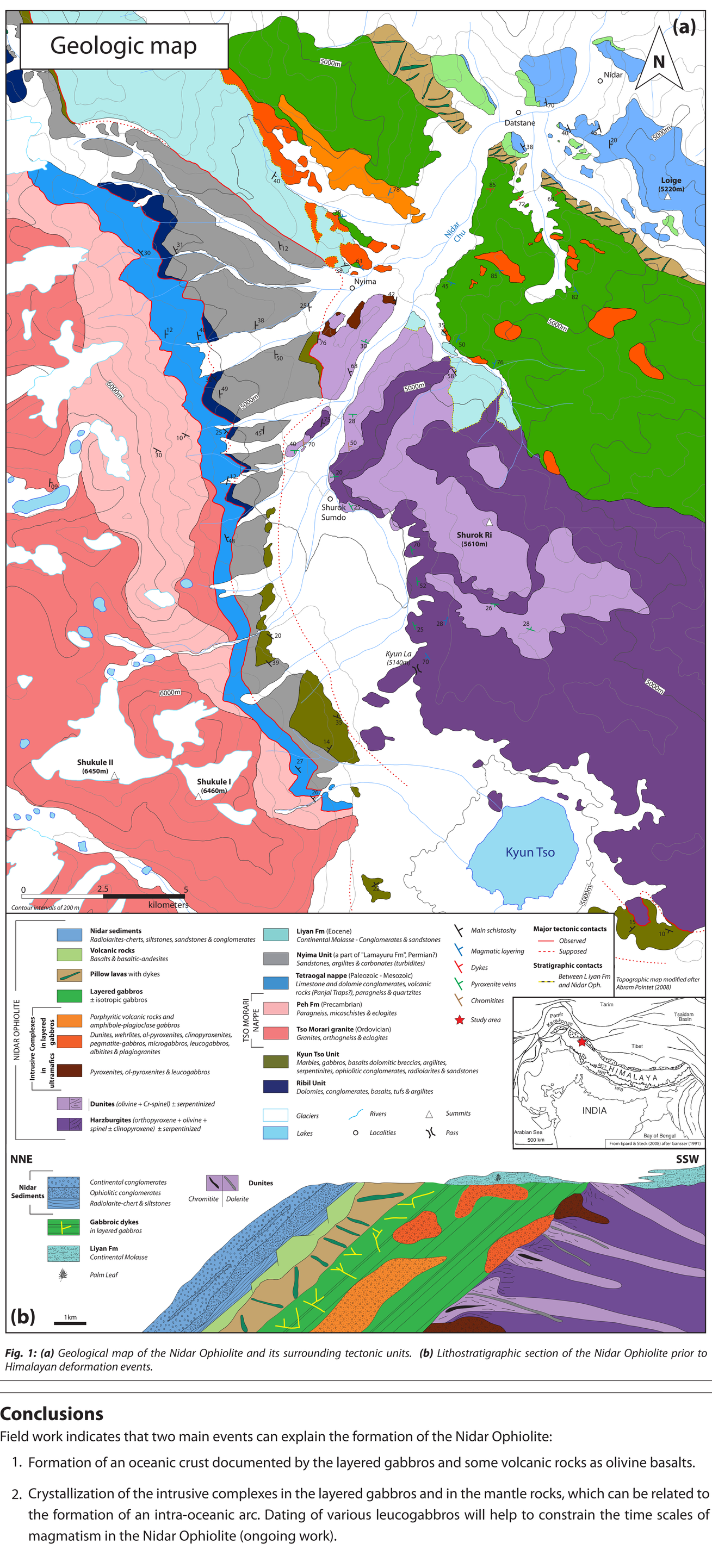

Fig. 1: ***(a)*** *Geological map of the Nidar Ophiolite and its surrounding tectonic units.* ***(b)*** *Lithostratigraphic section of the Nidar Ophiolite prior to Himalayan deformation events.*

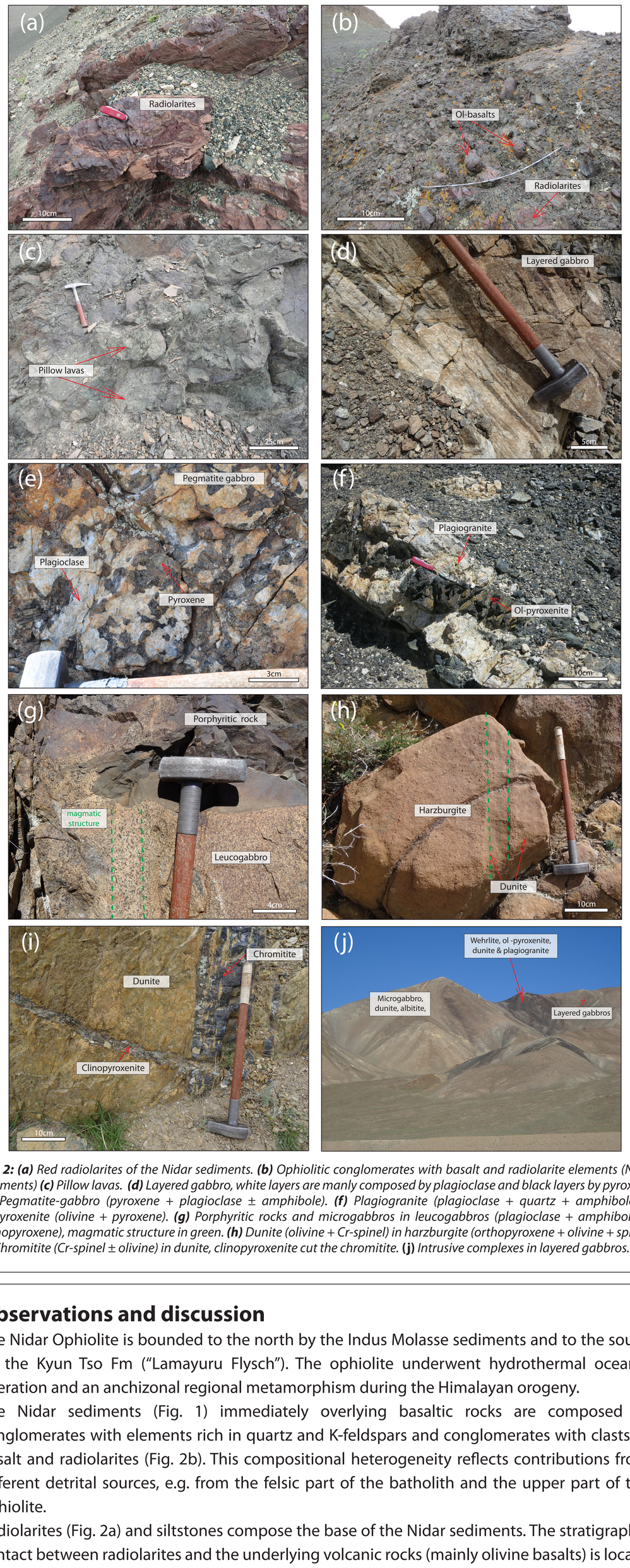

Fig. 2: ***(a)*** *Red radiolarites of the Nidar sediments.* ***(b)*** *Ophiolitic conglomerates with basalt and radiolarite elements (Nidar sediments)* ***(c)*** *Pillow lavas.* ***(d)*** *Layered gabbro, white layers are manly composed by plagioclase and black layers by pyroxene.* ***(e)*** *Pegmatite-gabbro (pyroxene + plagioclase ± amphibole).* ***(f)*** *Plagiogranite (plagioclase + quartz + amphibole) in ol-pyroxenite (olivine + pyroxene).* ***(g)*** *Porphyritic rocks and microgabbros in leucogabbros (plagioclase + amphibole ± orthopyroxene), magmatic structure in green.* ***(h)*** *Dunite (olivine + Cr-spinel) in harzburgite (orthopyroxene + olivine + spinel).* **(i)** *Chromitite (Cr-spinel ± olivine) in dunite, clinopyroxenite cut the chromitite.* **(j)** *Intrusive complexes in layered gabbros.*

Observations and discussion

The Nidar Ophiolite is bounded to the north by the Indus Molasse sediments and to the south by the Kyun Tso Fm ("Lamayuru Flysch"). The ophiolite underwent hydrothermal oceanic alteration and an anchizonal regional metamorphism during the Himalayan orogeny.

The Nidar sediments (Fig. 1) immediately overlying basaltic rocks are composed of conglomerates with elements rich in quartz and K-feldspars and conglomerates with clasts of basalt and radiolarites (Fig. 2b). This compositional heterogeneity reflects contributions from different detrital sources, e.g. from the felsic part of the batholith and the upper part of the ophiolite.

Radiolarites (Fig. 2a) and siltstones compose the base of the Nidar sediments. The stratigraphic contact between radiolarites and the underlying volcanic rocks (mainly olivine basalts) is locally characterized by onlap structures. .

Pillow lavas (Fig. 2c) are the most abundant volcanic rocks and they are mainly located on top of the layered gabbros (Fig. 2d). These gabbros are the main plutonic rocks of the Nidar Ophiolite.

The underlying mantle rocks are dunites with irregular contacts to surrounding harzburgites (Fig. 2h) These mantle rocks are locally serpentinized. Minor rock types are clinopyroxenites, gabbroic dykes and rare chromitites (Fig. 2i).

Layered gabbro and the upper part of the mantle are often intruded by several kilometre-sized intrusive complexes (Fig. 2j). Theses complexes can be subdivided in (see legend Fig.1a): a) porphyritic rocks and amphibole-gabbros (Fig. 2g); b) dunites, wehrlites, olivine pyroxenites, clinopyroxenites, pegmatite-gabbros (Fig. 2e), leucogabbros, albitites and plagiogranites (Fig. 2f); c) pyroxenites, ol-pyroxenites and leucogabbros which are associated only to the mantle rocks (Fig. 1a-b).

The Indus Molasse sediments (Liyan Fm, Eocene) unconformably cover the gabbros and ultramafic rocks of the Nidar Ophiolite.

Conclusions

Field work indicates that two main events can explain the formation of the Nidar Ophiolite:

1. Formation of an oceanic crust documented by the layered gabbros and some volcanic rocks as olivine basalts.
2. Crystallization of the intrusive complexes in the layered gabbros and in the mantle rocks, which can be related to the formation of an intra-oceanic arc. Dating of various leucogabbros will help to constrain the time scales of magmatism in the Nidar Ophiolite (ongoing work).

References

Ahmad et al. 2008. Tectonophysics 451 (1–4): 206-24.

Epard & Steck 2008. Tectonophysics 451 (1–4): 242-264.

Mahéo et al. 2000. Earth and Planetary Science 330 (4): 289-95.

Mahéo et al. 2004. Chemical Geology 203 (3–4): 273-303.

Pointet 2008. Trekking map, Ladakh & Zanskar, Ed. Olizane

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