

# Lithospheric structure in NW of Africa: Case of the Moroccan Atlas Mountains



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## ARTICLE INFO

### Article history:

Received 14 July 2015

Accepted 1 October 2015

Available online 28 December 2015

### Keywords:

Atlas Mountains

Seismic tomography

Crustal velocity

Lithospheric structure

Remains subduction

Delamination

## ABSTRACT

This study presents the outcomes of the local earthquake tomography applied in the Moroccan Atlas domains. A seismic data collected by 36 seismic and a linearized inversion technics are used for determination of local velocity structure.

The interpretation of tomography images results emphasizes a new and detailed lithosphere structure: a remaining subducted zone beneath the Souss Basin located from 20- to 45-km depth dipping to the North is detected and interpreted as a body that marks the border between the Moroccan Anti-Atlas and the Meseta-Atlas domains.

A subduction zones is detected in the SW of the High Atlas, beneath the Hercynian Tichka massif from 10 to 50-km inclined away from Anti Atlas and in the eastern part of Anti Atlas, dipping northward from Jbel Ougnat at 15–40 km.

The junction of the western and middle High Atlas is depicted by two high velocity blocks subducting from 10 to 50 km depth. The first is dipping SW beneath the High Atlas and the second is dipping SE beneath the Ouarzazate Basin.

In the northern part of the southwestern High Atlas, a high velocity body dipping towards the north beneath the Essaouira Basin from 15 to 45 km depth.

In northeastern part of the High Atlas in the Mougeur zone, a high velocity body is detected from 10 to 45 km depth, dipping to the S–E beneath the eastern High Atlas.

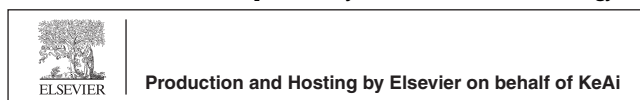
The negative lithospheric anomalies found in the upper and in the lower crust are interpreted as a hot asthenospheric material upwelling from deep and gradually replacing the part of crust detached in the High Atlas. The occurrence magmatic activities in these regions testify the existence of a remaining subduction process. This paper argues the implication of these deep structures in the evolution of the Moroccan Atlas Mountain.

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Peer review under responsibility of Institute of Seismology, China Earthquake Administration.

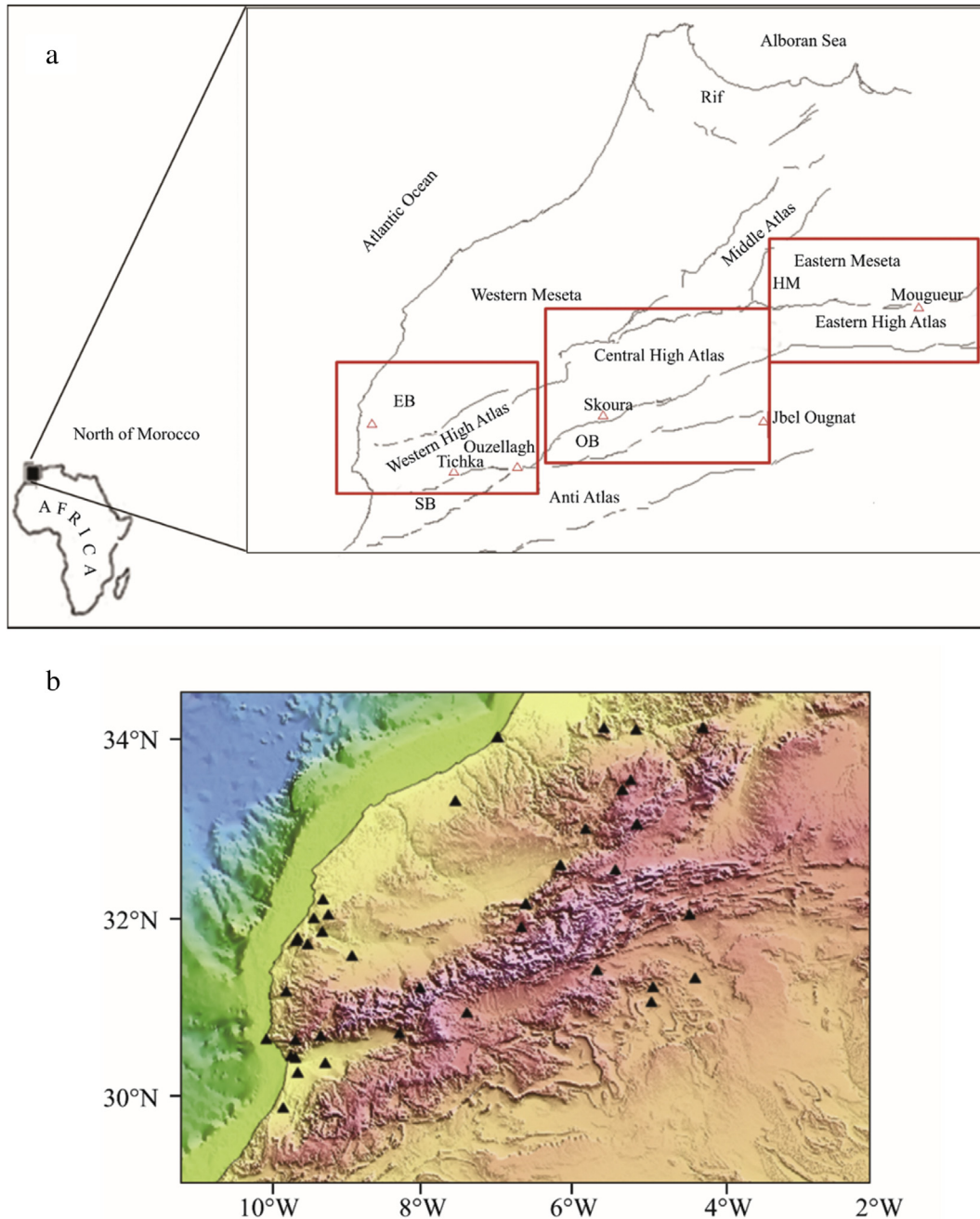


## 1. Introduction

The Atlas Mountains, Rif and the Anti-Atlas constitute the main structural domains in Morocco. The Moroccan western Meseta and the eastern Meseta limit respectively the Middle Atlas Mountains to the west and the east. The Atlas Mountains are intracontinental mountain belts which globally extend over 2000 km from Morocco to Tunisia. The Atlas

Mountains (Fig. 1a,b) resulted from the convergence between Africa and Eurasia from Cenozoic to present times [1–8]. The elevation in the Atlas domain is modest in the eastern parts and gradually gets higher in the western parts (High and Middle Atlas). The High Atlas is formed by Paleozoic and Mesozoic rocks, essentially Jurassic. A surface uplift is determined in the Atlas domain [9].

Geophysical investigations conducted across this region by long seismic refraction profiles came up with the fact that the



**Fig. 1 – a – The location and the main structural domains in north of Morocco: the Atlas Mountains, Rif and the Anti-Atlas. The western Meseta and the eastern Meseta limit respectively the Middle Atlas Mountains. The Souss Basin (SB) and Ouarzazate Basin (OB) are located in south of High Atlas. The Essaouira Basin (EB) and High Moulouya (HM) basins are located in north of High Atlas. The red triangles present the volcanic intrusions. The boxes are limited the study zone: western, central and eastern High Atlas. b – Locations of permanent stations in the Moroccan Atlas domain.**

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