3. Relief and Geomorphology

The Arabian Peninsula is a vast plateau, gently sloping northeastward from the Red Sea to the eastern lowlands bordering the Persian Gulf. It is bounded on the west, south and east by mountainous terrain. According to the digital elevation model (DEM) GTOPO30 (Gesch and Larson, 1996), the altitude varies between –37 m in the lowest point, in the Matfi salt flat south of Qatar, and 3660 m at the Peninsula's highest peak, Jebel An Nabi Shu'ayb. The elevation map, derived from this DEM, is shown in Figure 3.

Elevation does not really show a landscape. In addition to its elevation, a landscape is defined by its degree of dissection, or the range between high and low points. Plains are defined by a very small elevation difference between neighboring points, rolling topography by a higher difference, and mountains by a very large difference. The map of Figure 4, derived from the GTOPO30 DEM, captures the 'ruggedness' of the landscapes of the Arabian Peninsula. It should be noted that this map evidences errors in the DEM used. The checkerboard pattern in the central Rub-al-Khali desert in Saudi Arabia is due to inadequate coverage by detailed topographical maps with elevation benchmarks and does not constitute a natural pattern.

The blue lines on Figure 4 delineate 15 major geomorphological regions (modified after Guba and Glennie, 1998, and Barth, 1976). The superimposed areas in red are salt flats. The geomorphological regions are briefly described in Table 2.

Among the most common and important landscape elements of the Arabian Peninsula are its drainage channels. These seasonal watercourses, or wadis, drain wide catchment areas and high mountains through networks of well-developed tributaries, ravines and runnels. An example of the drainage network

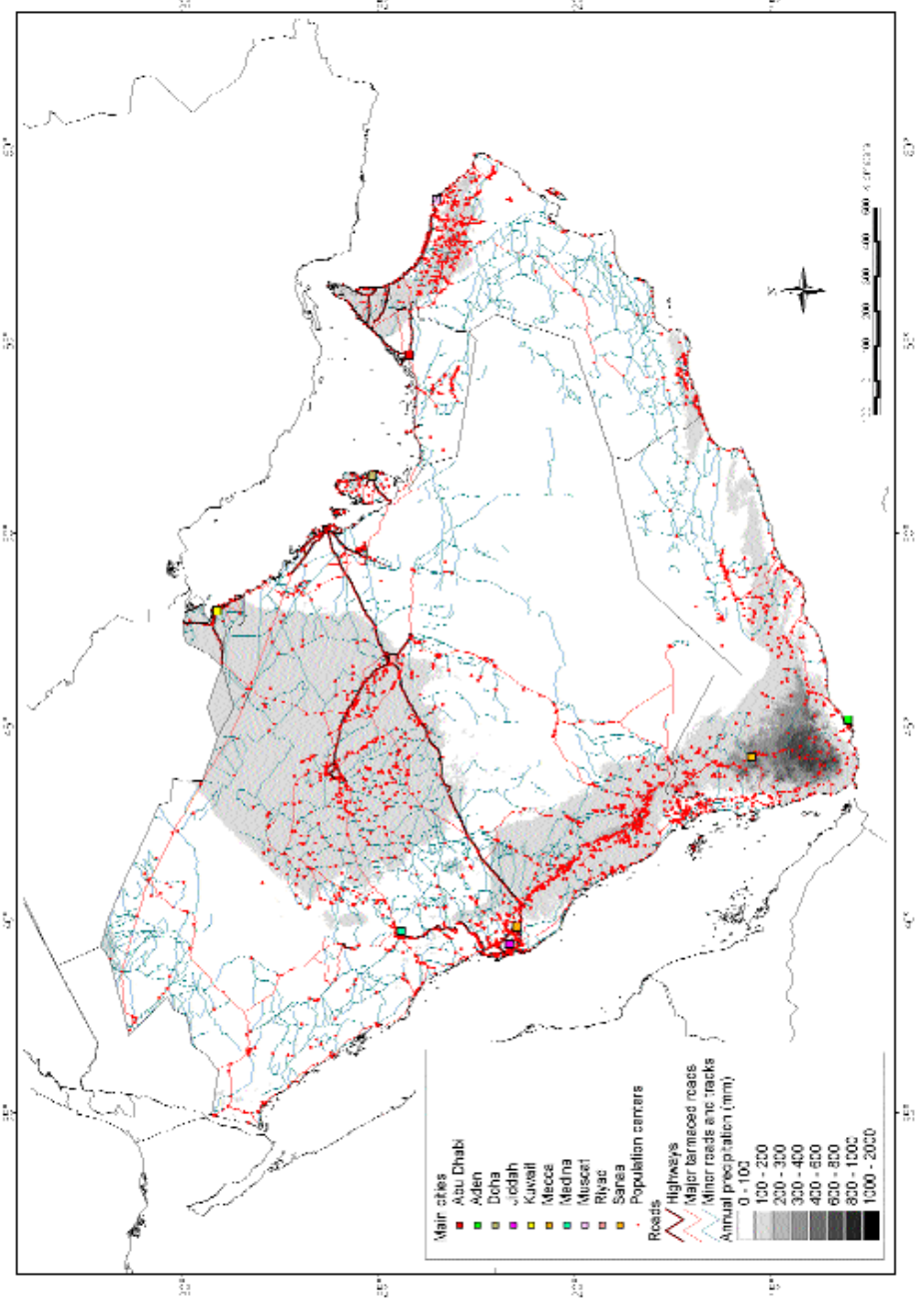

Fig. 2: Population density

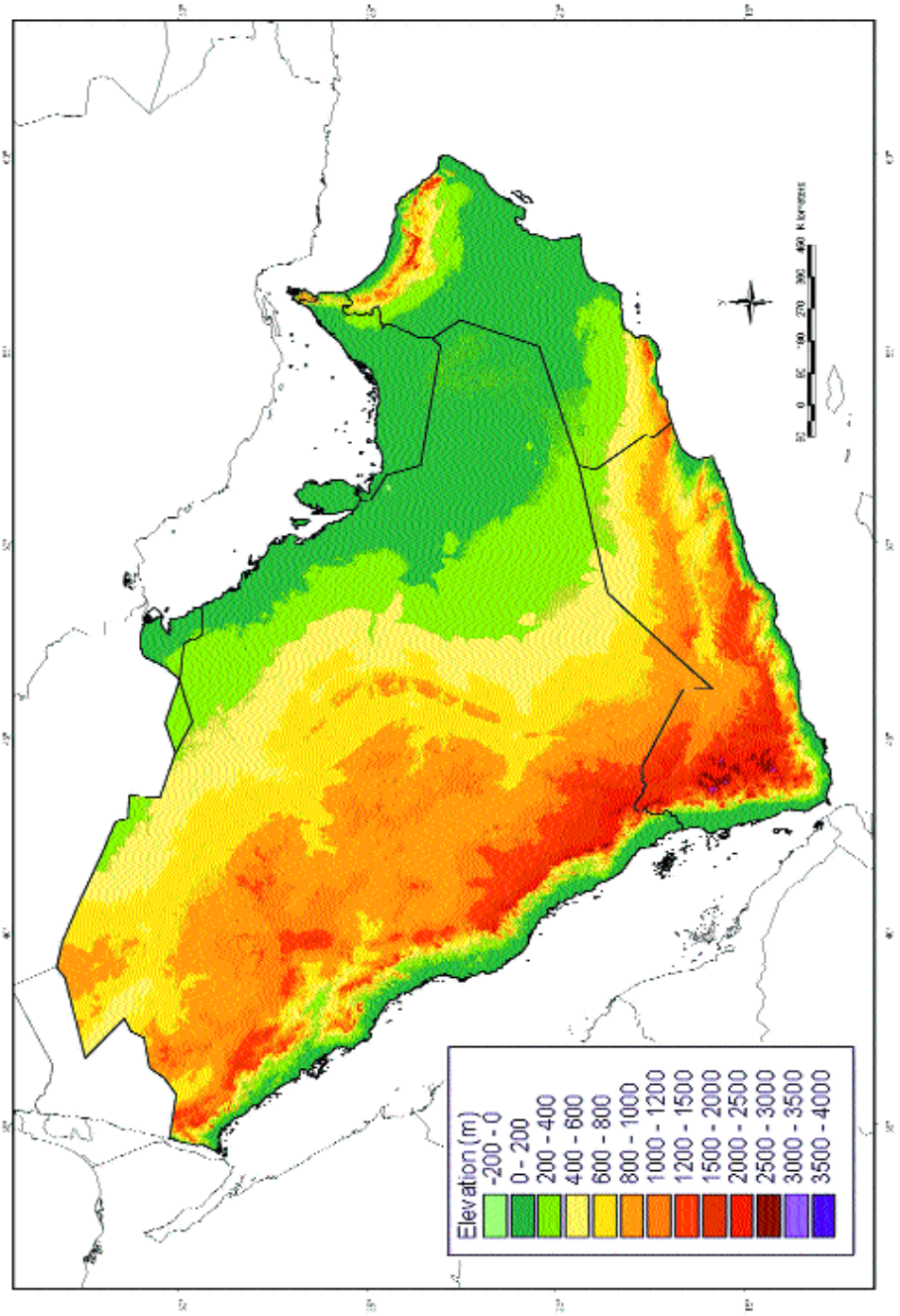

Fig. 3: Altitude

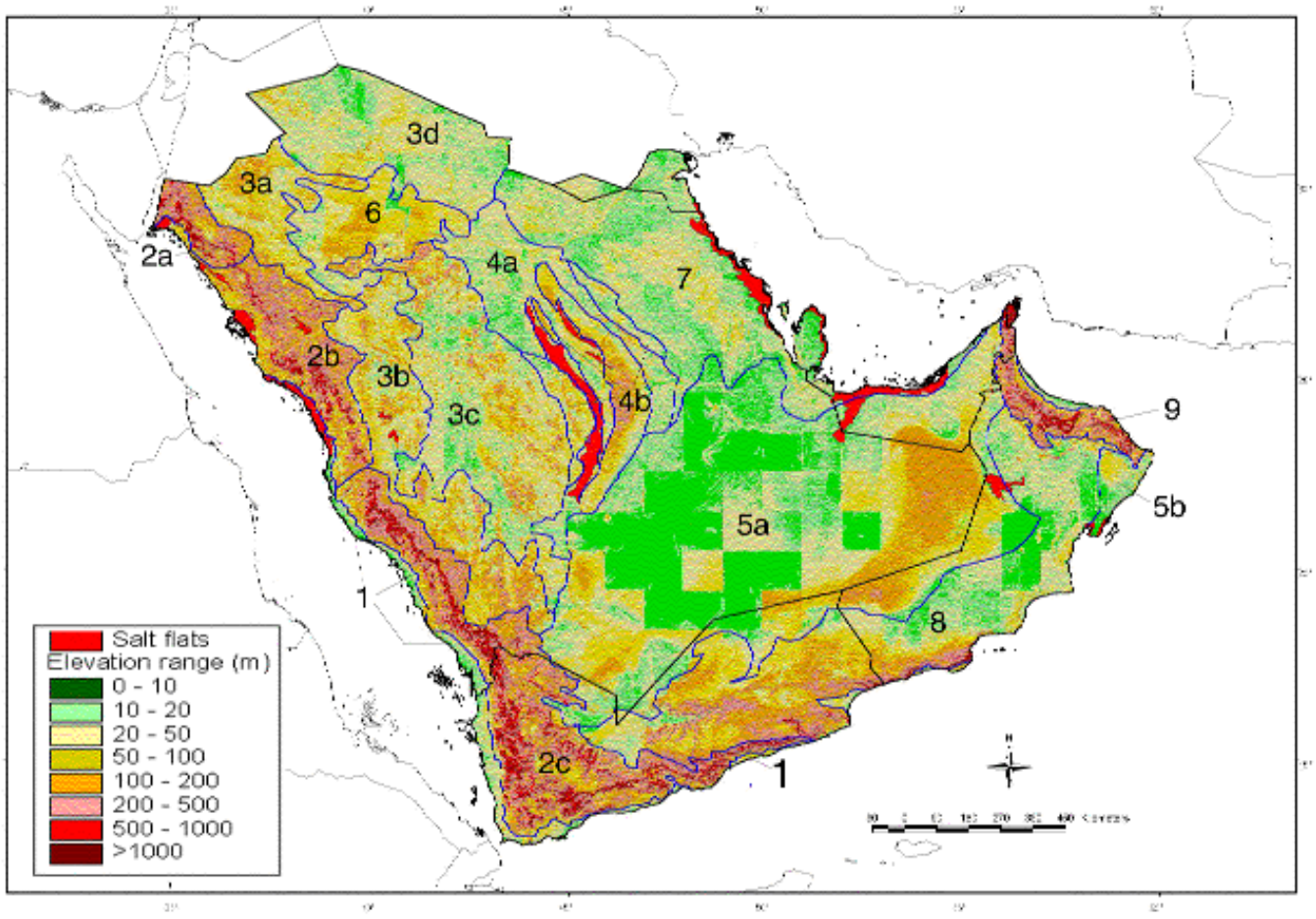

Fig. 4: Elevation range and geomorphological regions

Table 2. Geomorphological regions of the Arabian Peninsula (adapted from Guba and Glennie, 998)

symbol	Name	Altitude range (m)	Description
1	Coastal plain	0-200	Includes two sub-regions, the Tihama bordering the Red Sea, and the Batinah bordering the Gulf of Oman. Both plains are mostly pediments, gently sloping upward from sea level to the foothills of the mountains.
2	Western Escarpment Mountains		
2a	Midian Mountains	300-2000	Scarp mountains, very strongly dissected, with high peaks rising up to 3000 m.
2b	Hijaz Mountains	300-2000	Scarp mountains, rising less high, with interspersed high plateau areas. Very complex lithology, including granitic, metamorphic, volcanic, and sedimentary rocks
2c	Asir Mountains and Yemen Highlands	300-2500	Scarp mountains, very strongly dissected in the Asir, with high peaks rising up to 3000 m. Towards the Yemen highlands the high plateau areas become more widespread. Granitic and metamorphic rocks dominate the Asir, sedimentary rocks are predominant in the northern Yemen Highlands, and extrusive volcanic rocks in central and southern Yemen.
3	Arabian Shield		
3a	Sandstone plateau	700-1000	High plateau of fairly uniform elevation covered with sandy soils.
3b	Harrats (western Najd)	1000-1500	Area transitional towards the Najd plains at high elevation. Structural slope from SW to NE. Complex terrain with salt flats, pediments, and hills.
3c	Central plateau	800-1200	Mostly plains and plateaux with inselbergs and hill areas, built on the structural slope of the Arabian shield. Covered mostly by granitic and metamorphic basement complex rocks. Includes large areas with basaltic rocks.
3d	Summan plateau	250-500	Low-lying plateau with fairly uniform topography composed of flat-lying limestone with typical karst topography of sinkholes and caves.
4	Central Arabian Cuesta		
4a	Dahna sands and adjacent areas	500-800	Narrow belt of dunes and shifting sands extending over 1,300 km and connecting the Rub Al-Khali with the Great Nafud.
4b	Tuwayq mountain systems	500-1000	Cuesta region with 800-km-long escarpments composed of sedimentary rocks curving around the crystalline shield of the Central Plateau. Elevation may locally rise to 1500 m.
5	Southern Arabian Deserts		
5a	Rub al-Khali and adjacent areas	100-1000	The ‘Empty Quarter’ is the largest uninterrupted sand desert in the world. Contains both transverse and longitudinal dunes. Individual dunes reach heights exceeding 200 m.
5b	Wahiba Sands	0-300	Small sand sea formed by winds of the southwest monsoon, with longitudinal dunes mainly.
6	Great Nafud	700-1000	Second largest sand desert of the Arabian Peninsula
7	Eastern Gulf Region	0-500	Coastal plain rising gently to inland plateau areas. Covered mainly by unconsolidated beach sands, gravels, salt flats, and aeolian sands.

Table 2. Continued

symbol	Name	Altitude range (m)	Description
8	Southern limestone plateaux	300-1200	Includes the Hadramaut plateau and the raised plateau of Dhofar, which can locally reach an altitude of 2000 m, and dips to the north. The Dhofar plateau is bounded southward by an escarpment.
9	Hajar Mountains	500-2500	Steeply dissected narrow mountain range with heights up to 3000 m, formed by sedimentary rocks.

density, covering the northwestern part of the Peninsula, is shown in Figure 5. It is worth noting the absence of drainage channels in the eastern part, which is occupied by sand dunes.

The wadis are common to all geomorphological units, with the exception of sand dune areas, and support plant communities that are dependent on the water regime. Along wadis the vegetation cover is usually denser, except under conditions of overgrazing, fuelwood extraction, or aquifer over pumping. However, the vegetation pattern is highly site-specific, determined by the frequency of flooding, the stream velocity, type of sediments and coarse materials deposited, and variability of rainfall in the catchment areas ((Kürschner, 1998).

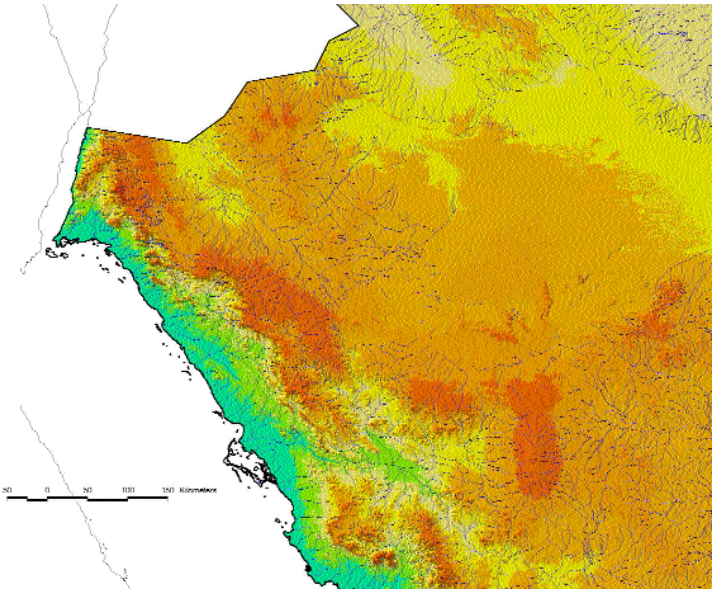

Fig. 5: Wadi network in the northwest of the Arabian Peninsula(Note: Wadis shown as blue lines. Elevation range is the same as in Fig.3)