ZAGROS CRUSH ZONE AND RED SEA RIFT, A COMPARISON BETWEEN THE MODEL OF FORMATION OF THESE TWO FEATURES.

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Introduction

Many geologists are now suggesting that the break-up of continents that generates new oceans is initiated at mantle generated uplifts, upon which three armed rifted systems commonly form. It is supposed that two of the three arms spread and become filled with oceanic crust, but the third arm never opens so far and is preserved as a sediment-filled fault trough.

The Red Sea provides the most typical processes of continental rifting, and the early stage of emplacement of oceanic crust by sea floor spreading are all active in this part of the world.

Zagros crust zone is an imbricated zone of faults and folds which has also been studied in detail by several geologists, as for example; Falcon (1969), Stocklin (1974), Bird (1978), (1981), etc. The northwest-southeast trend of this feature which is supposed to be located on the place of an earlier rift (Berberian and king, 1980), is more or less parallel to the present Red sea. These mountains mark the former position of a subduction zone according to plate tectonic interpretations which follow the close up of the supposed earlier rift.

Geology of the Red Sea

The Red Sea,a large linear trending structure (Fig.1), occupies an elongate northwest-southeast depression over 2000 Km. long. The width of this depression in the northern part is about 180 Km., while in the southern part the shorelines are about 360 Km., apart. The southern end of the Red Sea narrows to about 28 Km. to the strait of Babel-Mandab, which connects the Red Sea to the Gulf of Aden. Several cross sections reveal steep-sided walls in the axial trough and a very irregular bottom topography for the Red Sea depression.

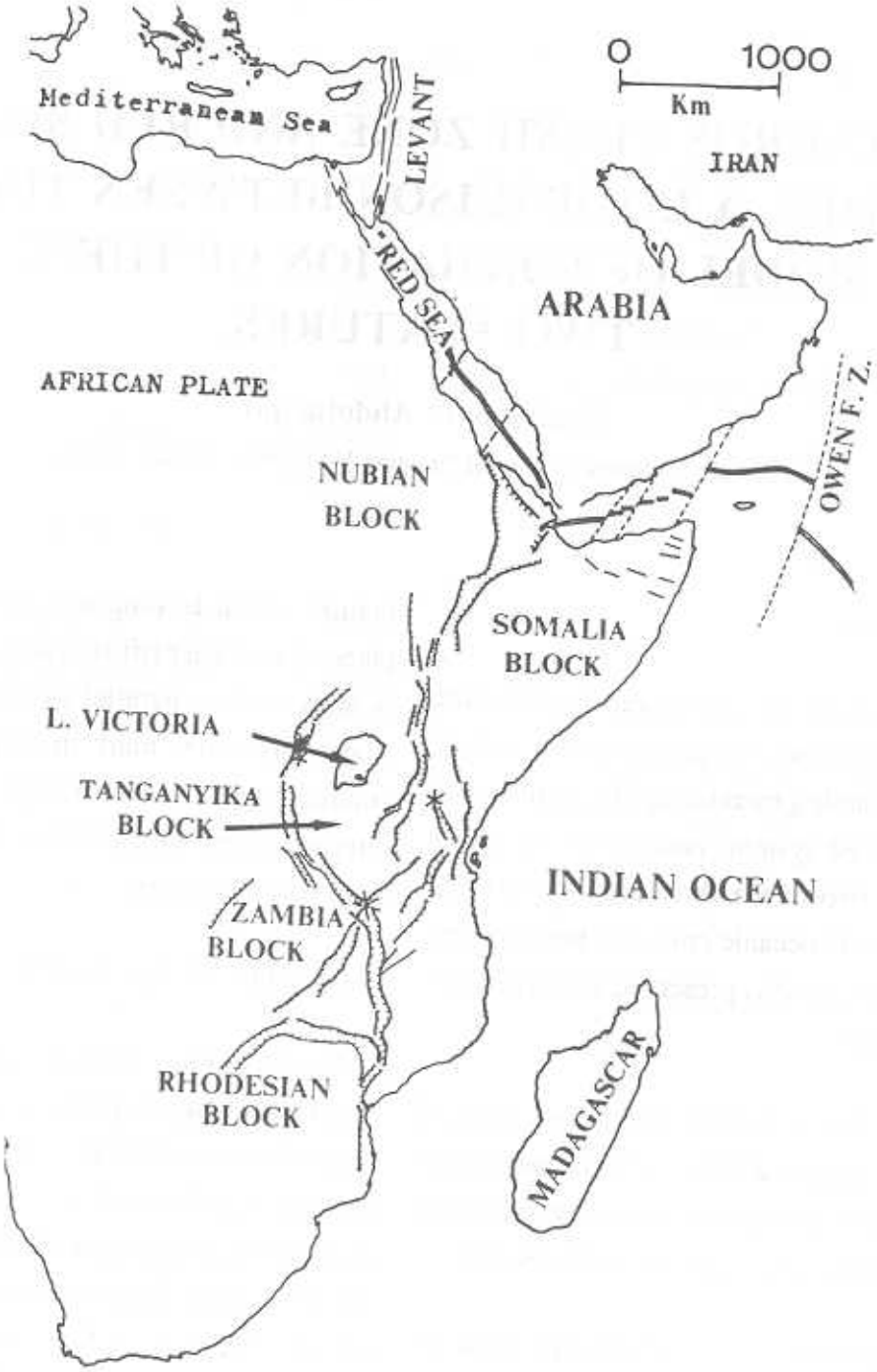

Fig 1. Three armed rifted system and geographical location of the Red Sea.

Paleogeographic reconstructions (Swartz and Arden, 1960; Said, 1962; Brown, 1972; and Coleman, 1974) indicate Jurassic seafloor spreading across the Red Sea, but the marine sediments record no strong evidence that the Red Sea depression existed during the Mesozoic time (Coleman, 1974). However; the interlayering of basaltic rocks with Cretaceous sedimentary rocks reveal the beginning of these rock sequences during the Cretaceous time (Geukens, 1966).

Deep sea core hole sampling along the western margins of the Red Sea have also penetrated Oligocene age shale and interlayered Oligocene age basalt (Whiteman, 1968). These rocks are overlain by an evaporite sequence, 4-5 Km. thick with the upper part being Upper Miocene in age (Fig.2). The evaporites then are unconformably overlain by 250-300 m. of Pliocene to Quaternary and argillaceous sediments (Zonenshayn et. al., 1981). The deep sea drilling project, has also demonstrared that the Red Sea depression received marginal clastic sediments, interfingering with evaporites, during the Miocene time (Coleman, 1974).

At the beginning of the Pliocene marine oozes and marginal clastics began to be deposited on the Miocene evaporite sequence. The marine sediments are supposed to have come from the Indian Ocean rather than the Mediteranean Sea, which was apparently separated from the Red Sea during the Early Pliocene by uplift of the Isthmus of Suez (swartz and Arden, 1960). In the axial trough of the Red Sea, a thin layer of sediments overlies basaltic rocks. The basalt is supposed to have been intruded into the axial trough of the Red Sea (Gass et. al., 1973). However; detailed geophysical investigations (Drake and Girdier, 1946, and Allan. 1970) along with the examination of the bottom cores have established that the Red Sea is underalain by oceanic crust with the axial trough which according to Roeser (1975), is developed in the last 5 m.y., while the bordering terraces were developed during an early phase of spreading, about 42-35 m.y. ago (Fig.2)

The average rate of spreading in the last million years according to Zonenchayn et.al. (1981), judging from the magnetic anomalies has been estimated to be about 1.6 cm / yr. Apparently the rate of spreading was not constant and had great variations from 2 cm/yr in the 1.71-0.89 m.y. rising to 3 cm / yr in the 0.89-0.69 m.y. dropping to 1.04 cm / yr in the last 0.69 m.y..

Zagros Thrust Zone

The Zagros thrust Zone (Stocklin, 1968 and 1974; Falcon, 1976 and 1974; Nowroozi, 1971; Le pichon et al, 1975; and Scott, 1981) located in the western part of Iran, trends northwest-south-east for about 1300 Km. from border with Iraq to the Hormoz region in the south central Iran, (Fig.3). This feature is an approximately arcuate belt and it is supposed to be the result of a collision between that Arabian Shield and Central Iran. This structural feature is presumably located in the place of an earlier rift.

According to Berberian and King (1981), from

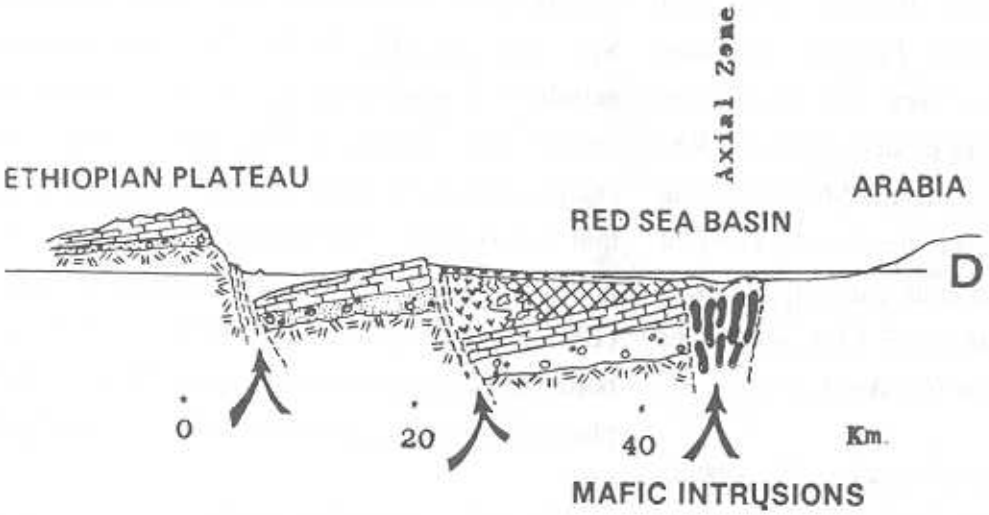

Fig 2. A diagramatic cross-section of the Red Sea rift.

the Crabonifereous time towards the end of the middle Triassic, due to the effect of the orogenic movements, Iran was apparently moved as one or a few continental fragments across the Hercynian Ocean, leaving new oceanic crust behind to form, the high Zagros Alpine Ocean in the south .

There is a stratigraphic evidence that during the permian time, Iran and some of its surrounding countries were becoming detached from Arabia. The dating of the main crustal separation in the Triassic time is also postulated by other authors, (Ricou, 1968; Stocklin, 1974).

The rift apparently continued to open until the middle Triassic Orogenic movements.

Following that, the Middle Triassic compressional phase started and apparently the whole region was effected by the forces of this phase. This compressional episode continued toward the Late Jurassic-Early Cretaceous time, in v Berberian and King (1981) supposed the Zagros Alpine Ocean was closing. The clos the high Zagros Alpine Ocean continued un Early Neogene which apparently in this tin continent-continent collision took place.

Discussion

The geophysical map of the south T Suture Zone location indicates a subparall between the Zagros Crush Zone and the Re This subparallelism also exists in the tectoni of the region. Geophsical interpretations alo Red Sea rift (Zonenshayn et al, 1981 and Kh 1985) and Zagros CrushZone based on lo regional measurements, (Wells, 1959; Niazi 1987; and also Aeromagnetic Map of compiled in the Geological Survey of Iran, 1

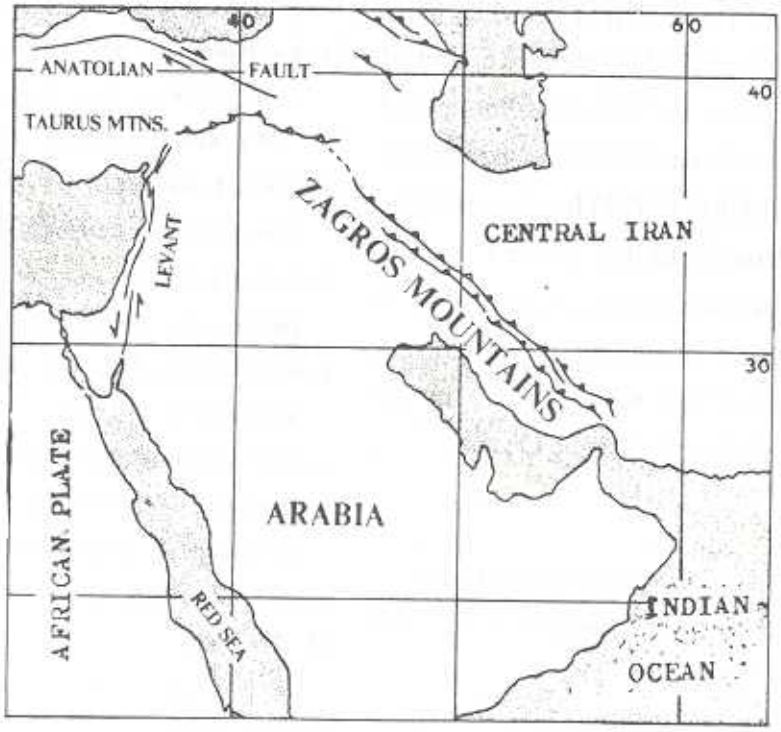

Fig 3. Location of Zagros mountion ranges in the western part of Iran and the major tectonic elements of the region.

indicate that these two features have more or less similar trends in their anomalies. The subparallelism between the Red Sea and the Zagros Crush Zone could be interpreted as subparallelism between the Red Sea rift and the supposed rift located in the place of the present Zagros Thrust fault. This phenomenon may be merely a coincidence which has just happened to occur in the way that shows a nearly parallel feature, but it may also be interpreted as a similarity in the origin between these two features. In other words it may indicate that the causative mechanism that has produced the opening of the Red Sea during 42 to 35 m.y. ago was similar to that responsible for opening the Zagros rift which is supposed to start opening sometimes in the Early Carbonifereous time. The possiblity of the movement in the cause of rifting which may be described as the eruptive centers, has been suggested by Gass et al (1973). They proposed that these eruptive centers have moved progressively northwards from the southerm end of the Red Sea in the comparatively recent geological past, and has apparently caused an anticlockwise rotation of Arabia relative to Africa. This idea was also supported by Tarling (1970). However; if this relatively recent geological movement of the cause of eruption which is actually the cause of rifting, could have moved from the southern part of the Red Sea towards the north which is actually from the southeast towards the northwest, the cause of the Zagros rift and the Red Sea rift could also be proposed to be similar in moving westward from the Carbonifereous time to the Miocene time; and if it is even believed that cause of rifting is stable, then the movement of the

crust would be east ward or as it is stated by Gass et al (1973) and Tarling (1970), the movement of the crust was anticlockwise. This statement could get more supports from considerable evidence that according to Mc Elhihhy, (1973) have caused the entire Red Sea trough to be formed by the movement of Arabia away from Africa. This is also similar to the type of movement which was proposed by Berberian and King (1981), for the formation of the High Zagros Alpine Ocean.

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