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Delineating active faults across the Narmada-Son Lineament (NSL), India using the technique of Fracture Induced Electromagnetic Radiation (FEMR)

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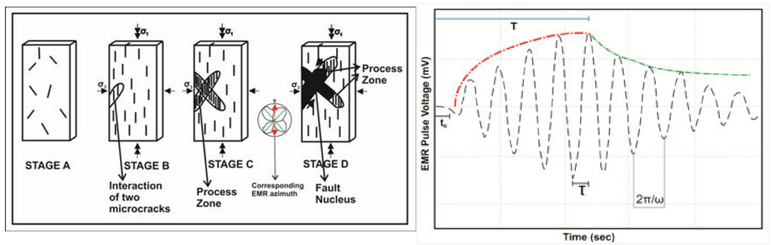
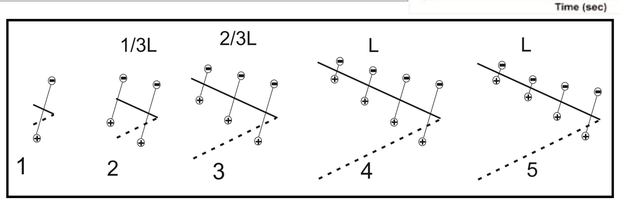
INTRODUCTION

- The Fracture Induced Electromagnetic Radiation (FEMR) technique has gained impetus in the past decade as a useful geophysical tool to determine recent crustal stresses, visualize the modification and realignment of stresses inside tunnels earthquake forecasting as well as delineate landslide-prone slip planes in unstable regions.
- It is based on the generation of electromagnetic radiation emanating from the brittle rock bodies that are fractured being subjected to an incremental increase of the differential stress in the near-surface of the Earth's crust.
- Natural EMR emission of frequencies varying between KHz to MHz range are emitted before the brittle macro-failure.
- A novel technique enabling easy accessibility to data acquisition.

BASICS OF FEMR

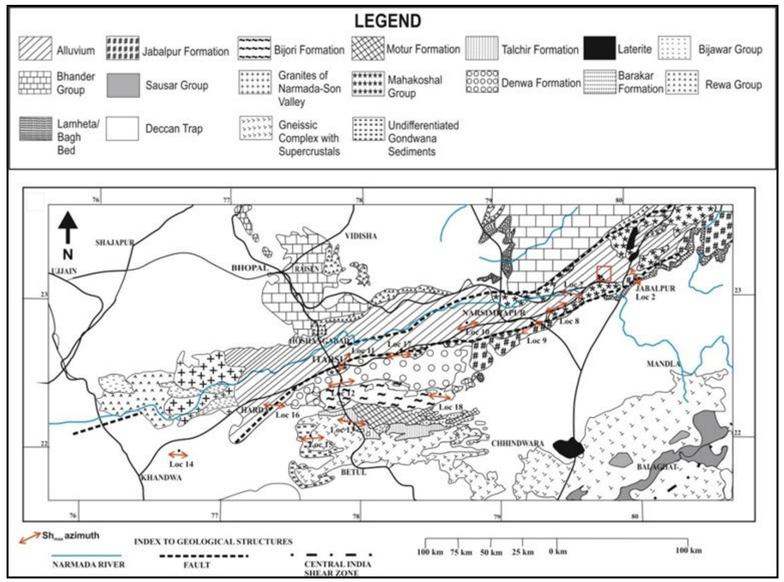


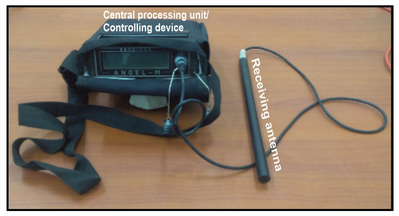


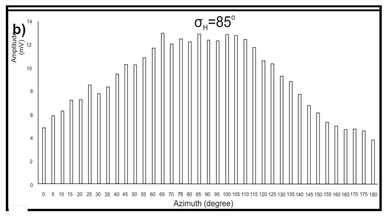
Das et al., 2020a

- The Reches-Lockner model explaining the concept of Process zone, fault nucleation and growth.
- A typical FEMR pulse shape dependent on the crack growth and propagation prior to and post macro-failure.

THE ACTIVE TECTONICS AROUND NARMADA-SON LINEAMENT (NSL)







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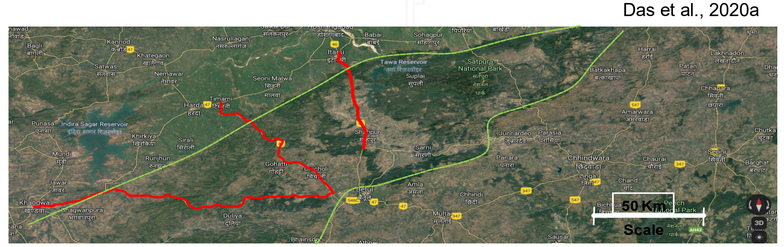
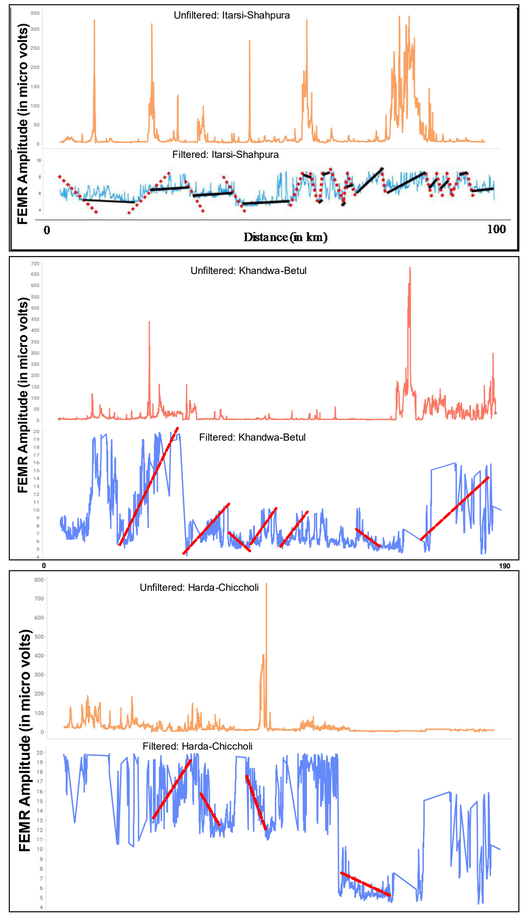


- Horizontal FEMR measurements yielding SHmax azimuth along NSL showing a deviation from the NNE-NNW trending regional stress and realignment along the E-W trending NSL.

LINEAR MEASUREMENTS ACROSS NSL PROFILES



CONCLUSIONS

- FEMR technique is quicker, non-destructive, cheaper and more accessible than conventional methods employed for obtaining data.
- A prolific method to obtain not just the azimuth of SHmax in a region, but also the magnitude of the horizontal stresses of the shallow crust.

References: 1. Das et al., 2018, Current Science, 115(6). 2. Das et al., 2020a, Journal of Geodynamics, 133, 101672. 3. Das et al., 2020b, Natural Hazards, 1-31. 4. Das et al., 2021, Engineering Geology, 279, 105882.