

M.Sc.GEOLOGY SEMESTER II

PAPER: GEOL-M-202

UNIT –V

HEAVY MINERALS ,PROVENANCE AND HEAVY MINERALS AS INDICATORS OF PROVENANCE

Heavy minerals are minerals having specific gravity greater than 2.9. They are chiefly silicates and oxides many of which are resistant to chemical weathering and mechanical erosion. They are significant in the study of arenaceous rocks. They are usually present in less than 1% in concentration. In view of their low concentration in sediments heavy mineral grains are separated from the crushed rock or loose sediment by using heavy liquids such as bromoform. The common heavy minerals are zircon, rutile, tourmaline, apatite, epidote, garnet, staurolite. Ilmenite and magnetite are two common opaque detrital minerals.

The heavy minerals are useful indicators of provenance. Heavy minerals such as garnet, epidote and staurolite are derived from metamorphic terrain whereas rutile, apatite and tourmaline indicate igneous source rocks. Major change in the source area geology such as uplift and unroofing of a granite may be recorded in the heavy mineral assemblage of sandstones deposited in the region. Heavy mineral suite can be used to identify petrographic provinces within a formation, for example sediment was supplied by two or more rivers draining areas of different lithologies.

In some cases the heavy mineral are concentrated in particular laminae or beds. This is common feature of beach and other sediments where persistent winnowing takes place. The monazite beach sand of Kerala coast is well known example. Placer gold are also significant.

Provenance Studies:

The composition of siliciclastic sediments that fill sedimentary basins is determined to a large extent by the lithology of the source rocks that furnished sediment to the basin as well as by the climate and weathering conditions of the source area. Therefore analysis of the particle composition of siliciclastic mineral assemblages and rock fragments provides a method of working backward to understand the nature of the source area. Provenance studies include the following:

1. Lithology of the source rocks.
2. The tectonic setting of the source area.
3. The climate, relief and slope of the source area.

Provenance studies provide important information about the palaeoclimatology and palaeogeography of the basin setting.

The lithology of the source rocks is interpreted on the basis of the kinds of minerals and rock fragments present in siliciclastic sedimentary rocks particularly in sandstones and conglomerates. The presence of abundant alkali feldspar, heavy minerals like zircon, apatite suggests derivation from

granitic source rocks, the abundant volcanic fragment suggest derivation from volcanic source rocks, the presence of staurolite, garnet is indicative of metamorphic terrain.

Climate slope and relief are more difficult to interpret from siliciclastic mineral assemblages but some clues are provided by quartz /feldspar ratios and by the degree of weathering of feldspar.