GENESIS

On the basis of the Sedimentological characters, Geochemistry and the Light and Heavy mineral analysis, an attempt was made to interpret the origin of the Silica sand in the study area. Anbarasu (1994) reported that source of the silica sand in and around Marakkanam area was Cuddalore sandstone formation. It was supported by Rajamanickam (1998), through the heavy mineral studies of the Cuddalore Sandstone formation.

Jacob (1956) indicated that the Chirala sands were removed from the place of their original deposition and redeposited. He considered the Cuddapah quartzites to be a possible provenance.

The geomorphology of the study area suggest that there is an abandoned river channel of Gingeeear and might be the possible agent for taking away the sediments and depositing in the present location.

The bimodal and polymodal frequency curves reflect an enrichment of white sands in alternate grain sizes from coarse to fine sands. The polymodality of frequency curves of silica sands indicate the multi source of deposition. The sediments might have been transported by river and deposited under lagoonal environment (Rajesh et. al, 2007).
The mean size of the silica sand indicate the medium to coarse sands, indicating a slightly higher energy condition prevailing in those areas to carry away the finer particles whereas in some of the locations namely, Urani, Agaram, and Pallampakkam which have the accumulations of fines, indicating low energy conditions. The presence of pebble sized grains of quartz found in some locations near Mudaliyarkuppam and near Urani indicates the sudden decrease of the velocity of the transporting agent, that can be inferred as the lagoonal environment of deposition for the sands of these areas. The concentration of coarse and middle sand in the middle portion of the study area can be inferred that the winnowing action of the wind must have contributed to a certain extent for the concentration of coarser fraction of sand by removing the finer selectively.

The standard deviation value for silica sands indicates well to very well sorted nature where there is a continuous, slow deposition of sediments. In some locations in the study area the poorly sorted nature of silica sand indicate the presence of minor amount of pebbles in this site which may be due to the deposition of the sands of varied sources with varying velocity of the transporting agent. Occurrence of poorly sorted sediments and admixture of pebbles are reported in the barriers occurring in front of the coastal lagoons.

The silica sand samples show the skewness values falling within very course to fine skewed. Most of the samples exhibit near-symmetrical character. This can be attributed to the addition of sediments from medium
energy conditions. The sands though coarse in the beginning must have slowly lost their dominance due to strong addition of medium sized sand in dried lagoonal portion. The prominent fine to coarse skewed nature suggests the probability of multi-source and multi-agent role.

The kurtosis values of the study area exhibit very platy to extremely leptokurtic, showing that low – medium energy conditions must have prevailed in this region. The plot of standard deviation Vs mean clearly indicates the dominance of inland and beach environment for most of the samples, whereas offshore influence for few samples near Mudaliyarkuppam, it is expected because of the link it is maintaining with the sea even today.

The plot of third moment Vs first moment shows that the samples of the study area retain their signature of beach environment. Similarly, the plot of first moment Vs second moment shows the distribution of silica sand samples in foreshore environment. Also the plot using standard deviation vs skewness lends support to the beach processes. The log probability curves prepared and the samples of the study area is characterized by traction, saltation and suspension population. These values matches with the tidal inlet, similar to the white sands of Prakasam District, Andhra Pradesh Sankara Pitchaiah P (1985).

In order to find out the mode of transportation and the energy level of the sediments during transportation and deposition, CM pattern was prepared by using Median and First percentile. The distribution of samples
of the present study falls in NOP sector indicating the deposition of white sands by rolling. As the textural parameters clearly indicate the influence of marine environment in the present study area, the same phenomenon is registered by way of distribution of samples in rolling sector.

The dominant quartz sands have been studied for their kinds of quartz and other lithic fragments to infer the source rock in the study area. The distribution of quartz sands displays the dominant presence of monocrystalline quartz with and without inclusions, expected to have been derived from primary rock rather than the metamorphic deposits. However, lower amount of polycrystalline quartz and feldspar suggests that recent sediments are not having much influence on this environment.

The heavy mineral assemblages indicate the presence of zircon, rutile, tourmaline, chlorite, topaz, kyanite, epidote, garnet, hypersthene, staurolite, pyroxenes and amphiboles. The way in which more rounded nature of heavy minerals with etching and overgrowth are present, they direct the possibility of derivation of these minerals of multi-cycle nature mostly the contribution from the earlier sediments. The Cuddalore sandstone (Rajamanickam 1998) has registered the predominant presence of opaque, zircon, kyanite and rutile. The sediments have shown high order of roundness and sphericity in some locations, also support the possibility of pre-existing rounded grains contributing to the present sands.

The silica sand samples are sub-rounded, followed by sub angular to rounded grains are observed. The sub-rounded grade of distribution
suggests that the sediments are contributed by present day sediments, which are deposited from nearby lacustrine environment. The sub angularity indicates that some of the sediments are derived from nearby areas and not travelled much distance. It can also be inferred that the mechanical breakage also play a minor role on the sub angularity of the sand grains. Rounded grade of distribution suggests that, some of the locations of the study area are contributed by recycled nature of beach sediments, which must have been subjected to intensive wear and tear by strong waves and they are traversed by rolling.

The SEM study of silica sand grains in the study area exhibits the rounded crescent like pits, straight net like sutures, V shaped pits etc. The quartz grains show concoidal fractures, irregular in shape, sub angular to sub rounded in nature. Few crack like features are also noticed. This may be due to mechanical activities of waves and currents. The rounded grains noticed may be due to long distance transportation. The edges are smooth in most of the grains. It indicates that the grains are transported for a long distances and the transportation might have been mostly by rolling. The angular and sub angular grains also seen indicates that the deposit is also derived from varying source and transported in short distance. The concoidal fractures and etched marks observed in the quartz grains indicate a high energy environment as well as the longer stay of sediments in the depositional basin.
It is observed from the sedimentological, geochemical and the light and heavy mineral assemblages that the silica sand in this study area is derived from the nearby popularly known siliceous rock, Cuddalore Sandstone. The presence of abandoned river of Gingeear river favours the transportational history of the silica sand of this area. Fewer amount of the sand also derived form the Pondicherry formations which can be inferred from the heavy mineral assemblage and angularity. River and wind played main role in transporting the sand particle with varying velocities and seasons. Lacustrine environment prevailed in the study area as the barrier developed by the silica sand deposit.

The chemistry of the silica sand shows the SiO$_2$ value more than 95%, Al$_2$O$_3$ of 1-1.5% and remaining the others. The trace elements also analyzed, and found that Cr, Zn, Zr and Ba are found to be available more when compared to the other traces. The source rock might be a siliceous rock which contain lower amount of other minerals.

In the Trilinear diagram of Fe$_2$O$_3$-MgO-TiO$_2$ all the points fallen in the field of Granite and Quartz monzonite as source rock. The QFR diagram shows the continental block Orogen Provenance for the silica sand samples of the study area.

Chemical maturity of silica sand deposits shows most of the points fall in the field of humid climatic phase indicating chemically matured nature of these sediments. The geochemical classification of silica sand
deposits in the study area shows the silica sand corresponds to the composition of Quartzarenite.

In the scatter plot of samples Vs Ba most of the samples fall below 100 ppm concentration. Similarly the scatter plot of samples Vs Zr indicates the concentration of Zr in a very low level that is below 30 ppm.

The elements plotted against the concentration shows very lower level of concentration in all the samples in the study area enrichment of LREE compared to HREE in the study area. The scatter plot of La,Ce,Th and Ce shows the lower concentrations of the elements in all the samples of the study area.