CHAPTER VII

Summary and Conclusions

The oils produced from Eocene reservoirs in Upper Assam basin are waxy in nature i.e. they have abundant n-alkanes in the range of n-C_{21} to n-C_{35} present in them. Due to this, they have generally high pour points (27°C to 51°C) and relatively low °API gravities (13.9 to 31.5), barring few oils that are condensates. The Eocene oils are derived from clastic source rocks. The organic matter in the source rocks is derived from terrestrial, land plant material that is deposited in a dysoxic to oxic environment, as evidenced by distribution of pristane and phytane. Presence of oleananes in the oils confirms higher land plant input to the source rocks of these oils. Further, this also implies that the source rocks were deposited during Cretaceous or younger i.e. Tertiary period. This is consistent with the fact that rocks older than Tertiary are not present in this part of the basin. Presence of bicadinanes in the oils also confirms that they are derived from terrestrial source rocks. Low steranes to hopane ratio also implies that the oils have generated from non-marine, terrestrial organic matter. The above findings are also confirmed by other biomarker ratios like C_{30} diahopane / hopane and C_{35} / C_{34} hopane.

Distribution of C_{31} to C_{35} hopane, C_{27}, C_{28} and C_{29} steranes, C_{29} / C_{30} Hopane, C_{23} tricyclics and C_{24} tetracyclics, C_{30} diahopane / C_{29} Ts, C_{35}S / C_{34} S hopane and distribution of oleananes, steranes and bicadinanes show that these oils are broadly similar and genetically related. However, subtle differences among these oils are also brought out by these parameters. These differences can be summed up as below.

- Oils from Samdang A, Baghjan A & C, Dikom-Kathalani E, Tengakhat G have slightly marine character and are, therefore, derived from different source rocks as compared to other oils
- Oil from Santi A is rich in bicadinanes and could have generated from another source rock.
- Moran-Haldibari A & B oils are rich in C_{24} tetracyclics and have also generated from a different source rock.

Presence of oils having different characteristics based on biomarker ratios indicates that multiple source rocks have generated Eocene oils. The following different groups of oils are present in the basin, each group of oils having generated from a distinct source rock.

1. Oils from Dikom-Kathalani, Tengakhat, Bhogpara, Chabua, Matimekhana etc., that form the bulk of the oils produced from Eocene reservoirs, have generated from a single source rock.

2. Oils from Baghjan and Samdang have generated from a second source rock.

3. Moran-Haldibari oils have generated from a third source rock.

4. Santi oil has generated from a fourth source rock.

However, all the oils have generated from Lakadong and Langpar source rocks having different characteristics in different parts of the basin.

The composition and physical properties of oils like API gravity show that most of the oils have generated from source rocks that are in the main oil generation window. Baghjan A and Samdang A oils have generated from high maturity source rocks, whereas, Tengakhat C & F and Dikom-Kathalani D & E oils have generated from low maturity source rocks.

Maturity parameters from the middle fraction of oil i.e. pr / n-C_{17} and ph / n-C_{18} confirm that Samdang A oil has high maturity. But it also shows that Mechaki A oil has high maturity and Tengakhat G oil has low maturity.

One of the biomarker maturity parameters from heavier fraction of oil i.e. C_{32} S/(S+R) Hopane, shows that the oils have generated from source rocks that have entered the oil window. Similarly, maturity parameters, Ts/Tm and 29Ts/Tm also show that these oils have generated from source rocks in early to mid-mature range. Also, maturity parameters diahopane / normoretane and hopane /
moretane show that oils from Moran-Haldibari A & B, Mechaki A, Santi A and Borhapjan–Makum C are a mixture of early charge, which is less mature and late charge, which is more mature.

However, sterane maturity parameters, that are also from the heavier fraction of oil, show a much wider variation in the maturity of oils. Baghjan A and Borhapjan-Makum B oils are showing very low maturity whereas Tengakhat B & E, Mechaki B, Matimekhana A and Dikom-Kathalani E oils are also showing relatively low maturity. On the other hand, Moran-Haldibari A & B, Santi A, Samdang A and Bhogpara A are showing high maturity.

This apparent anomaly in different biomarker maturity parameters is further brought out when a sterane maturity parameter $C_{29} S/(S+R)$ sterane is plotted against $Ts/(Ts+Tm)$ and saturates / (saturates + aromatics) ratio. These plots show that Baghjan A and Borhapjan-Makum B oils have anomalously low maturity based on sterane maturity parameters. This anomaly can be explained by invoking the process of migration-contamination where mature migrating oil picks up immature oil rich in biomarkers from organically rich shales in the migration path. In the present case, the oil has encountered source rocks that are relatively rich in sterane biomarkers. Thus, a lowering of maturity based on sterane maturity parameters is accompanied with increase in sterane concentration.