2. Flood Plains and their Significance

2.1 Symmetrical Flood Plains (1-3, Fig-1)

The Tamirabharani river (1), while is currently flowing in the centre as a spinal cord, developed wide flood plains with uniform 5-7 kms breadth and uniform elevation on its either banks as vividly seen in uniform red tone in satellite FCC data (2&3, Fig.1). These are called as symmetrical flood plains as these occur on both sides of the rivers with almost equal breadth. Such symmetrical flood plains indicate that river has steadily flowed without much inference by the above said various phenomena like coriolis force, tectonic movements, sea level changes etc. However such symmetrical flood plain in this river itself appears to be an anomaly that the river must be flowing along the axis of a currently subsiding East-West graben or a down warp. Infact, while [2] inferred such east-west alternative arches and deeps throughout the Indian plate due to post collision tectonic phenomenon, [1] has inferred a lot of East-West faults in Tamil Nadu which are active and causing upward and downward block faulting. [2] earlier observed similar east – west graben in Indian ocean deep down south of Cape comorin, India. All these indicate that such symmetrical wider flood plains may indicate an East – West graben. From the resources and hazards point of view, the ground water potential and recharge from the river are likely to be uniform on the flood plains occurring on either sides of the river. As there is a feasibility of on going subsidence along the east-west graben, the entire river and the flood plain segments are prone for flooding due to the ongoing grabening and its induced struggled flow of the river. Except along the zones of curvatures, the bank erosion and deposition phenomenon will be less in this river.

2.2 Asymmetrical Flood Plain (4-7, Fig-1)

The Indus river, Pakisthan, flowing now to the east of Sulaiman hills in the western rim of Thar desert, in Rawalbhindi region shows that presently it flows in the western extreme (4) with very wide flood plain of over 70 to 100 kms breadth developed only to its east (5, Fig.1) as seen from the darker tone in black & white satellite data. At the same time, no flood plain is seen to the west of Indus River. This indicates that, the Indus River might have flowed in the eastern side in Thar desert region(far east of 5,Fig.1) and preferentially migrated towards westerly and stabilized now atthe western edge, along the foot hills of Sulaiman hill ranges. Such an asymmetrical flood plain indicating the preferential westerly migration of the river Indus may be due to the tectonic upliftment of the Aravalli mountains which are located along the eastern boundary of the Thar desert [3]. In such zone of asymmetrical flood plains, the ground water potential as well as recharge will be restricted mostly to the flood plains close to the present flow of the river and again the flooding will also be less in major part of the flood plain occurring away from the present course of the river. In contrast, erosion will be more at the foot hills of the Sulaiman ranges along the western bank of the Indus River . This might even induce landslides in Sulaiman hills (6,Fig.1) because of toe erosion.

2.3 Multi level Flood Plains (8-10, Fig.1)

In some river systems, the flood plains will be seen at different elevations which are called as multilevel flood plains. Such multi level flood plains will show different tonal and vegetation packages in satellite data due to the variations in the moisture content. The LANDSAT TM data of a parts of Cauvery river basin ,Central Tamil Nadu, India (8-10, Fig. 1) shows that the Cauvery River presently flows in the centre as the spinal cord (8) with wider flood plains of 7 to 10 kms breadth on either sides. This is again over all a symmetrical flood plain similar to Tamirabharani river (1,fig.1). But in this symmetrical flood plains, two contrasting tones and vegetational packages are seen with prolific vegetation and cultivation close to the river showing deep red tone in IRS FCC data (9) and comparatively less vegetation and cultivation practices away from the river (10,Fig.1). These two flood plains also occur at two different elevations with former occurring close to the river (9) at lower elevations and the later occurring away from the river (10) at little higher elevations. The flood plain close to the river (9) hence was interpreted as younger or lower flood plains and the one occurring away from the river (10) at little higher elevations as older or upper flood plains.

Occurrence of such upper and lower flood plains or multi level flood plains indicates that either this region must be getting uplifted now resulting the River Cauvery which has flowed upto the limit of the upper flood plain to incise itself and vertically cut the area and gradually flow in the deeper and deeper part in the centre. In this process such multi level flood plains would have been formed on it's either sides. Alternately, the level of the sea located 100 – 120 east of location 9 (Fig.1) might have fallen down in the recent years and in order to maintain it's base level of erosion, the River Cauvery might have incised by vertically cutting the terrain. Further, as the upper flood plain gave a 14 C date of nearly 2670 ±90 years before present [4], it can be said that such tectonic upliftment or the sea level fall might have started around 2700 years back.

2.4 Offset Flood Plain (11-15, Fig-2)

The LANDSAT TM FCC image of part of Tinej River (11) basin of Phillipines shows similar multi level flood plains with upper flood plain or old flood plain away from the river (12) and the younger flood plain or the lower flood plain (13) close to the river(Fig 2). Hence tectonic activities and sea level changes and also natural resources and hazards could probably be similar to the river Cauvery discussed above.

But more significantly, in this river, the younger flood plain, occurs to a wider breadth alternately in the southern (14) and the northern (15, Fig.2) banks and thus 14 & 15 show offsetting pattern in the flood plain. So this was interpreted as offset flood plains. Such an offset flood plain indicates either the ongoing scissor fault tectonic movements along the general North – South oriented faults or this river must be undergoing a phenomenon of compression and rarifaction in its flow like a spring, due to the pressure exerted by the storm surges and repetitive / oscillatory tides from its mouth

in the sea in the south west. The probability is more for the second phenomenon as no obvious lineaments or faults are seen in the area.

2.5 Meander Scrolled flood plain (16&17, Fig.2)

The study of IRS 1B FCC data shows that Brahmaputra river in Assam valley, India (16, Fig.2) shows that the river has developed a wide flood plain to its south (17) and this flood plain is filled with bundles of noodled and over printed meanders.Such meander filled flood plain indicates that the River Brahmaputra has oscillated very much in the recent years in this region. This may be due to either the upliftment of the Assam Plateau lying to its south or frequent seismic tremors. Environmentally such meander filled flood plains will be flood prone and also prone for marshiness and water logging .

3. Conclusion

Rapid appraisal of satellite data with special reference to the anomalies seen in the flood plains in selected Asian rivers indicates that this branch of study requires deeper look for understanding fully the life histories of the rivers, from which geodynamics, Hydrodynamics, Palaeo climatology, Sea level Changes etc can be precisely brought out which are vital for various development. Again from the same the natural resources like placer minerals in levees, ground water potential and recharge and geo hazards like tectonic movements and seismic vulnerability, flooding and flood yield fore casting, water logging, marshiness and soil salinity, bank erosion and deposition and also other various engineering geological applications can be dealt with.

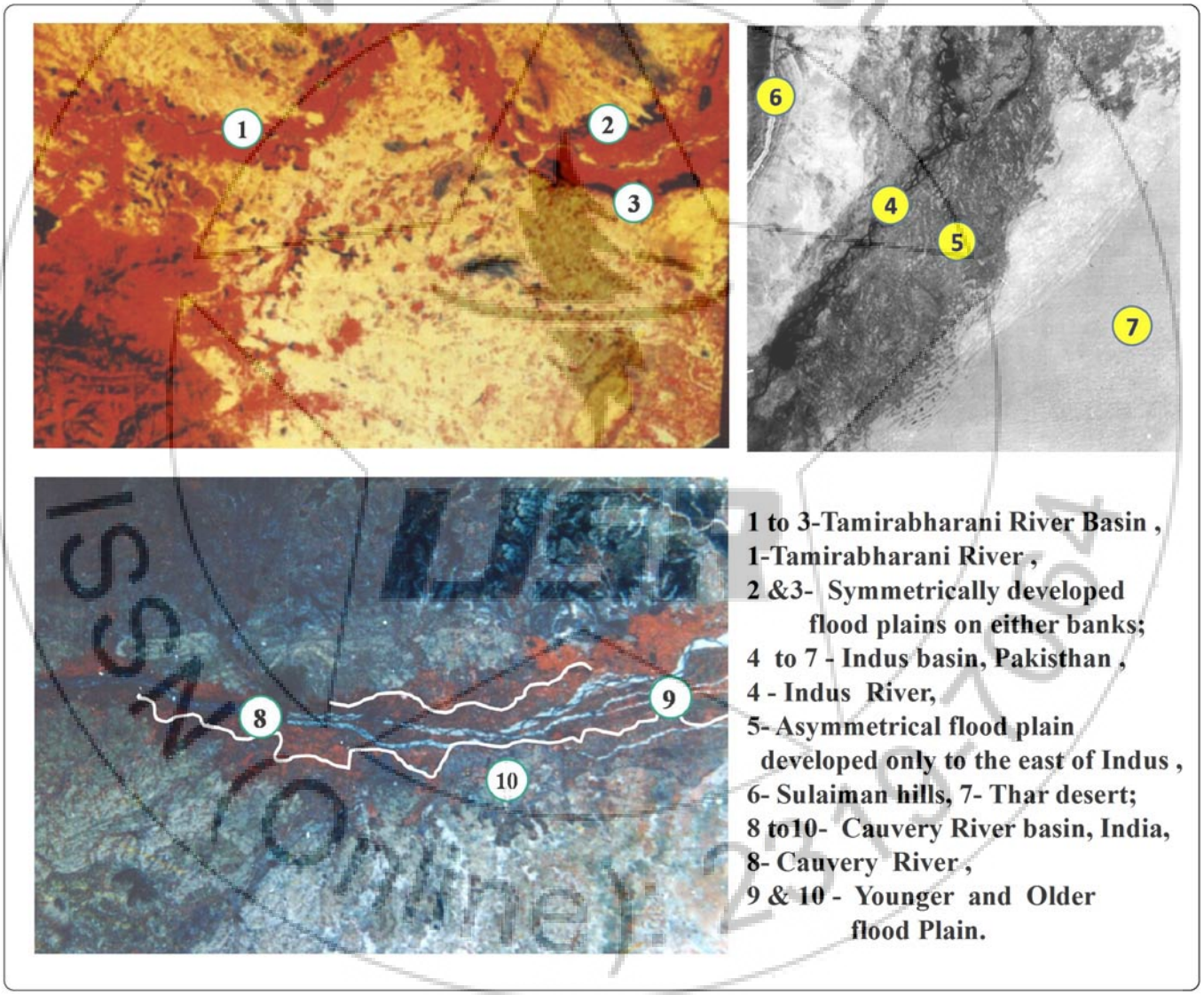
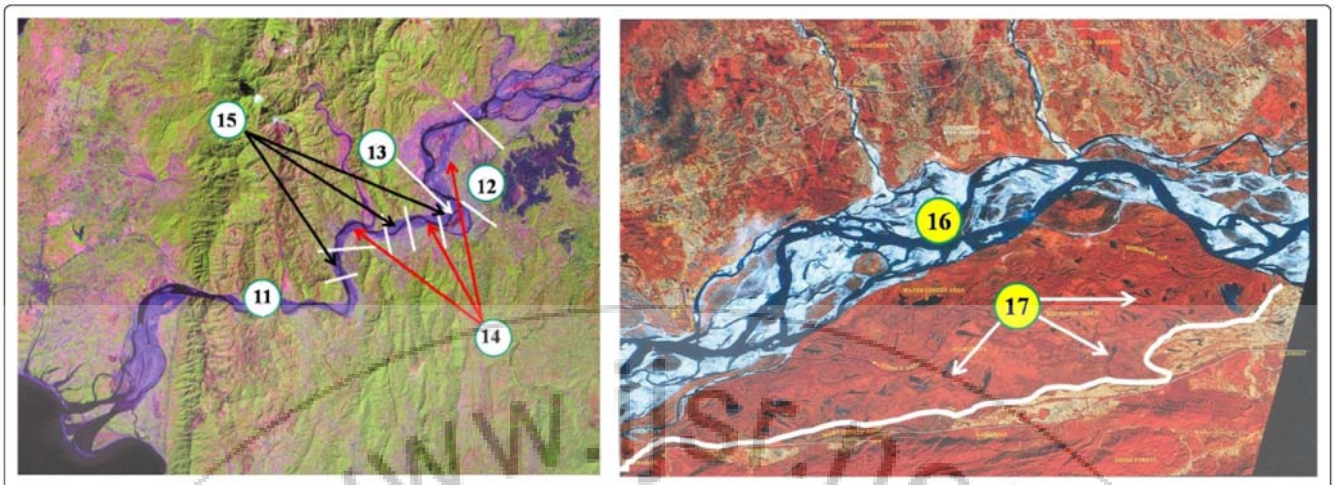


Figure 1: Flood Plain features in South Asian Rivers



11 to15 - Tinej river, Phillipines, (11-Tinej river,12- older and 13- younger flood plains, 14 & 15 - flood plains in southern and the northern blanks displaying offsetting pattern, 16 - Brahmaputra river Assam, India. 17- Meander filled flood plain in Brahmaputra river.

Figure 2: Flood Plain features in South Asian Rivers

References

[1] Elliott, C.I., Joyce, E.B., Bishop, I., Ramasamy, SM., and Kumanan, C.J. 1998. Lineaments of Southeastern India and their Relationship to Drainage Pattern and Groundwater Flow. Proc. Vol. on Int. Association of Hydrogeologists, University of Melbourne, Feb. 8 - 13, 1998, 131 - 135.

[2] Ramasamy, SM. 2006. Remote Sensing and Active tectonics of South India, International Journal of Remote Sensing, Taylor and Francis, London, 27(20), 4397-4431.

[3] Ramasamy, SM., Bakliwal, P.C. and Verma, R.P. 1991. Remote sensing and river migration in western India, International Journal of Remote Sensing, 12(12), 2597 - 2609.

[4] Ramasamy, SM., Saravanavel, J., Yadava, M.G., and Ramesh, R. 2006. Radiocarbon dating of some palaeochannels in Tamil Nadu and their significance, Current Science, 99(12), 1609 – 1613.

[5] Ranadhir Mukhopadhyay and Khadge, N.H. 1992. Tectonic Reactivation In The Indian Ocean: Evidences from Seamount Morphology and Manganese nodule characteristics, Journal of Geological Society of India, 40(5), 443 – 452.

[6] Thornbury 1985. Principles of Geomorphology, 2nd Edition, JohnWiley and sons Inc., New York, 594p.