Hydrographic comparison of estuary and fjord essay

The earth has been subsistent because of several physicochemical factors principal of which is reliant on water.

The hydrologic cycle for example performs on a global basis. Energy from the sun causes water in the earth’s oceans to evaporate. As water evaporates, the hot air rises and carries water vapor up into the cooler atmosphere and to different geographical regions where water forms clouds. Water falls from clouds as rain or snow; else, it forms glaciers on mountain caps due to the effect of pressure and temperature brought about by altitude.

Rain and ice are powerful agents of erosion which leads into the formation of several structures such as Fjords. It has been also known that water bears with it several properties, some of which directly contributes to water cycling which leads to the formation of currents. Current in this sense aids in the formation in bodies of water such estuary. The essence here is that fjords and estuaries cater to a considerable number of biodiversity. The specific features of a fjord and estuary makes it a suitable habitat for such a number of species.

Considering this fact, one would lead for the differences of fjord and estuary in terms of its hydrographic features. To address such, this paper will primarily focus on geologic formation, water and vegetation patterns, animal life, importance, and some ecological issues. Not a river and not a sea which makes it part river and part sea. That is how briefly one could describe an estuary. The estuary serves as a banquet of decaying plants, planktons, and small fishes. Millions of sea animals get their start in life feeding in the quiet

waters of the estuary where they find shelter in salt marshes, beds of slender eelgrass, or wide mudflats.

Since an estuary has very little wave action, so it provides a calm refuge from the open sea. It is a partially enclosed body of water where saltwater from the sea mixes with freshwater from rivers, streams and creeks. These areas of transition between the land and the sea are tidally driven, like the sea, but sheltered from the full force of ocean wind and waves, more like a river. Estuaries are generally enclosed in part by the coastline, marshes and wetlands; the seaward border may be barrier islands, reefs and sand or mud flats. Every estuary is unique; each individual ecosystem has different components that complete the estuarine habitat. Estuaries are the areas where most freshwater run-off in the world encounters the oceans.

Because freshwater is lighter than salt water there are major density differences and hence a salinity gradient. Unless mixed by the tides or winds, freshwater remain at the surface. On the other hand the tides force seawater inland as a countercurrent and produce a salt-water wedge below the freshwater surface. This means that the gravitational circulation within the estuary is much greater than if only river water were flowing to sea. Abrupt rises in tidal water (tidal bores) occur in estuaries, when strong tides are forced upwards by shallows before actually reaching shore areas.

Estuaries are very rarely in a static condition. Tides are the principal energy source causing estuarine mixing, but wind, wave motions, and river run-off can also be important locally. Salt water and freshwater mix to form what is generally called brackish water. Due mostly to oscillations in river flow, the

three main estuarine zones—salt water, brackish, and freshwater—can shift seasonally and vary greatly between different areas. Also, an area of the estuary can change from stratified to well-mixed during the spring-neap tide cycles. The most highly stratified estuaries are ones that receive a large amount of freshwater but have a relatively low tidal range.

Partially mixed estuaries have moderate freshwater inflow and tidal range. The brackish zone might have a salinity of 2 to 10 parts per million (ppm), compared with salt water of about 35 ppm. Where there is a large tidal range but little freshwater inflow, mixing will be heavy. Wind is usually a more important mixer than tides in coastal lagoons where there are large open waters, small tidal range, and low freshwater inputs. Freshwater shows great chemical variability whereas salt water is fairly uniform.

River chemistry, then, produces considerable differences in estuarine nutrient cycles. In general the most important compounds for estuarine life supplied by freshwater are silicon, iron, nitrogen, and phosphorus. Seawater provides sulphates and bicarbonate. Estuaries contain some of the most productive habitats on Earth because of the accumulation and availability of nutrients, along with adequate light conditions, that fuel phytoplankton production.

Many of the organisms that live in the estuary are the same as those that might be found along the coastal ocean. Phytoplankton and algae are highly adapted to the nutrient-rich but often rigorous conditions of estuarine waters. A group of algae called diatoms are especially important. On a worldwide basis estuaries have very diverse vegetation types, which range

from small, sparsely distributed grasses to large rainforest trees with a closed canopy. Salt marshlands are intertidal communities of rooted plants that are inundated by the tides.

Finally, there are often dense communities of submerged vascular plants in the shallower and at least partially protected areas of estuaries. These plants usually root in soft sediments. Some mobile species may move from offshore into the more protected areas to reproduce, so that estuaries are important nursery areas for many species. And, for a number of reasons, estuaries may be highly productive, yielding a high biomass of fish and shellfish per unit area.

For these reasons, estuaries are generally considered to be valuable biological resources requiring protection against abuse. Geologically, there are three types of estuary mixing (salt wedge, partially mixed, well-mixed, and fjord type), and they cover a large range of sizes. Estuaries are generally characterized according to the nature and extent of the salinity gradient forming between the freshwater riverine head to the coastal marine waters at the mouth. This brings about different stratifications in the various types of estuaries.

The most highly stratified type is a salt wedge estuary (Figure 1) in which there is a strong river flow compared to the mixing that is generated by tidal currents. A distinct freshwater layer flows out over a distinct saltwater layer, which is seen at the bottom and the two are distinct over some length of the estuary. Figure 1. Salt Wedge Estuary. The partially mixed estuary (Figure 2), displays a consistent gradient of salinity from the mouth to the head with a

corresponding gradient of salinity from the surface to the bottom over a significant length of the estuary. The Narragansett Bay is an example of which.

Figure 2. Partially Mixed Estuary The well-mixed estuary (Figure 3) is dominated by tidal currents over river flow and is thus well mixed over most of its length. While there is a gradient of salinity from the freshwater sources to the mouth, there is little vertical salinity variation, and thus little stratification in this type of estuary. Figure3.

Well-Mixed Estuary The fjord (Figure 4) is a distinct estuarine type with a different geometry. The typical fjord is relatively long and narrow and is deep along much of its length. A defining feature of a fjord is a sill of shallow water at the mouth, which serves to isolate the deeper waters of the fjord from the ocean. As a result, the deeper waters may not be well mixed, and a fjord can be a highly stratified type of estuary if there is sufficient freshwater. Figure 4. Fjord-type Estuary Geologically speaking, present-day estuaries are young and ephemeral coastal features.

Today’s estuaries began to take their current form during the beginning of the present interglacial period, when sea level rose about 120 m (400 ft) between 15, 000 years ago and 5, 000 years ago, when it reached its current level. When sea level was lower (glaciation periods), estuaries were greatly restricted compared to their present form and were located on what is now the continental slope. The relatively high sea levels and extensive estuaries found today have only been characteristic of about 10 to 20 per cent of the last million years. Unless sea level rises the tendency of estuaries is to fill

with sediments and become greatly reduced in size. The sediments are derived from river-borne terrestrial materials from the eroding continents and from sand transported upstream by the tides from the continental shelf. Estuaries are generally divided into four main groups.

Coastal plain estuaries are suggestive of a V-shaped river channel, usually less than 20 m (65 ft) deep, with an accompanying floodplain. It was formed during the last great sea level rise when melting glaciers caused river valleys to become increasingly flooded, or a combination of rising sea levels and increased rainfall which led to greater flooding. Salt-marsh estuaries have a well-defined drainage network but they are not usually fed by rivers, and are thus dominated by salt water. This type of estuary is common in parts of the Florida coastline of the United States. Lagoons, as opposed to the salt-marsh type of estuary, have a less well-defined drainage-channel network, larger open areas, and are usually shallow.

A sand barrier (raised ridge), is characteristic of the edge of lagoons. This feature was formed during the last ice age, fluvial and atmospheric processes eroded the earlier coast. When new sea levels rose, the areas behind the barrier were again flooded. Tectonic estuaries originated from geological events such as faulting, volcanic eruption and landslides.

Fjords, on the other hand are major type of estuary in both the northern and southern temperate latitudes above about 45°. Fjords usually have a U-shaped cross-sectional form and water depths in the interior part that can exceed 500 meters. A Fjord is a steep-sided inlet of the sea characteristic of glaciated regions. Fjords possibly effected from the scouring by glaciers of

valleys shaped by any of numerous processes, including faulting and erosion by running water. When the regions occupied by these glaciers subsided, the valleys were drowned by the sea.

Most common examples are fjord coast lines of Norway, Scotland, Greenland, Alaska, British Columbia, S Chile, S New Zealand, and Antarctica. Fjords are often shallow at the mouth, fjords are frequently very deep farther inland. Sognafjord (Norway) is 4, 000 ft (1, 220 m) deep and over 100 mi (160 km) long. Loch Moran, Scotland (1, 017 ft/310 m), is a typical fjord but is separated from the sea. Norwegian fjords are noted for their grandeur.

Fiords usually have branches that just from the main body of water. The walls of a fiord extend deep below the surface of the water. Fjords tend to be most shallow near the mouth, and deepest inland. Most geologists believe that fiords were formed when glaciers carved deep grooves in the coastline.

Later these grooves filled with water as the sea level rose. Many fjords began as river mouths and were deepened by glaciers. Fjords frequently exceed 305 m (1, 000 ft) below sea level in depth, and they may be more than 6 km (4 mi) wide and more than 161 km (100 mi) long. Figure 6. Fiord (Microsoft ® Encarta ® Premium Suite 2005.

© 1993-2004 Microsoft Corporation). Fjords exists where glaciers once formed on mountains bordering coastal areas. The glaciers carved out glacial valleys downslope. Later, when temperatures warmed, the glaciers melted and the sea level rose, flooding the valleys. Fjords commonly have channels which follow the faults of the underlying rock, including occasional sharp corners.

The valley at their head, in many cases, extends into the mountains. Sometimes a small residual glacier remains at the valley head. If there is no residual glacier, the river which flows in the valley will begin to build a delta at the head of the fjord; frequently this delta is the best place for farms and villages. The shallow threshold, great depth and the protection afforded by the valley's sides generally means that fjords are excellent natural harbors. In many cases the only place where villages and farms are established is at the head of the fjord, where a river has formed a delta before entering the sea.

The circulation of the water in a fjord primarily depends upon the characteristics of the sill created by the terminal moraine and river flow into the fjord. Taller or longer sills can block deep intrusions of ocean water. The sill can also act as a hydraulic control. The deep inner basin of many fjords only gets replenished with new ocean water once a year, which can lead to Anoxic sea water. In addition to the sill, the combination of tides, winds, river flow and ocean density determine how frequently the deep water gets flushed. As late as 2000, some of the world's largest coral reefs were discovered along the bottoms of the Norwegian fjords.

These reefs were found in fjords all the way from the north of Norway to the south. The marine life on the reefs is believed to be one of the most important reasons why the Norwegian coastline is such a generous fishing ground. The shallowest cold water coral reef in Norway begins at 39 m (128 ft) in Trondheimsfjord. The reefs are host to thousands of life forms such as plankton, coral, anemones, fish, several species of sharks, and many more one would expect to find on a reef. However most are specially adapted to

life under the greater pressure of the water column above it, and the total darkness of the deep sea.

New Zealand’s fjords are also host to deep sea corals, but a surface layer of dark fresh water allows these corals to grow in much shallower water than usual. A fjord differs from most estuaries in its sheer, parallel walls, often extending far below the water surface, and in its many branches of similar form. Estuaries are transition zones between saltwater and freshwater ecosystems. They are located at the mouth of rivers where freshwater meets the saline water of the nearshore. No two estuaries are alike and they are often associated with other coastal ecosystems such as salt marshes, mudflats, beaches and bogs. Tides play a major role in the salinity of the water.

With each incoming tide there is an influx of saltwater. When saltwater mixes with freshwater it is termed brackish. Fjords are the deepest of all estuaries, with their water properties that differ from the classic estuary. The circulation of water in the upper layers (above sill depth) is similar to other estuaries, with a brackish outflowing surface layer and deeper inflowing saline layer. But the circulation of deep water in the fjord is dependent on the depth of the sill, the amount of tide water entering the fjord (tidal mixing over the sill), and the amount and frequency of deep ocean water flushing behind the sill (deep water renewal). In eastern Canada deep water renewal is mostly internal, and happens mainly in winter.

ReferencesBellNET©, (1997) BellNET Webmaster Revised: http://bellnetweb. brc. tamus. edu/evaluati. htm Gulf of Maine Aquarium (1998) http://octopus.

gma. org/katahdin/estuary. html Microsoft ® Encarta ® Premium Suite (2005). © 1993-2004 Microsoft Corporation. All rights reserved. National Ocean Service, National Oceanic and Atmospheric Administration http://estuaries.

gov /estuaries. html http://www. estuaries. gov/estuaries. html Pritchard, D.

W. (1967) What is an estuary: physical viewpoint. p. 3–5 in: G. H.

Lauf (ed.) Estuaries, A. A. A. S.

Publ. No. 83, Washington, D. C.

Retrieved from http://en. wikipedia. org/wiki/Estuary The Columbia Encyclopedia, Sixth Edition. 2001-05.

The Columbia Encyclopedia, 6th Edition. Copyright © 2001-05 Columbia University Press. (http://www. bartleby. com/65/es/estuary. html) U.

S. Environmental Protection Agency. National Estuary Program (http://www. epa. gov/owow/estuaries/about1. htm) Stilling, P.

(1998). Ecology: theories and applications, 2nd ed.. Prentice Hall, Inc. London, UK. pp.

267-270. Fisheries and Oceans, Canada(1997) http://www. glf. dfo-mpo.

gc. ca/sci-sci/bysea-enmer/fjords-e. html.