PETROLÜN KÖKENİ ÜZERİNE TARİHSEL TARTIŞMALAR

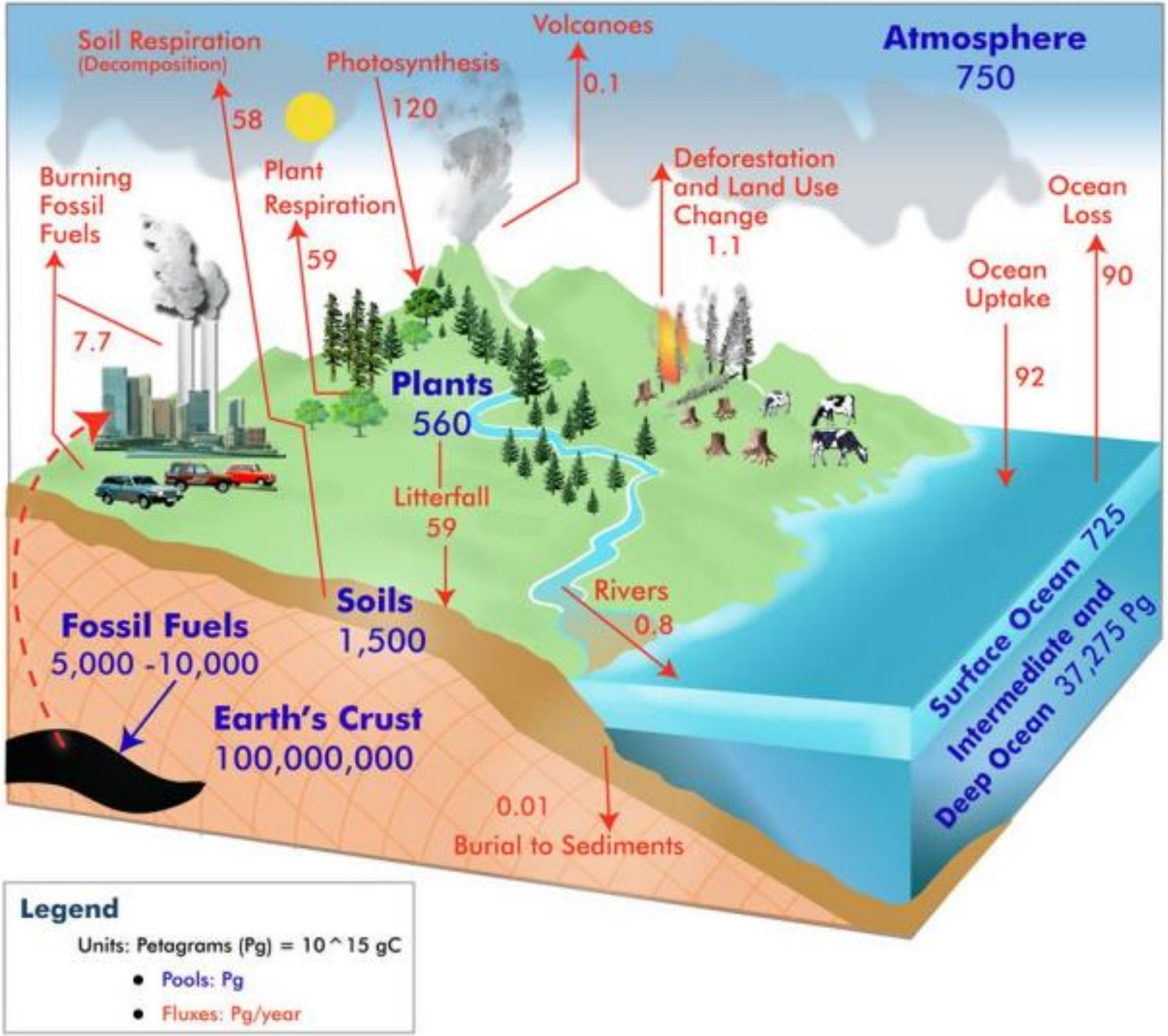
İnorganik Teoriler

- Volkanik/magmatik gazlar
- Kabuk kimyasal reaksiyonları
- Kabuktaki fiziksel reaksiyonlar
- Kozmik evre gazları

Organik Teoriler

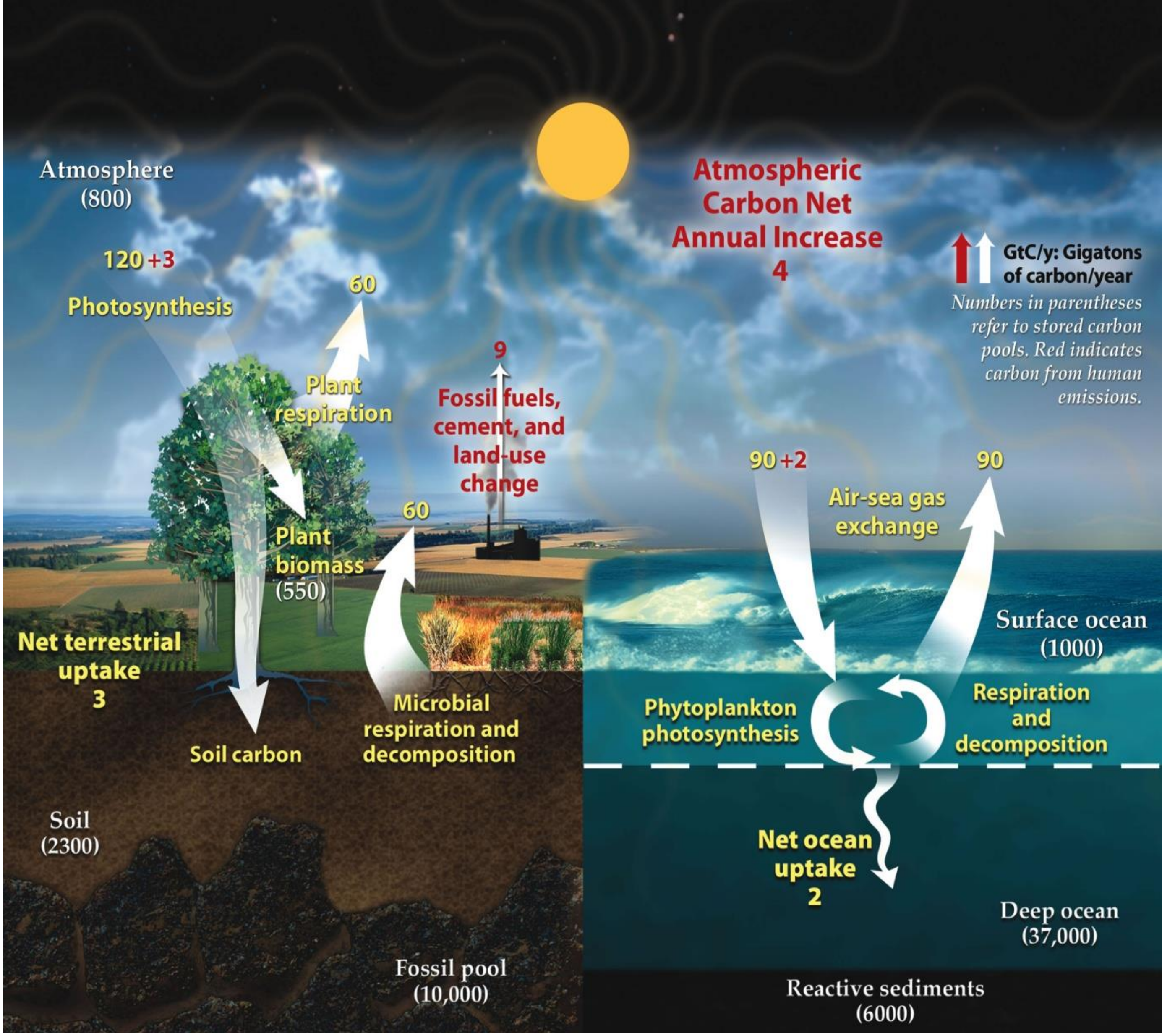
- Kömür kökenli
- Bitkisel kökenli
  - Karasal bitki kökenli
  - Denizel bitki (alg ve algal spor) kökenli
- Hayvansal (balık, foraminifer, molusk vs.) kökenli (Engler-Höfer teorisi)
- Biyomas kökenli (çeşitli türden bitki ve hayvan)

KARBON DÖNGÜSÜ

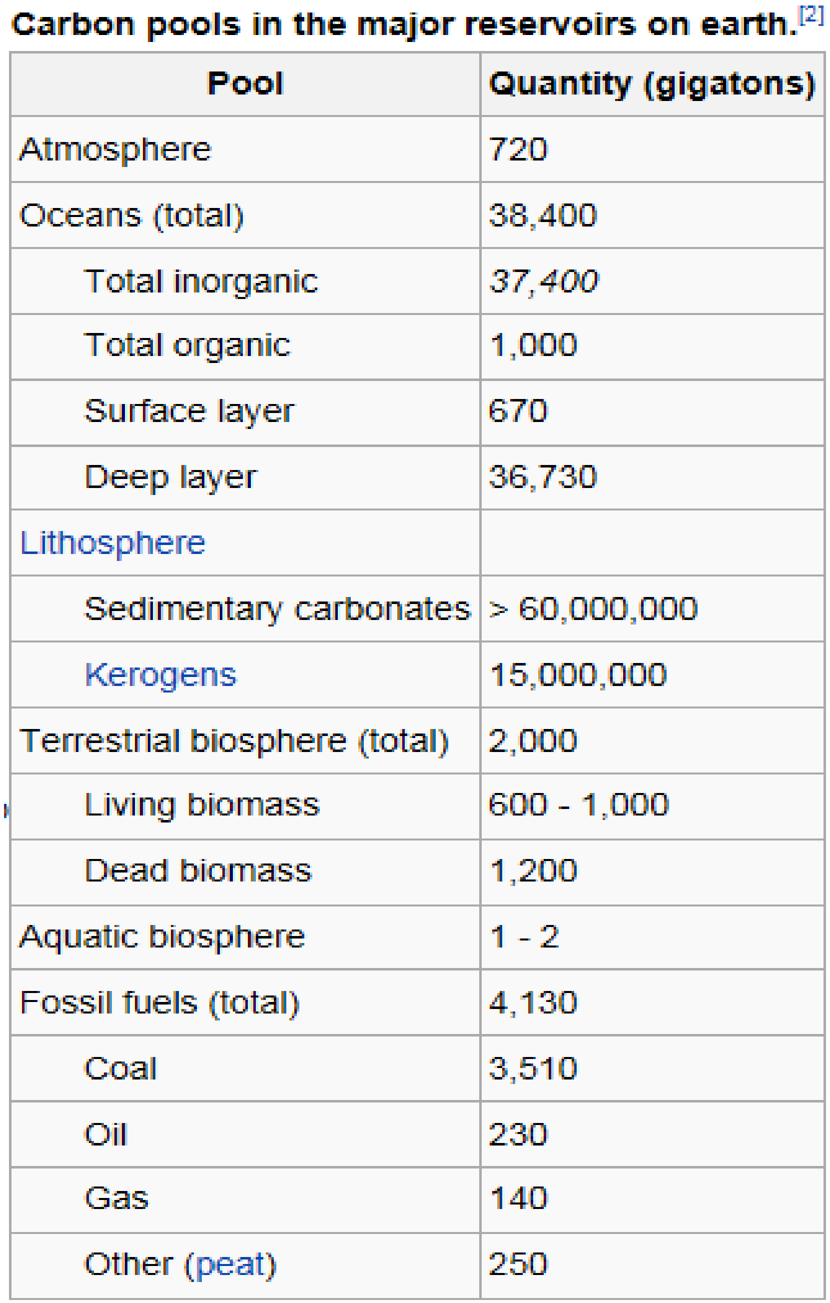


Fotosentez karbon döngüsünün en geniş kısmıdır. Fotosentez sonucu oluşan organik maddenin önemli bir kısmı CO2 olarak atmosfere geri döner. Bu dönüþümün en temel yolu terlemedir. Ayrıca oksitlenme ve bakteriyel bozunma yoluyla da CO2 atmosfere salınır. Ancak karbon çevrimi %100 böyle değildir. OM (organik madde)’nin küçük bir kısmı, yaklaşık binde biri bu çevrimden kaçar. Sedimanlarla taşınarak gömülür. Jeolojik zaman boyunca gömülen bu organik maddenin çok az bir kısmı da fosil yakıtlara dönüşür. Bu nihai (en son) dönüþen organik madde miktarı yaklaşık 20·102 tondur. OM’nin sedimanlar içerisinde yer alması denizel bitkiler, denizel hayvanlar veya karasal bitkiler yolu ile olur. Organik madde çoğunlukla ince taneli şeyl ve kireç çamuru (mikrit) türü litolojiler içerisinde yer alır. Bu litolojiler düşük enerjili ortamlarda çökelirler. Bu ortamlar: okyanuslar, göller, lagün ortamları ve kömür bataklık ortamlarıdır.

Karbon Çevrimi



This diagram of the fast carbon cycle shows the movement of carbon between land, atmosphere, and oceans in billions of tons of carbon per year. Yellow numbers are natural fluxes, red are human contributions in billions of tons of carbon per year. White numbers indicate stored carbon.



Carbon pools in the major reservoirs on earth.[2]

Pool	Quantity (gigatons)
Atmosphere	720
Oceans (total)	38,400
Total inorganic	*37,400*
Total organic	1,000
Surface layer	670
Deep layer	36,730
Lithosphere	
Sedimentary carbonates	> 60,000,000
Kerogens	15,000,000
Terrestrial biosphere (total)	2,000
Living biomass	600 - 1,000
Dead biomass	1,200
Aquatic biosphere	1 - 2
Fossil fuels (total)	4,130
Coal	3,510
Oil	230
Gas	140
Other (peat)	250

Atmosphere[edit]

Main article: Atmospheric carbon cycle

Carbon in the earth's atmosphere exists in two main forms: carbon dioxide and methane. Both of these gases absorb and retain heat in the atmosphere and are partially responsible for the greenhouse effect. Methane produces a large greenhouse effect per volume as compared to carbon dioxide, but it exists in much lower concentrations and is more short-lived than carbon dioxide, making carbon dioxide the more important greenhouse gas of the two.[5]

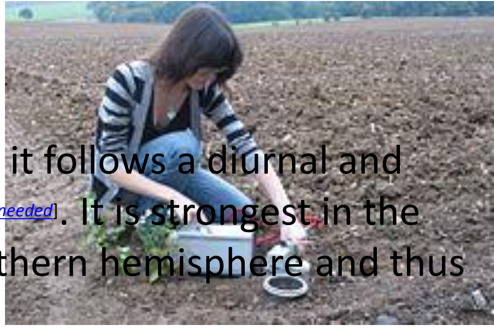
Carbon dioxide leaves the atmosphere through photosynthesis, thus entering the terrestrial and oceanic biospheres. Carbon dioxide also dissolves directly from the atmosphere into bodies of water (oceans, lakes, etc.), as well as dissolving in precipitation as raindrops fall through the atmosphere. When dissolved in water, carbon dioxide reacts with water molecules and forms carbonic acid, which contributes to ocean acidity. It can then be absorbed by rocks through weathering. It also can acidify other surfaces it touches or be washed into the ocean.[6]

Human activity over the past two centuries has significantly increased the amount of carbon in the atmosphere, mainly in the form of carbon dioxide, both by modifying ecosystems' ability to extract carbon dioxide from the atmosphere and by emitting it directly, e.g. by burning fossil fuels and manufacturing concrete.[2]

Terrestrial biosphere[edit]

Main article: Terrestrial biological carbon cycle

The terrestrial biosphere includes the organic carbon in all land-living organisms, both alive and dead, as well as carbon stored in soils. About 500 gigatons of carbon are stored above ground in plants and other living organisms,[4] while soil holds approximately 1,500 gigatons of carbon.[7] Most carbon in the terrestrial biosphere is organic carbon, while about a third of soil carbon is stored in inorganic forms, such as calcium carbonate.[8] Organic carbon is a major component of all organisms living on earth. Autotrophs extract it from the air in the form of carbon dioxide, converting it into organic carbon, while heterotrophs receive carbon by consuming other organisms.



A portable soil respiration system measuring soil CO_2 flux

Because carbon uptake in the terrestrial biosphere is dependent on biotic factors, it follows a diurnal and seasonal cycle. In CO_2 measurements, this cycle is often called a Keeling curve[citation needed]. It is strongest in the northern hemisphere, because this hemisphere has more land mass than the southern hemisphere and thus more room for ecosystems to absorb and emit carbon.

Carbon leaves the terrestrial biosphere in several ways and on different time scales. The combustion or respiration of organic carbon releases it rapidly into the atmosphere. It can also be exported into the oceans through rivers or remain sequestered in soils in the form of inert carbon. Carbon stored in soil can remain there for up to thousands of years before being washed into rivers by erosion or released into the atmosphere through soil respiration. Between 1989 and 2008 soil respiration increased by about 0.1% per year.[9] In 2008, the global total of CO_2 released from the soil reached roughly 98 billion tonnes, about 10 times more carbon than humans are now putting into the atmosphere each year. There are a few plausible explanations for this trend, but the most likely explanation is that increasing temperatures have increased rates of decomposition of soil organic matter, which has increased the flow of CO2. The length of carbon sequestering in soil is dependent on local climatic conditions and thus changes in the course of climate change. From pre-industrial era to 2010, the terrestrial biosphere represented a net source of atmospheric CO_2 prior to 1940, switching subsequently to a net sink.[10]

Oceans[edit]

Oceans contain the greatest quantity of actively cycled carbon in this world and are second only to the lithosphere in the amount of carbon they store.[2] The oceans' surface layer holds large amounts of dissolved organic carbon that is exchanged rapidly with the atmosphere. The deep layer's concentration of dissolved inorganic carbon (DIC) is about 15% higher than that of the surface layer.[11] DIC is stored in the deep layer for much longer periods of time.[4] Thermohaline circulation exchanges carbon between these two layers.[2]

Carbon enters the ocean mainly through the dissolution of atmospheric carbon dioxide, which is converted into carbonate. It can also enter the oceans through rivers as dissolved organic carbon. It is converted by organisms into organic carbon through photosynthesis and can either be exchanged throughout the food chain or precipitated into the ocean's deeper, more carbon rich layers as dead soft tissue or in shells as calcium carbonate. It circulates in this layer for long periods of time before either being deposited as sediment or, eventually, returned to the surface waters through thermohaline circulation.[4]

Oceanic absorption of CO_2 is one of the most important forms of carbon sequestering limiting the human-caused rise of carbon dioxide in the atmosphere. However, this process is limited by a number of factors. Because the rate of CO_2 dissolution in the ocean is dependent on the weathering of rocks and this process takes place slower than current rates of human greenhouse gas emissions, ocean CO_2 uptake will decrease in the future.[2] CO_2 absorption also makes water more acidic, which affects ocean biosystems. The projected rate of increasing oceanic acidity could slow the biological precipitation of calcium carbonates, thus decreasing the ocean's capacity to absorb carbon dioxide.[12][13]

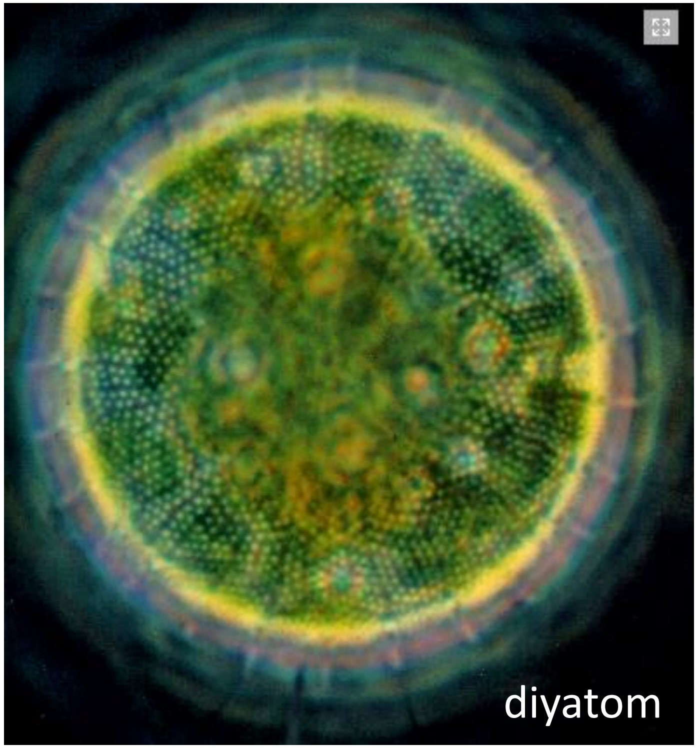
Geological carbon cycle[edit]

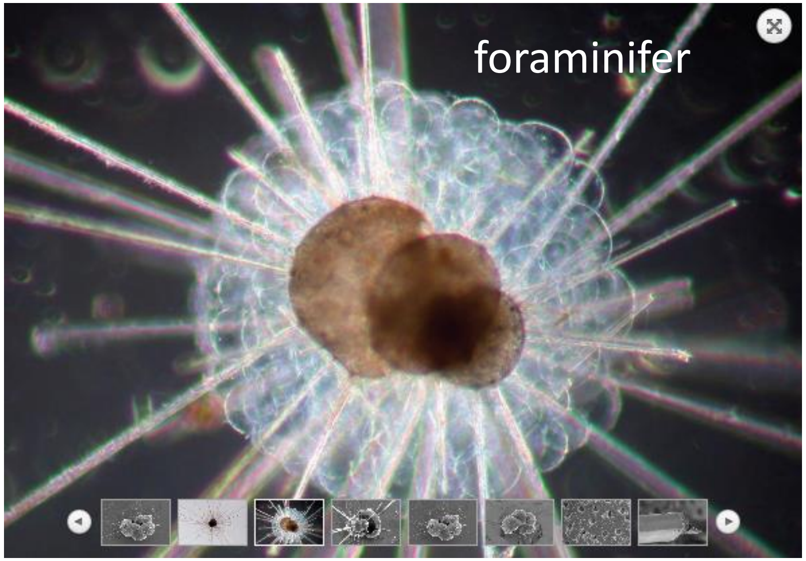
The geologic component of the carbon cycle operates slowly in comparison to the other parts of the global carbon cycle. It is one of the most important determinants of the amount of carbon in the atmosphere, and thus of global temperatures.[14]

Most of the earth's carbon is stored inertly in the earth's lithosphere.[2] Much of the carbon stored in the earth's mantle was stored there when the earth formed.[15] Some of it was deposited in the form of organic carbon from the biosphere.[16] Of the carbon stored in the geosphere, about 80% is limestone and its derivatives, which form from the sedimentation of calcium carbonate stored in the shells of marine organisms. The remaining 20% is stored as kerogens formed through the sedimentation and burial of terrestrial organisms under high heat and pressure. Organic carbon stored in the geosphere can remain there for millions of years.[14] Carbon can leave the geosphere in several ways. Carbon dioxide is released during the metamorphosis of carbonate rocks when they are subducted into the earth's mantle. This carbon dioxide can be released into the atmosphere and ocean through volcanoes and hotspots.[15] It can also be removed by humans through the direct extraction of kerogens in the form of fossil fuels. After extraction, fossil fuels are burned to release energy, thus emitting the carbon they store into the atmosphere.

Human influence[edit]

Human activity since the industrial era has changed the balance in the natural carbon cycle. Units are in gigatons.[4]
Since the industrial revolution, human activity has modified the carbon cycle by changing its component's functions and directly adding carbon to the atmosphere.[2]
The largest and most direct human influence on the carbon cycle is through direct emissions from burning fossil fuels, which transfers carbon from the geosphere into the atmosphere. Humans also influence the carbon cycle indirectly by changing the terrestrial and oceanic biosphere.
Over the past several centuries, human-caused land use and land cover change (LUCC) has led to the loss of biodiversity, which lowers ecosystems' resilience to environmental stresses and decreases their ability to remove carbon from the atmosphere. More directly, it often leads to the release of carbon from terrestrial ecosystems into the atmosphere. Deforestation for agricultural purposes removes forests, which hold large amounts of carbon, and replaces them, generally with agricultural or urban areas. Both of these replacement land cover types store comparatively small amounts of carbon, so that the net product of the process is that more carbon stays in the atmosphere.
Other human-caused changes to the environment change ecosystems' productivity and their ability to remove carbon from the atmosphere. Air pollution, for example, damages plants and soils, while many agricultural and land use practices lead to higher erosion rates, washing carbon out of soils and decreasing plant productivity.
Higher temperatures and CO_2 levels in the atmosphere increase decomposition rates in soil, thus returning CO_2 stored in plant material more quickly to the atmosphere.
However, increased levels of CO_2 in the atmosphere can also lead to higher gross primary production. It increases photosynthesis rates by allowing plants to more efficiently use water, because they no longer need to leave their stomata open for such long periods of time in order to absorb the same amount of carbon dioxide. This type of carbon dioxide fertilization affects mainly C3 plants, because C4 plants can already concentrate CO_2 effectively.
Humans also affect the oceanic carbon cycle. Current trends in climate change lead to higher ocean temperatures, thus modifying ecosystems. Also, acid rain and polluted runoff from agriculture and industry change the ocean's chemical composition. Such changes can have dramatic effects on highly sensitive ecosystems such as coral reefs, thus limiting the ocean's ability to absorb carbon from the atmosphere on a regional scale and reducing oceanic biodiversity globally.





Petrolün kaynağı organizmalar

- Bitkiler: deniz yosunları (algler), diyatomlar, mantarlar, bakteriler, algal sporlar
- Hayvanlar: foraminifer, radyolarya, protozoa, sünger, mercan, bryozoa, molusk, omurgalılar (balık vs.)

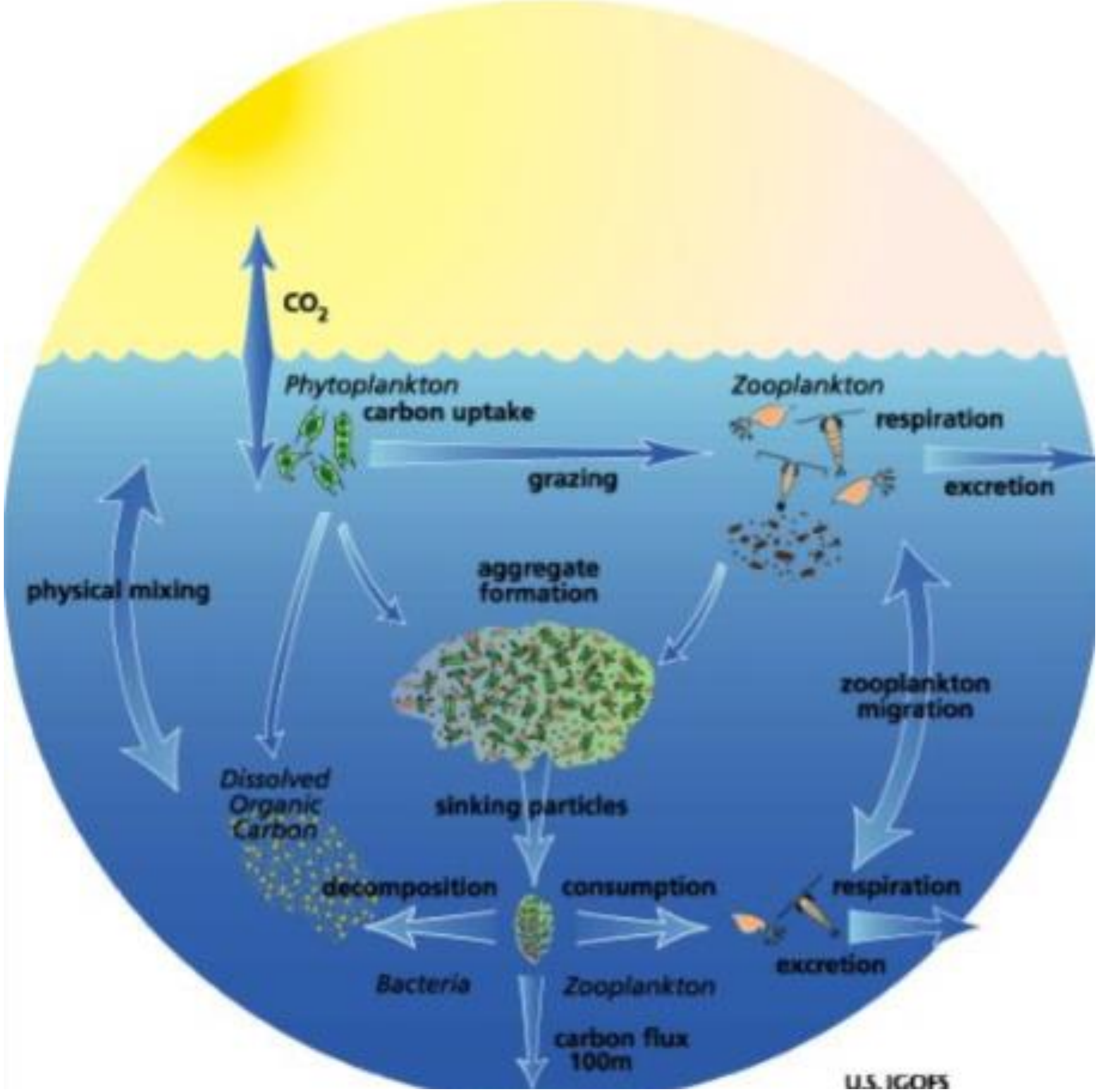
Planktonlar

Plankton are viewed as the foundation for food webs in the oceanic ecosystem. The plankton provide a source of food for larger organisms such as fish, crustaceans and even whales.

Phytoplankton are a type of plankton that use photosynthesis to provide energy to the rest of the body.

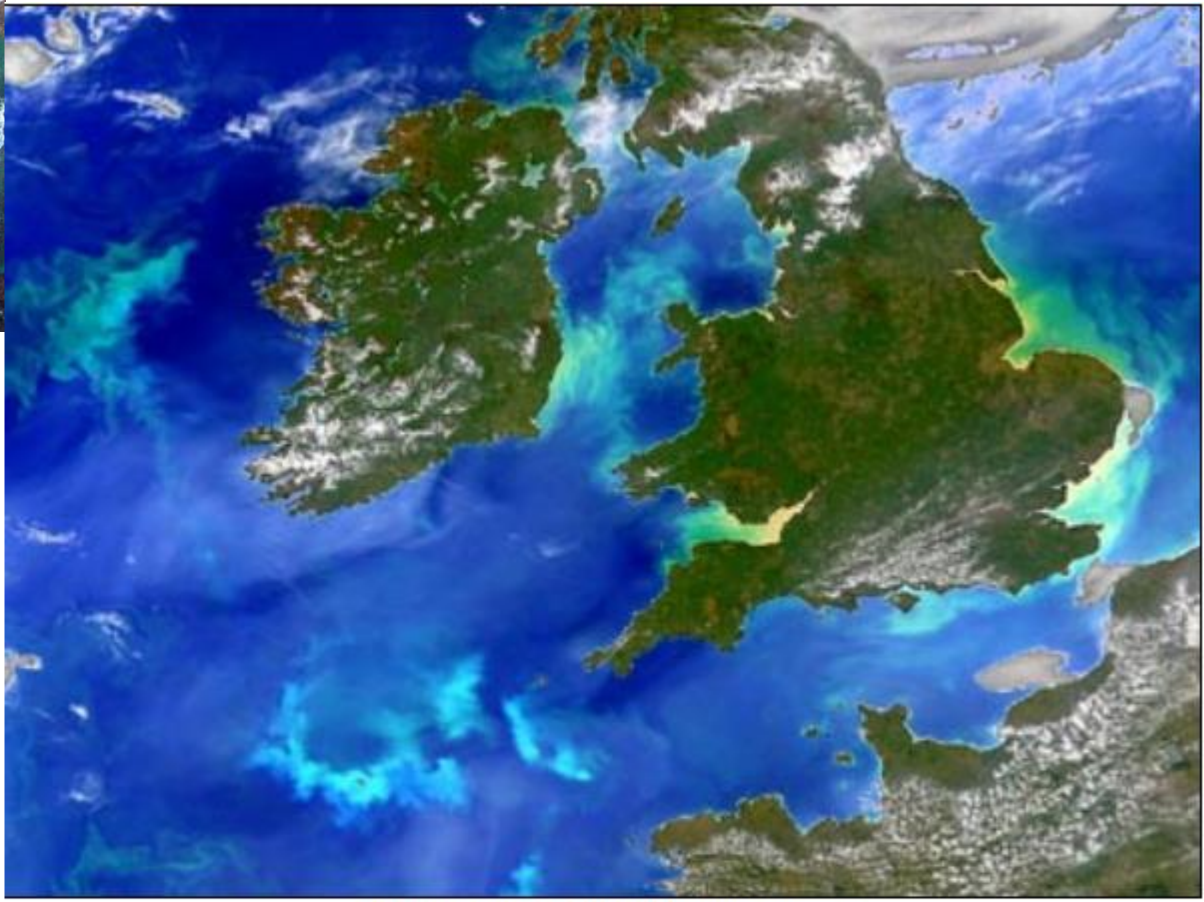
Phytoplankton serve as the food source for zooplankton.

Zooplankton are oceanic animals that rarely swim. Instead, the organisms drift and move using currents and waves in the body of water.



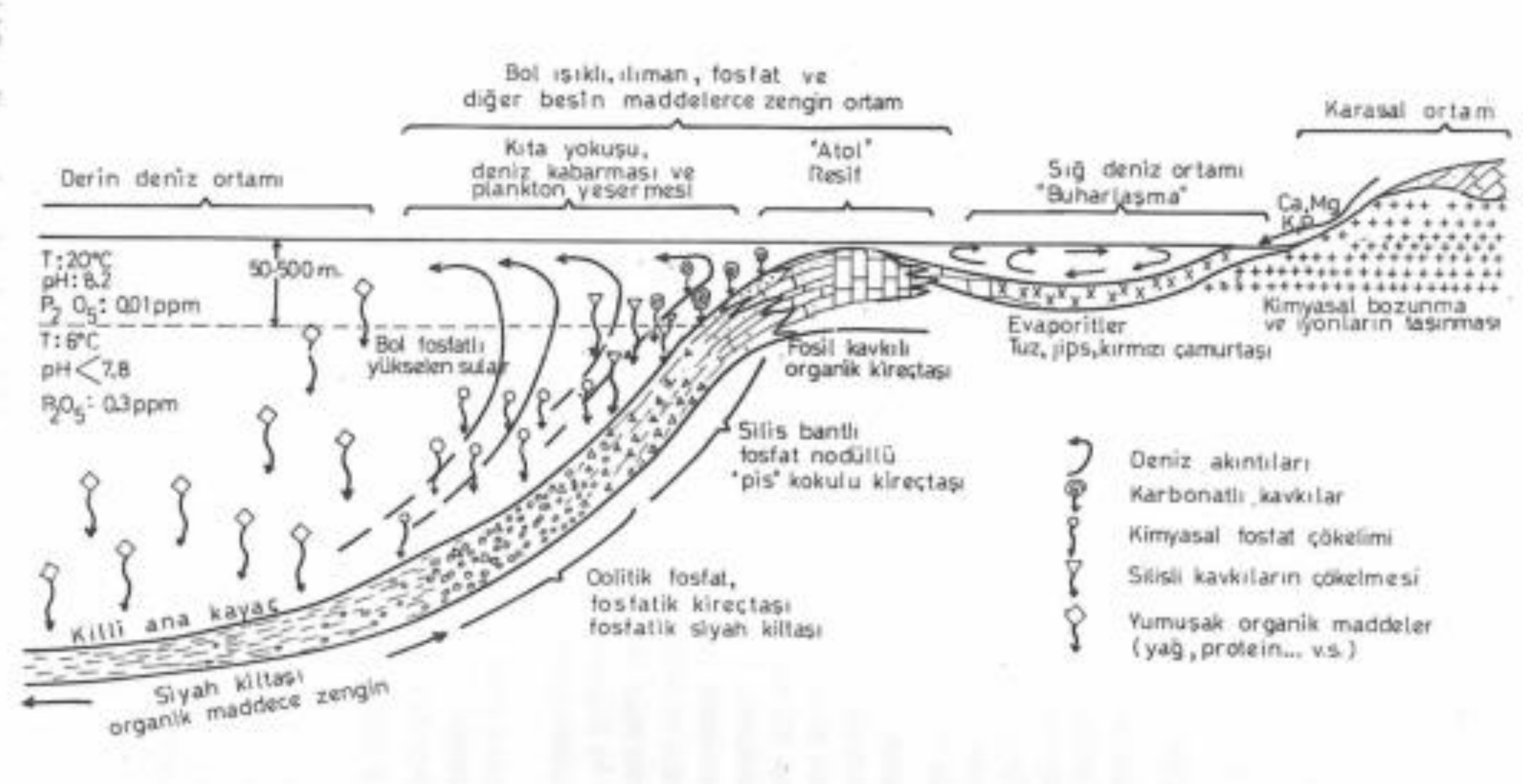
Marine plankton are comprised mainly of protein (50% or more), with 5-25% lipids, and not more than 40% carbohydrates. Higher order plants, on the other hand, are largely cellulose (carbohydrate) (30-50%) and lignin (15-25%), and average less than 3% protein.

Okyanuslarda Plankton Patlaması (plankton Bloom)



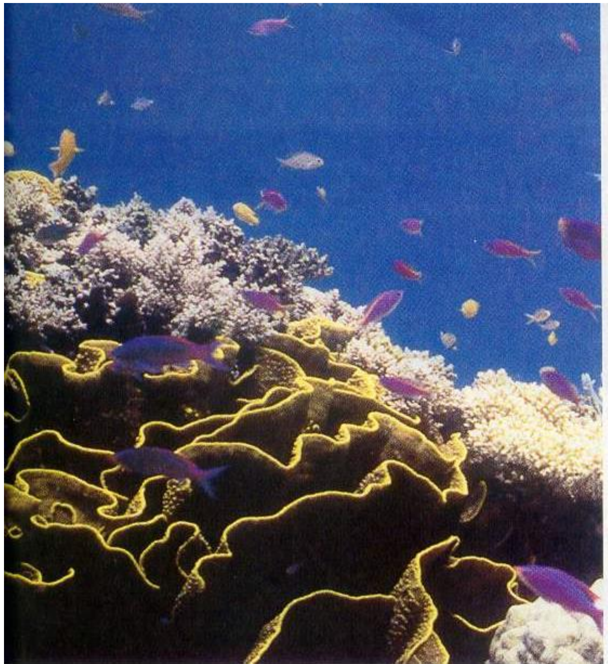
Coccolithophorid blooms in the Celtic Sea

- Soğuk, yüksek çözünmüş madde içerikli derin suların yamaç kenarı/şelfe ulaşması
- Derin sular içinde bol miktarda fosfor'un (P) varlığı
- Fosfor plankton ve omurgasızlar için yaşamsal önemde; yumuşak dokuların yapımında kullanılıyor
- Ölen organizmalar yamaç/derin şelfte organikçe zengin çamur olarak birikiyor.



Petrolün Ana Kayacı

*Anerobik ortamda çökelmiş çamurtaşı, şeyl (çoğunlukla yamaç-derin şelf-delta-lagün'de çökelenler)
*Resifal Kireçtaşları (sığ deniz-şelf kenarlarında)



ORGANİK MADDENİN PETROLE DÖNÜŞÜMÜ

Diyajenetik Evre

Bir kaç 100 m derine kadar ki gömülme.

mikrobiyal/bakteriyal faaliyet

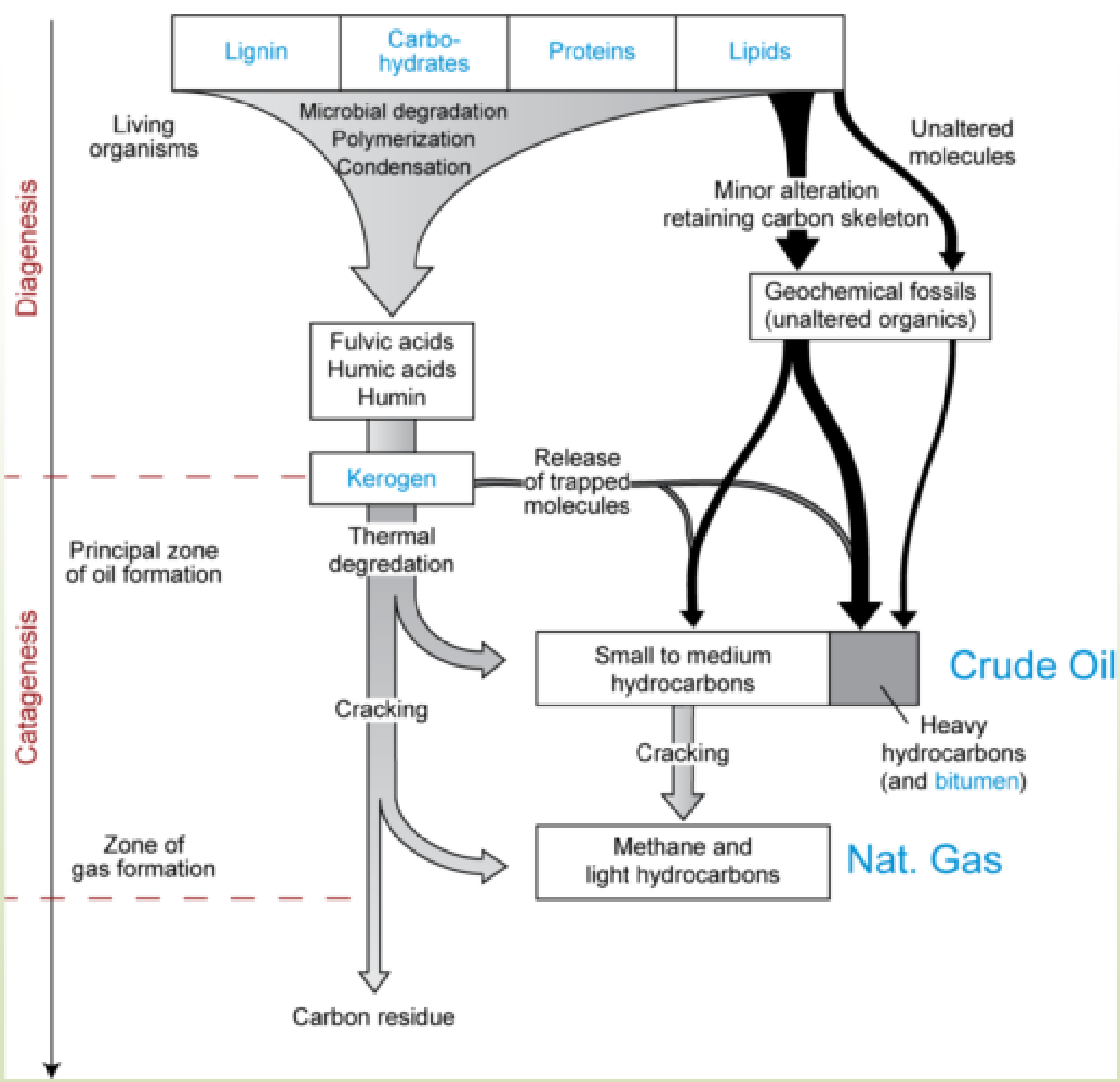
- * yüzeyde aerobik bakteriler
- * derinde Sülfat (SO_4) indirgeyen bakteriler: SO_4'teki Oksijeni kullanan bakteriler
- * (böylece protein, karbonhidrat ve yağlar → hidrokarbon+aminoasit+fülvik asit+hümik asit+hümin'e dönüşür. Bu kayaca **Kerojen** denir.

Katajenik Evre

- * en fazla bir kaç km'lik gömülme evresi
- * T=50-150 derece, P= 300-500 bar
- * gözenklilik ve geçirgenlik azalmayı sürdürür.
- * gözenk suyu kimyası değişir, tuzluluk artar.
- * kerojen ısı etkisi ile parçalanmaya başlar; sıvı petrol ve gaz partikülleri oluşmaya başlar

Metajenik Evre

- * Kırıntılı kayaçlarda erken metamorfizma (epimetamorfizma ya da anşimetamorfizma) evresi *
- * Oluşan hidrokarbonlar sistemi terkeder; terkedemeyenler ayrışır; geriye kalıntı karbon (grafit) kalır.



Modified from Tissot and Welte, 1984. *Petroleum formation and occurrence*, Springer –Verlag, 699 pp.
Summary of the oil formation process