

Sedimentation

Sedimentation bzw. **Sedimentierung** (von lat. *sedimentum* „Bodensatz“) ist das Ablagern/Absetzen von Teilchen aus Flüssigkeiten oder Gasen unter dem Einfluss der Schwerkraft oder der Zentrifugalkraft. Bildet sich zuunterst eine Schicht von Schwebstoffen, so nennt man diese **Bodensatz**, **Sediment** oder (um Verwechslungen mit Sedimentgestein auszuschließen) **Lockersediment** (Lockergestein).

Grundlagen

Bei der Sedimentation schichten sich die abgelagerten Teilchen aufgrund ihrer unterschiedlichen

Sedimentationsgeschwindigkeiten

(Absinkgeschwindigkeiten) nach ihrer Dichte und ihrer Größe. Die Teilchen mit größter Sedimentationsgeschwindigkeit lagern sich zuerst ab, liegen also zuunterst. Da die Sedimentationsgeschwindigkeit wesentlich von der Dichte bestimmt wird, können sich verschiedene Stoffe schichtweise getrennt abgelagern, was auch dazu benutzt werden kann, die verschiedenen Stoffe eines Gemenges zu trennen (siehe Dekantieren). Wird nur ein Material abgelagert oder Materialien ähnlicher Dichte, lagern große Partikel schneller ab und liegen zuerst unten, während kleine Partikel oben liegen. Je größer also die Dichte ist, desto schneller sinkt der Stoff zu Boden. Bei aufgeschäumtem Material, beispielsweise eruptiven Bimssteinen, kann eine inverse Gradierung auftreten, kleinere Teilchen weisen dann eine höhere Sedimentationsgeschwindigkeit auf und lagern unten, während größere oben lagern.



Von schweren Sandstürmen im Dust Bowl zugewehes Anwesen in South Dakota (USA) 1936

Natürliche Sedimente

Natürliche Sedimente lassen sich nach ihrer Entstehung in drei Hauptgruppen unterteilen:

- *klastische Sedimente* (durch Wasser, Wind, Gletscher, Murgang usw. transportierte und so mechanisch geformte Partikel, z. B. Sand, Schotterbank, Sandbank)
- *chemische Sedimente* (durch chemische Prozesse aus wässrigen Lösungen durch Fällung ausgeschieden, z. B. Carbonate)
- *biogene Sedimente* (Ablagerungen von Organismen oder aus Organismenresten, z. B. Korallenriffe)^[1]

Der Ablagerungsort ist eine weitere Einteilungsmöglichkeit. Hier lassen sich fluviatile, limnische, marine, äolische, glaziale und pyroklastische Sedimente voneinander abgrenzen.

Herangeführt werden die Schwebstoffe im Falle einer natürlichen Sedimentation in der Regel durch Erosionsprozesse und hierbei vor allem durch fluviatilen Transport, wobei in der Regel eine Verwitterung des Ausgangsgesteins vorausgegangen ist. Je nach Entfernung zum Abtragungsort und der Strömungsgeschwindigkeit weist die Korngrößenverteilung der im Wasser mitgeführten Partikel deutliche Unterschiede auf. Hierbei gilt, dass die Korngröße der Partikel mit der Entfernung und einer absinkenden Strömungsgeschwindigkeit abnimmt, da die größten bzw. schwersten Partikel (Geschiebe) zuerst sedimentieren und die Strömung oft nicht mehr in der Lage ist, diese vom Gewässergrund aufzuwirbeln.

Besonders in stehenden Gewässern bilden diese Schwebstoffe durch gravitative Ablagerung Sedimentschichten aus, die zum Teil zur Altersbestimmung (Stratigraphie) verwendet werden. Dies liegt vor allem daran, dass hier im Gegensatz zu Fließgewässern keine Strömung mehr vorliegt und sich daher auch sehr kleine Partikel ablagern können. Zusätzlich zeigt die Sedimentation je nach Klimasystem oft ein unterschiedliches Muster im Jahresgang, da sich beispielsweise im Winter bei einem zugefrorenen Gewässer die feineren Teilchen absetzen. Somit entstehen, ähnlich den Jahresringen bei Bäumen, gröbere und feinere Schichten pro Jahr, welche als Warven bezeichnet werden. Diese schließen oft Lebewesen oder deren Spuren mit ein, welche sich im Zuge der Fossilisation zu Fossilien entwickeln können. Auch die Entstehungsbedingungen (Paläoklima) der einzelnen Schichten sind in diesen oft dokumentiert, weshalb Sedimente wichtige Klimaarchive darstellen. Besonders marine, flachmarine und seeische Ablagerungen haben diesbezüglich eine hohe Aussagekraft, weshalb sie auch das Hauptziel von klimatologischen Forschungsbohrungen darstellen.

Während durch fortschreitende Sedimentation die Mächtigkeit der Sedimente steigt, kann vor allem der steigende Druck in den tiefer liegenden Schichten weitere geologische Vorgänge auslösen. Die Diagenese bildet aus den Lockersedimenten die Sedimentgesteine. Einen Sonderfall stellt hierbei der Schnee dar, welcher ebenfalls geschichtet und unter Druckeinfluss zu Eis verdichtet werden kann. Hält dieser Effekt über mehrere Jahre an, so kann dies zur Ausbildung eines Gletschers führen.



Zufluss der Rhône in den Genfersee



Querschnitt einer dünnschichtigen Sedimentationsabfolge

Anwendung

In so genannten „Split-Systemen“^[2] wird dieser Effekt etwa bei der biologischen Präparation unter Ausnutzung der dichteabhängigen Sedimentationsgeschwindigkeit zur Trennung von Partikeln wie Eiweißmolekülen oder biologischen Zellen ausgenutzt. Im Mühlenlabor wird ein *Sedimentationstest* durchgeführt, bei dem das Volumen des Sediments einer Mehl-Wasser-Suspension als Maß für die Quellfähigkeit der Eiweißstoffe im Mehl gilt. In der Bodenkunde dienen Sedimentationsversuche der Bestimmung der Korngrößenverteilung eines Bodens.

In kleineren dezentralen Ölmühen wird das Prinzip der Sedimentation genutzt, um das bei der Pressung von Pflanzenöl entstehende Trüböl von Sedimenten zu reinigen. Dabei wird das ausgepresste Öl in ein Behältnis gegeben, in dem es längere Zeit (bis zu mehreren Wochen) verharren kann, während die schwereren Sedimente durch die Erdanziehung langsam zu Boden sinken. Nach der Sedimentation wird das gereinigte Öl langsam aus dem Behältnis entnommen, so dass die abgesenkten Partikel im Sedimentationsbehältnis verbleiben. Neuere Pflanzenöl-Sedimentationsverfahren laufen kontinuierlich ab. Dabei fließt das zu reinigende Trüböl über ein Röhrensystem durch nacheinander geschaltete Behältnisse. Hierbei setzen sich die Trübstoffe (Sedimente) jeweils in den einzelnen Behältnissen ab, so dass nach dem Verlassen des letzten Behältnisses ein hoher Reinigungsgrad erreicht wird.

Ein weiteres praktisches Beispiel ist die mechanische Klärung von Wasser im Absetzbecken einer Kläranlage.

Bei der Herstellung, Lagerung und Verarbeitung von Suspensionen wie z. B. Lacken, Gießharzen, Beton oder auch manchen Lebensmitteln stellt die Sedimentation oft aber auch einen störenden Effekt dar.

Literatur

- Maurice E. Tucker: *Einführung in die Sedimentpetrologie*. Enke, Stuttgart 1985, ISBN 3-432-94781-X.
- Andreas Schäfer: *Klastische Sedimente. Fazies und Sequenzstratigraphie*. Elsevier, Spektrum Akademischer Verlag, München 2004, ISBN 3-8274-1351-6.

Weblinks

- Mineralienatlas:Sinter (wiki)

Einzelnachweise und Anmerkungen

[1] Die biogenen Sedimente werden auch als Untergruppe der chemischen Sedimente klassifiziert

[2] C. Bor Fuh: *Split-flow Thin Fractionation*. In: *Analytical Chemistry*. Bd. 72, Nr. 7, April 2000, , S. 266 A–271 A, .

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