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EDITORIAL

Remembering Wim Salomons (1945–2022): a pioneer in sediment–contaminant science

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It is with deep sadness that we write this obituary to Willem ("Wim") Salomons, who passed away in February 2022. Born in May 1945, Wim obtained his PhD in 1973 from the University of Groningen in the Netherlands. Over his long career, he was employed at numerous institutions including Delft Hydraulics, DLO Research Organization, Institute for Agro-Biology and Soil Fertility Research, and the Free University in Amsterdam.

Wim was an outstanding scientist who greatly influenced our understanding of sediment, especially contaminated sediment, in a range of environments. He was a true intellectual, who was able to see things in a different way, and had a special ability to integrate ideas from different disciplines. He was also one of the driving forces behind the European Sediment Research Network, SedNet, and co-edited one of the main publications to stem from that organization (Salomons and Brils 2004). Between 2006 and 2010, he was a co-Editor-in-Chief of JSS with Ulrich and Zhihong, overseeing the Intercompartmental section of the journal. There is no question that he helped shaped the journal and contributed to its reputation and success. It is therefore fitting that we honor Wim's contribution to sediment–contaminant science and management. It is difficult to do justice to his full and broad contribution, but we hope that the examples below provide some indication of how he shaped a discipline.

1. Contaminated sediment

   One of the reasons that Wim made such a large contribution to our understanding of contaminated sediment is that much of his education was grounded in inorganic chemistry and geochemistry. This enabled Wim to see

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issues associated with sediment–contaminant interactions through a different lens than most aquatic scientists, who typically came from hydrological, geomorphological, and geological backgrounds. Wim's early work with Ulrich on metals (e.g., Förstner and Salomons 1980; Salomons and Förstner 1980) is still used today, and the book *Metals in the Hydrocycle* (Salomons and Förstner 1984) is one of the most important and widely cited books in its field. Wim subsequently developed this work and published additional influential journal papers (e.g., Salomons 1985; Salomons et al. 1987) and books, including *Biogeodynamics of Pollutants in Soils and Sediments* (Salomons and Stigliani 1995) and *Heavy Metals: Problems and Solutions* (Salomons et al. 1995). This work, in combination to that described below, contributed to the development by Wim and colleagues of the concept of "chemical time bombs" (Stigliani et al. 1991) and the influential article on this in the popular science magazine "New Scientist" (Stigliani and Salomons 1993).

2. Mines and sediment

   One of Wim's main research areas was the impacts of mines on the environment, with a focus on metals. In addition to numerous field-based investigations in countries such as Papua New Guinea (e.g., Jeffrey et al. 1988; Salomons and Eagle 1990) and Brazil (e.g., De Lacerda et al. 1991; Pereira et al. 2008), he also edited books and wrote key papers which looked at broader issues of prediction and prevention (e.g., Salomons 1995; Geller et al. 1988). This work seems particularly relevant today given the number of metal mines in the world to meet the needs of society.

3. Soil systems

   For many of us, we associate Wim's work with (contaminated) sediment, but he also made important contributions in soil science, in part influenced by an early mentor, Prof. Ane J. de Groot of the University of Groningen. Wim's work addressed issues of the behavior and mobility of carbonates and metals in soils (e.g., Salomons and Mook 1976; Römkens and Salomons 1998), including the effect of manures on metals in agricultural soils (e.g., Japenga et al. 1992; Del Castilho et al. 1993). A significant contribution to soil science was in response to concerns over the impacts of acid rain on environmental systems, which resulted in the book "Acidic Precipitation" (Bresser and Salomons 1990). Wim and colleagues demonstrated the relation between soil pH and metal mobility. They showed that a decrease in pH (i.e., more acidic) would lead to higher dissolved metal concentrations in soil solutions, which in turn could influence both crop productivity and pollute surface and groundwaters (e.g., Bresser and Salomons 1990; Salomons and Stigliani 1995).

4. River catchment systems

   It may be true to say that the largest body of research by Wim concerned sediment–contaminant dynamics in river catchment systems. His work addressed sources of sediment and contaminants, their fluxes and storage, and processes controlling the interactions of organic and inorganic pollutants with sediment and waters. Much of this work focused on European rivers such as the Elbe (e.g., Vink et al. 1999a, b; Förstner et al. 2016) and Rhine (Japenga et al. 1990). This work contributed to the creation of SedNet, and Wim wrote and contributed to numerous publications from this initiative (e.g., Salomons and Brils 2004; Owens et al. 2005).

5. Coastal and estuarine systems

   While much of Wim's early work was on particulate material and pollutant dynamics in estuarine systems (e.g. Salomons and Mook 1977, 1981; Salomons 1980), in recent decades, Wim became increasingly interested in how process-based science could be used to understand and manage estuarine and coastal systems (e.g., Salomons et al. 2005; Vermaat et al. 2005; Förstner and Salomons 2010). This speaks to his understanding of the big picture (next section) and his strong desire to utilize scientific knowledge for improved management decision-making and policy development. One of his main contributions in this area was recognizing the strong link between terrestrial and coastal systems in the "catchment–coast continuum" (Salomons 2005; Salomons et al. 2005) and how this underpins our understanding of material fluxes at the global scale.

6. Big-picture science

   While Wim's background in chemistry enabled him to understand chemical interactions with sediment and water at the smallest of scales, he was one of the few who could easily translate this knowledge to understand environmental issues at regional, national, and international scales. Many of his publications and technical reports contain conceptual representations of environmental systems (e.g., Salomons and Förstner 1984; Salomons and Brils 2004); his ability to simplify complex systems has been particularly influential. It was therefore appropriate that Wim should be the Chief Editor for the *Environmental Science* book series published by Springer.

Perspective

Few scientists are able to have such a profound influence on a discipline such that they essentially become synonymous with that topic. Wim Salomons' work on sediment–contaminant (especially metals) dynamics in soil, riverine, estuarine, and coastal systems in Europe and elsewhere built the foundation for much of the work presently being undertaken in this field of research. We thank him for

his legacy, and know that future generations will be inspired by his wisdom, enthusiasm, and intellect.

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References

Bresser AHM, Salomons W (Eds) (1990) Acidic precipitation; international overview and assessment. Springer-Verlag, Berlin – Heidelberg

De Lacerda LD, Salomons W, Pfeiffer WC, Bastos WR (1991) Mercury distribution in sediment profiles from lakes of the high pantanal, Mato Grosso State, Brazil. Biogeochemistry 14:91–97

Del Castilho P, Chardon WJ, Salomons W (1993) Influence of cattle manure slurry application on the solubility of cadmium, copper and zinc in a manured acidic, loamy-sand soil. J Environ Qual 22:689–697

Förstner U, Salomons W (1980) Trace-metal analysis on polluted sediment. 1: assessment of sources and intensities. Environ Technol Lett 1:494–505

Förstner U, Salomons W (2010) Sediment research, management and policy. J Soils Sediments 10:1440–1452

Förstner U, Hollert H, Brinkmann M, Eichbaum K, Weber R, Salomons W (2016) Dioxin in the Elbe river basin: policy and science under the Water Framework Directive 2000–2015 and toward 2021. Environ Sci Europe. https://doi.org/10.1186/s12302-016-0075-8

Geller W, Klapper H, Salomons W (Eds) (1988) Acidic mining lakes: acid mine drainage, limnology and reclamation. Springer, Berlin – Heidelberg

Japenga J, Zschuppe KH, Degroot AL, Salomons W (1990) Heavy-metals and organic micropollutants in floodplains of the River Waal, a distributary of the River Rhine, 1958–1981. Neth J Agric Sci 38:381–397

Japenga J, Dalenberg JW, Wiersma D, Scheltens SD, Hesterberg D, Salomons W (1992) Effect of liquid animal manure application on the solubilization of heavy-metals from soils. Int J Environ Anal Chem 46:25–39

Jeffrey J, Marshman N, Salomons W (1988) Behaviour of trace metals in a tropical river system affected by mining. In: Salomons W, Förstner U (Eds) Chemistry and biology of soil waste: dredged material and mine tailings. Springer, Berlin – Heidelberg

Owens PN, Batalla RJ, Collins AJ, Gomez B, Hicks DM, Horowitz AJ, Kondolf GM, Marden M, Page MJ, Peacock DH, Petticrew EL, Salomons W, Trustrum NA (2005) Fine-grained sediment in river systems: environmental significance and management issues. River Res Applic 21:693–717

Pereira AA, van Hattum B, Brouwer A, van Bodegom PM, Rezende CE, Salomons W (2008) Effects of iron-ore mining and processing on metal bioavailability in a tropical coastal lagoon. J Soils Sediments 8:239–252

Römkens PFAM, Salomons W (1998) Cd, Cu and Zn solubility in arable and forest soils: consequences of land use changes for metal mobility and risk assessment. Soil Sci 163:859–871

Salomons W (1980) Adsorption processes and hydrodynamic conditions in estuaries. Environ Technol Lett 1:356–365

Salomons W (1985) Sediments and water-quality. Environ Technol Lett 6:315–326

Salomons W (1995) Environmental of metals derived mining activities: processes, predictions, prevention. J Geochem Explor 52:5–23

Salomons W (2005) Sediments in the catchment-coast continuum. J Soils Sediments 5:2–8

Salomons W, Brils J (2004) Contaminated sediments in European river basins. SedNet Report for EU project EVK1-CT-2001–20002 pp. 80

Salomons W, Eagle AM (1990) Hydrology, sedimentology and the fate and distribution of copper in mine related discharges in the Fly river system – Papua New Guinea. Sci Total Environ 97(98):315–334

Salomons W, Förstner U (1980) Trace-metal analysis on polluted sediments. 2: Evaluation of environmental-impact. Environ Technol Lett 1:506–517

Salomons W, Förstner U (1984) Metals in the hydrocycle. Springer-Verlag, Berlin – Heidelberg

Salomons W, Mook WG (1976) Isotope geochemistry of carbonate dissolution and re-precipitation in soils. Soil Sci 122:15–24

Salomons W, Mook WG (1977) Trace-metal concentrations in estuarine sediment – mobilization, mixing or precipitation. Neth J Sea Res 11:119–129

Salomons W, Mook WG (1981) Field observations of the isotopic composition of particulate organic-carbon in the southern North Sea and adjacent estuaries. Mar Geol 41:M11–M20

Salomons W, Stigliani W (Eds) (1995) Biogeochemistry of pollutants in soils and sediments: risk assessment of delayed and non-linear responses. Springer, Berlin – Heidelberg

Salomons W, De Rooji NM, Kerdijk H, Bril J (1987) Sediments as a source for contaminants. Hydrobiologica 149:14–30

Salomons W, Förstner U, Mader P (Eds) (1995) Heavy metals: problems and solutions. Springer, Berlin – Heidelberg

Salomons W, Kremer H, Turner RK (2005) The catchment to coast continuum. In: Crossland CJ, Kremer HH, Lindeboom HJ, Marshall Crossland JJ, Le Tissier MDA (eds) Coastal fluxes in the Anthropocene. Springer, Berlin, pp 145–200

Stigliani WM, Salomons W (1993) Our father's toxic sins. New Scientist 140:38–42

Stigliani WM, Doelman P, Salomons W, Schulin R, Smidt GRB, Van der Zee SAETM (1991) Chemical time bombs: predicting the unpredictable. Environ 33:4–30

Vermaat J, Bouwer L, Turner K, Salomons W (Eds) (2005) Managing European coasts – past, present and future. Springer, Berlin – Heidelberg

Vink R, Behrendt H, Salomons W (1999a) Development of the heavy metal pollution trends in several European rivers: an analysis of point and diffuse sources. Water Sci Technol 39:215–233

Vink R, Behrendt H, Salomons W (1999b) Point and diffuse source analysis of heavy metals in the Elbe drainage area: comparing heavy metal emissions with transported river loads. Hydrobiologia 410:307–314