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Review

Distribution, formation and human-induced evolution of geogenic contaminated groundwater in China: A review

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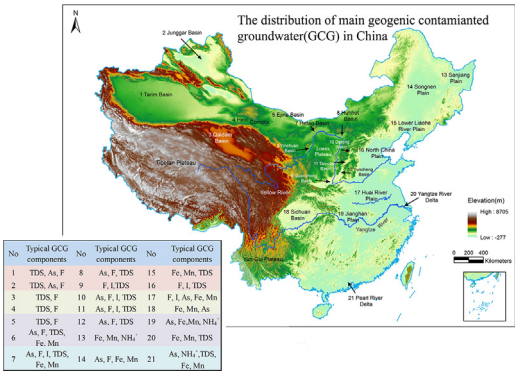
HIGHLIGHTS

- The geogenic contaminated groundwater (GCG) in China is systematically summarized.
- Water scarce and health issues related to GCG are involved.
- The co-occurrence of different GCG components is discussed.
- The impact of anthropogenic activity on the evolution of GCG is proposed.

GRAPHICAL ABSTRACT



No	Typical GCG components	No	Typical GCG components	No	Typical GCG components
1	TDS, As, F	8	As, F, TDS	15	Fe, Mn, TDS
2	TDS, As, F	9	F, I,TDS	16	F, I, TDS
3	TDS, F	10	As, F, I, TDS	17	F, I, As, Fe, Mn
4	TDS, F	11	As, F, I, TDS	18	Fe, Mn, As
5	TDS, F	12	As, F, TDS	19	As, Fe,Mn, NH_4^+
6	As, F, TDS, Fe, Mn	13	Fe, Mn, NH_4^+	20	Fe, Mn, TDS
7	As, F, I, TDS, Fe, Mn	14	As, F, Fe, Mn	21	As, NH_4^+, TDS, Fe, Mn

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ABSTRACT

The sustainability of groundwater usage faces quality problem caused by anthropogenic activity as well as geogenic contamination. With varied climate zones, geomorphology and geological background, China faces a variety of geogenic contaminated groundwater (GCG) reported known as high TDS, Fe, Mn, As, F, I, NH_4^+, U, Cr and low I, Se, etc., may still exist some others not fully known yet. The problem of GCG is more significant in northern China due to extensive groundwater usage, arid climate and widespread Holocene strata. High salinity groundwater is mainly distributed in semi-arid/arid northwestern inland basins and coastal areas. Elevated Fe and Mn are frequently concomitant and controlled by redox potential, prevailing in the Sanjiang Plain, Yellow River Basin, and middle and lower reaches of the Yangtze River Basin. High As groundwater occurs in reducing aquifer is mainly distributed in the Yellow River, Yangtze River and Huai River Basins as well as the Songnen Plain and Xinjiang. Fluoride is characterized by its areal distribution in northern China in comparison with scatter occurrence in the south. The dissolution of F-bearing minerals as well as evaporation effect both contribute to elevated F. High iodine groundwater mainly distributed in the Yellow-Huai-Hai River Basin and low iodine prevailing in piedmont areas both pose health issues. Iodine is related to decomposition of organic matter (OC) as well as marine origin. Contributed by OC mineralization naturally-occurring NH_4^+ was found in reducing aquifers. The GCG triggers endemic disease in addition to reduce groundwater resource. The co-occurrence like high TDS and F, As and F are frequently observed posing major challenges for mitigation. Anthropogenic influence like abstraction and pollutant infiltration would alter groundwater flow and the redox condition causing the further evolution

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of GCG. Identification of GCG should be made in rural areas where private wells prevail to ensure resident's health.

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